

Abstract

GEOGRAPHIC PATTERNS OF PHYSICAL EDUCATION PARTICIPATION AND  
BMI PERCENTILES: HAVE LEGAL MANDATES MADE A DIFFERENCE?

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Childhood obesity in the United States of America has become a widespread epidemic. Over 30% of children ages 2 to 19 are overweight as classified by their Body Mass Index (BMI) (Ogden, Carroll, & Flegal, 2008). Prevention and treatment strategies are necessary to reverse this alarming trend. The purpose of this study was to investigate the impact of the *Child Nutrition and WIC Reauthorization Act* using the number of days of physical education participation and BMI percentiles, the standard measurement for overweight classification, as outcomes associated with compliance. Additionally, geographic differences in both variables were analyzed in order to detect variations in wellness policy implementation. This was the first known study to analyze the impact of the legislation using these variables. Archival data from the 2003 and 2007 Youth Risk Behavior Surveillance System (YRBSS), a self-report, school-based survey, were used to analyze differences in reported physical education days and BMI percentiles in participants in 2003 (pre-legislation) versus participants in 2007 (post-legislation). Results of this initial investigation indicate an increasing trend in physical education participation in the West region, including Alaska, Arizona, Montana, Utah, and Idaho. In

addition, participants in 2007 in the West reported significantly lower BMI percentiles than participants in 2003, thus indicating the potential for school wellness policies to slow and perhaps reverse the obesity epidemic in children and adolescents.

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## CHAPTER I: INTRODUCTION

An epidemic is spreading throughout the United States of America. Almost one in three school-aged children is at risk of becoming or is overweight (Ogden, Carroll, & Flegal, 2008). Rates of childhood obesity have nearly tripled since the 1960s in certain age groups (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). Most recent surveys estimate that over 30% of children ages 2 to 19 are at risk of becoming overweight as classified by age-related Body Mass Indexes (Ogden et al., 2008). Further, obesity prevalence is disproportionate across ethnic groups. Results reported in the Ogden et al. (2008) analysis of the National Health and Nutrition Examination Survey (NHANES) in 2005-2006 indicate that Hispanic and African American children ages 2 to 19 are at greater risk for obesity and have a higher prevalence of obesity than their non-Hispanic Caucasian peers.

Obesity and overweight statistics are based on Body Mass Index (BMI). BMI is an indirect measure of body fat (Institute of Medicine [IOM], 2007). It is calculated by dividing weight in kilograms by height in meters squared (Pyle, Sharkey, Yetter, Felix, Furlong, & Poston, 2006). Adults follow universal BMI scales that include the following: (a) under 18.5 is underweight, (b) between 18.5-24.9 is normal weight, (c) between 25.0-29.9 is overweight, and (d) over 30.0 is obese. Child and adolescent classifications are based on age- and sex-based scales in order to account for normal development and growth. Child and adolescent weight classifications, based on BMI, are as follows: (a) below the 5<sup>th</sup> percentile is underweight, (b) between the 5<sup>th</sup> and 85<sup>th</sup> percentiles are

normal, (c) between the 85<sup>th</sup> and 95<sup>th</sup> percentiles are at risk for overweight, and (d) above the 95<sup>th</sup> percentile is overweight (Pyle et al., 2006).

Childhood obesity is a comprehensive problem with physical, emotional, and economic consequences. Obesity has both short and long term effects including increased threat of cardiovascular risk factors, asthma, high blood pressure, and premature mortality (Freedman, Dietz, Srinivasan, & Berenson, 1999; Reilly, 2005; Ribeiro, Guerra, Pinto, Oliveira, & Mota, 2003). For example, Ribeiro and colleagues (2003) found that both systolic and diastolic blood pressure for 6- to 18-year-old boys and girls were positively associated with BMI. Overweight children experience more teasing and bullying than normal weight peers. Obsession with body size and weight can also affect overweight children (Dietz, 1998). One review by Dietz (1998) found that almost half of a 7- to 13-year old participant group was concerned about weight and one third of that group had attempted to lose weight in the past. The potential for development of eating disorders is also higher in obese girls (Reilly, 2005). Children who are treated for obesity can expect to have medical costs that are three times higher than their normal weight counterparts. According to the IOM (2007), higher healthcare costs are associated with obesity; health care spending for children with overweight diagnosis is roughly \$280 million for private insurance and around \$470 million for Medicaid (IOM, 2007).

Obesity is a worldwide epidemic (Kosti & Panagiotakos, 2006), but prevalence varies according to race, sex, and geographic location. A review by Wang and Beydoun (2007) revealed that African American and Mexican American youth have higher prevalence rates of obesity than Caucasian counterparts. Significant gender gaps exist

within African Americans and Mexican Americans (Wang & Beydoun, 2007). For example, Mexican American males aged 6 to 11 years had the highest prevalence of overweight or at risk of becoming overweight (43.9%), while non-Hispanic black females aged 12 to 19 years had the highest prevalence (41.9%) (Wang & Beydoun, 2007). Disproportionate rates of obesity may exist across different geographic regions of the United States as well (Singh, Kogan, & van Dyck, 2008). According to Singh and colleagues (2008), children and adolescents in West Virginia, Kentucky, Texas, Tennessee, and North Carolina have twice the chance of being overweight as peers in Utah. According to the authors, their analysis is the only study to date that examines geographic disparities in childhood and adolescent obesity rates. More evidence in this area is needed to further direct prevention efforts.

### The Energy Balance

Balance of food intake and energy expenditure mediates weight. A healthy weight requires careful equilibrium referred to as energy balance. The amount and type of food consumption have to be in careful balance with the amount of physical activity in order to achieve a healthy weight (Peters, Wyatt, Donahoo, & Hill, 2002). In addition, the energy balance must account for healthy growth in children and adolescents. Children and adolescents who are overweight or at risk of becoming overweight should reduce caloric intake and increase physical activity in order to obtain optimal weight loss and maintenance (Kumanyika et al., 2008). Although seemingly simple, this balance is difficult to measure; physiological processes and biological compositions vary from child to child, thus impacting measurement.

Throughout history, humans survived on limited food supplies. Physiological processes were modified around the availability of food and the associated survival needs. Moreover, physical environments demanded physical robustness. Over the years, the environment has changed and the demands for survival have weakened. Food intake has increased due to availability and affordability of energy-dense foods. Meanwhile, physical activity has decreased, thus shifting the energy balance and increasing the prevalence of obesity (Peters et al., 2002).

Physical activity is one of the critical components in maintaining healthy weight in this new environment. Physical activity is linked with positive psychological and physical outcomes (Burgeson, Wechsler, Brener, Young, & Spain, 2001; Taylor, Sallis, & Needle, 1985). Many professional organizations have established recommendations for the ideal amount of time children and adolescents should spend engaged in physical activity. The United States Department for Health and Human Services (USDHHS) introduced an initiative to promote healthy living in the United States. *Healthy People 2010* was created in part to eliminate health disparities and to increase enjoyable years of healthy living (2000). Many of the objectives outlined in this initiative target physical activity as a way to meet initiative goals (USDHHS, 2000). The National Association for Sport and Physical Education (NASPE) and the Council on Physical Education (2000) also advocate for the increased need for children and adolescents to be more active. They recommend that children receive at least 60 minutes of age-appropriate physical activity each day.

In general, youth and adolescents do not meet these activity recommendations in their daily lives. Over 11% of high school students report no moderate or vigorous physical activity (NASPE & American Heart Association [AHA], 2006). One-third of 9<sup>th</sup>-12<sup>th</sup> graders report that they do not get sufficient levels of moderate activity (NASPE & AHA, 2006). This lack of physical activity contributes to the current obesity trend in childhood.

Just as NASPE and AHA (2006) reports that overall adolescent physical activity is declining, this drop in activity is more apparent in certain populations. Students from low socioeconomic and minority backgrounds have disproportionately higher risks for obesity (Strauss & Pollack, 2001) and lower physical activity levels (Anderson, Crespo, Bartlett, Cheskin, & Prat, 1998; Bradley, McMurray, Harrell, & Deng, 2000.) In an analysis by Eaton et al. (2006), data show that Caucasian males are more likely to meet recommended levels of physical activity, whereas African American and Hispanic females are least likely. Parenting styles, lifestyle choices, and fewer opportunities and access to physical activity may contribute to the disproportion (Delva, Johnston, & O'Malley, 2007; Eaton et al., 2006; Hanson & Chen, 2007).

Factors associated with the decline in physical activity are multi-faceted and include environmental, behavioral, and cultural/family variables (IOM, 2007). Research shows that in addition to home and community influences, school policies may also impact physical activity patterns of children (IOM, 2007). The school environment affects over 50 billion children and provides an optimal venue for overweight prevention efforts (Koplan, Liverman, & Kraak, 2005).

One nationwide survey indicates that 65% of parents believe schools to be a major change agent in the childhood obesity epidemic (Kropski, Keckley, & Jensen, 2008). The majority of children in the United States are enrolled in schools and spend most of their day there. It is unlikely that the obesity epidemic will decline unless schools develop strong policies to increase opportunities for optimum nutrition and physical activity during the day (Story, Nannery, & Schwartz, 2009).

Traditionally, physical education has been the most common outlet for physical activity needs in schools, but no federal legal mandates on physical education requirements exist, to date (NASPE & AHA, 2006). Objectives 22-8 and 22-9 of the *Healthy People 2010* initiative recommend that U.S. schools provide additional requirements for physical education (USDHHS, 2000). Similarly, the *Preventing Childhood Obesity: Health in the Balance* report, produced by the IOM, suggests that schools become a healthy environment with healthful food choices and physical activity options including physical education (as cited by IOM, 2007). Research also emphasizes the role of physical education in obesity prevention.

A study by Datar and Sturm (2004) followed kindergarten students through first grade to analyze the difference in BMI when a change in physical education participation was implemented. The researchers estimated that a 1-hour increase in physical education per week between kindergarten and first grade would lead to changes in BMI for girls. Results indicated that, if physical education time was extended by five hours a week for kindergarteners, it would result in a decrease in prevalence of overweight girls and girls at-risk for overweight by 4.2 and 9.2 percentage points, respectively (Datar & Sturm,

2004). Results for boys, however, were not significant (Datar & Sturm, 2004). Physical education has the potential to impact the overweight crisis in children and adolescents.

In 2004, Congress enacted the *Child Nutrition and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Reauthorization Act* (Public Law 108-265), which mandated that schools participating in the National School Lunch Program and the School Breakfast Program implement school wellness policies (*Child Nutrition and WIC Reauthorization Act [CNWICRA]*, 2004). These wellness policies were designed to provide educational programs and opportunities for better nutrition and physical activity within the school environment (IOM, 2007). The wellness policies were to be in place by 2006, but the implementation of these policies faced many challenges. The legislation did not provide funding for the changes which hindered policy compliance (Moag-Stahlberg, Howley, & Luscri, 2008). In addition to financial constraints, academic pressure applied by the *Elementary and Secondary Education Act (ESEA)* hampered the development of wellness policies (United States Department of Education, n.d.). The *Child Nutrition and WIC Reauthorization Act* expires on September 30, 2009, and without evidence of effectiveness, this legislation may cease to exist (*CNWICRA*, 2004). This study sought to provide missing data of the Act's impact on America's youth.

#### Purpose of the study

The *Child Nutrition and WIC Reauthorization Act* offers an opportunity to increase the school's role in obesity prevention. With this Act, schools have the responsibility to provide nutritious meals and avenues for physical activity within the

school day. Physical education is one way in which to increase physical activity in the schools. It is important to analyze the impact of the *Child Nutrition and WIC Reauthorization Act* by studying how the mandate affected the school environment, specifically examining physical education participation as an indicator of compliance. Survey results from the Youth Risk Behavior Surveillance System (YRBSS) from the years 2003 and 2007 were used to analyze these differences. Additionally, BMI percentiles were analyzed to better understand how the legislation directly impacted obesity.

Given the lack of funding provided by the *Child Nutrition and WIC Reauthorization Act*, it was worthwhile to investigate whether certain areas of the country have complied more fully with wellness policy recommendations. Geographic differences in both physical education participation and BMI percentiles were analyzed to better understand this trend.

*Research Questions and Hypotheses:*

The following questions were addressed by this data analyses.

1. (a). In response to the 2004 *Child Nutrition and WIC Reauthorization Act*, has the number of days of self-reported physical education participation increased when comparing adolescents participating in the 2003 YRBSS to those participating in 2007?

H<sub>1</sub>: Overall, the number of days of physical education participation will not be significantly different due to academic accountability changes and budget restraints.

1. (b.) Have adolescent BMI percentiles decreased from 2003 to 2007, per YRBSS self-report data, based on school policy changes resulting from the 2004 *Child Nutrition and WIC Reauthorization Act*?

H<sub>2</sub>: Adolescent BMI levels have not significantly decreased due to the *Child Nutrition and WIC Reauthorization Act*. BMI percentiles are expected to remain stable due to other variables including accountability mandates.

2. (a.) Are there regional differences in days of physical education participation between the years of 2003 and 2007 due to the *Child Nutrition and WIC Reauthorization Act* according to adolescent self-report data?

H<sub>3</sub>: There are significant differences in the number of days of physical education offered in four different regions across the United States. Some school systems in certain regions have been more diligent in implementing wellness policies (including physical education requirements) in response to the legislation than others.

2. (b.) Are there BMI percentile differences according to geographic regions in the United States per adolescent self-report data?

H<sub>4</sub>: Research indicates that regional differences exist in obesity levels. Therefore, BMI percentiles are expected to be significantly different between geographic regions.

*Definitions of Relevant Constructs*

*Body Mass Index* - BMI is calculated by dividing weight in kilograms by height in meters squared. Children and adolescents use an age-based BMI scale where gender and age range are the basis of weight status (Pyle et al., 2006).

*Underweight* – BMI below the 5<sup>th</sup> percentile

*Normal weight* – BMI between the 5<sup>th</sup> and 85<sup>th</sup> percentile

*At risk of overweight* – BMI between the 85<sup>th</sup> and 95<sup>th</sup> percentile

*Overweight* – BMI above the 95<sup>th</sup> percentile

*Child Nutrition and WIC Reauthorization Act (PL 108-265)* – United States law requiring school districts involved in the National School Lunch Program or School Breakfast Program to enact local school wellness policies by the year 2006-2007.

*Physical activity* - “any bodily movement produced by skeletal muscles that results in energy expenditure” (Caspersen, Powell, & Christensen, 1985, p. 126).

*Regions* – Organized by United States Census Bureau classifications and available data. (United States Census Bureau, 2007)

Northeast: Maine, Massachusetts, New York

Midwest: Indiana (i.e., the only state from the Centers for Disease Control that had data for all variables across both years)

South: Delaware, Kentucky, Mississippi, North Carolina, Tennessee, West Virginia

West: Alaska, Arizona, Montana, Utah, Idaho

## CHAPTER II: REVIEW OF THE LITERATURE

The obesity crisis affecting the nation today is well-documented. According to the National Health and Nutrition Examination Survey (NHANES), body mass index (BMI) measurements from 4,207 children and adolescents aged 2 to 19 years showed that 10.9% of those surveyed in 2005/2006 were at or above the 97<sup>th</sup> percentile of the 2000 BMI-for-age growth charts (Ogden et al., 2008). Similarly, 15.5% of those participants were at or above the 95<sup>th</sup> percentile (overweight) and 30.1% were at or above the 85<sup>th</sup> percentile (at risk of becoming overweight). Ogden and colleagues studied trends in obesity and previously found a significant increase in the prevalence of overweight from 1999-2004 (2006). Overweight females in this age group increased from 13.8% in 1999-2000 to 16.0% in 2003-2004; similarly, males who were overweight increased from 14.0% to 18.2% between the same time period (Ogden et al., 2006).

Wang and Beydoun (2007) found similar results in a literature review of multiple surveys measuring obesity prevalence. Data from the NHANES, Behavioral Risk Factor Surveillance System (BRFSS), Youth Risk Behavior Surveillance System (YRBSS), and the National Longitudinal Survey of Adolescent Health were used to analyze obesity trends and disparities in variables such as gender, race/ethnicity, and geographic location. Results showed that BMI for males increased by 1.4 points and females increased by 2 points between 1971-1974 and 1999-2002 (Wang & Beydoun, 2007).

Current research like the Wang and Beydoun (2007) study shows the growing need to reverse the overweight trend. Understanding the various components of energy balance is the first step in developing more effective strategies in overweight treatment

and prevention efforts. An unequal balance between energy consumed through caloric intake and energy exerted through physical activity results in unhealthy weight. Although seemingly physical in nature, the overweight epidemic stems from a combination of biological, socioeconomic, and cultural factors that create an unhealthy lifestyle (Adair, 2008; Kumanyika et al., 2008).

### Origins of the Epidemic

Humans instinctually eat when food is available and reduce energy exertion when physical activity is not required (Peters et al., 2002). Underlying details of human energy balance operations are still quite uncertain (Kumanyika et al., 2008). We do know, however: when energy is consumed beyond what is needed, deposits of fat form to store the excess energy (Kumanyika et al., 2008). Small changes in this delicate energy equation result in weight gain, especially over months and years.

Today's environment has shifted in that availability of food is everywhere. Additionally, strenuous physical activity is rarely required for tasks of daily living (Peters et al., 2002). This convenient food is higher in caloric density and fat than in the past. All the while, transportation does not require energy exertion; cars, planes, and mass transit make moving from place to place easy and energy-free. Similarly, leisure activities also require less energy. Television viewing and computer games keep children stationary during free time (Vandewater, Shim, & Caplovitz, 2004). Differences within the home environment also affect the energy balance of a child. In the United States, more parents work long hours outside of the home which results in more meals from fast food

restaurants (Koplan et al., 2005). This shift promotes a consistent energy imbalance that results in an overweight nation.

### Beyond Biology

According to researchers, the epidemiology of the overweight problem is not simple. A variety of factors contribute to the imbalance (Adair, 2008). Many researchers are beginning to understand that, in addition to biological variables, environmental factors also play a vital role in weight changes of both adults and children (Ahn, Juon, & Gittlesohn, 2008; Hanson & Chen, 2007; Segal & Gadola, 2008). Associations between minority backgrounds and low socioeconomic status have been documented within research studies, but causal explanations have not been well understood (Hanson & Chen, 2007). Geographic disparities in obesity have not been widely researched (Singh, Kogan, & van Dyck, 2008).

Low socioeconomic status (SES), which can include family income and education attainment (Ahn et al., 2008), has been linked with lower levels of physical activity and subsequently, higher incidence of overweight (Delva et al., 2007). The association between SES and overweight is not entirely clear and complex (Reilly, 2005). Children and adolescents living with parents of lower educational attainment are more likely to be overweight or at risk for becoming overweight (Ahn et al., 2008; Delva et al., 2007). Delva and colleagues (2007) also found that children and adolescents from low SES backgrounds consume fewer nutrients, watch more television, and participate in fewer physically active behaviors. Hanson and Chen (2007) found similar results with SES defined as a combination of parent (a) income/assets, (b) education, and (c) occupation.

They also discovered a direct relationship between parent SES and amount of physical activity (Hanson & Chen, 2007).

Similarly, children and adolescents from racial/ethnic minority backgrounds have been noted to be at a disadvantage. According to results from the 1994-1996 National Longitudinal Survey of Adolescent Health, combined at risk for overweight and overweight prevalence rates were as follows: (a) Mexican American children at 39.9%, (b) African American children at 35.4%, and (c) non-Hispanic Caucasian children at 28.2% (Wang & Beydoun, 2007). According to trend data provided by the NHANES, Non-Hispanic Caucasian adolescent boys had slower increases in overweight status than either non-Hispanic African American or Mexican American adolescent boys (Wang & Beydoun, 2007). Ogden and colleagues (2006) uncovered similar trends among females. Mexican American and non-Hispanic African American female children and adolescents have a greater chance of being overweight than non-Hispanic Caucasian females (Ogden et al., 2006). In one study of California residents, survey results reported that American Indians/Pacific Islanders were at highest risk for becoming overweight, along with Hispanic and African American students (Ahn et al., 2008). Prevalence rates are increasing fastest among minority groups and those living in Southern areas when confounding variables were eliminated (Strauss & Pollack, 2001).

Just as Strauss and Pollack (2001) found, people living in certain parts of the country have higher rates of overweight. Singh, Kogan, and van Dyck (2008) reviewed data from the National Survey of Children's Health (NSCH) conducted between 2003 and 2004. The self-report data was based on 46,707 adolescents between the ages of 10

and 17 years old from across the United States. Results from the review indicated significant differences in BMI percentiles according to location. Utah adolescents reported the lowest overweight prevalence (as measured by BMI percentiles at or above the 95<sup>th</sup> percentile) with 8.5% in the overweight range. Results showed that Washington, DC adolescents reported the highest BMI percentiles at 22.8% in the overweight range (Singh, Kogan, & van Dyck, 2008). When the authors controlled for behavioral and socioeconomic factors, adolescents in North Carolina, Kentucky, West Virginia, Texas, and Tennessee were twice as likely to be obese than comparable adolescents in Utah (Singh, Kogan, & van Dyck, 2008). In terms of regional differences, prevalence of childhood and adolescent overweight was highest (18.9%) in the East Southcentral region (including Kentucky, Tennessee, Alabama, and Mississippi) and lowest in the Mountain region (including Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada). Obesity plagues children and adolescents all over the country, but some areas are more susceptible to higher BMI percentiles and less physical activity.

#### The Role of Physical Activity

Physical activity is one of the key components in developing a healthy energy balance. Research indicates an association between physical activity and BMI. Sulemana, Smolensky, and Lai (2006) used ankle actigraphy to track physical activity of females aged 14 to 17 through various times of day and compared their movement to their BMI. They found physical activity to be significantly correlated with BMI such that lower physical activity levels were associated with increased body mass indexes (Sulemana et al., 2006).

Likewise, Trost, Kerr, Ward, and Pate (2001) compared the physical activity levels of overweight and non-overweight sixth graders to analyze differences between the two groups. Researchers used state-of-the-art accelerometers in order to track amount and intensity of physical activity levels. Results indicated that overweight children had significantly lower levels of moderate and vigorous activity. When compared to their non-overweight counterparts, overweight children also participated in significantly fewer consecutive minutes of physical activity (Trost et al., 2001).

In addition to weight-related outcomes, regular participation in physical activity is linked with many health-related outcomes including reducing the chance of developing diabetes, high blood pressure, heart disease, and ultimately premature death (Burgeson et al., 2001). In addition, physical activity promotes muscle strength and physical endurance. Physical activity also contributes to improved psychological functioning including lower levels of anxiety and stress and better self-esteem (CDC, 1997). Research demonstrates the important role physical activity plays in a healthy lifestyle. Organizations and governmental agencies recognize this relationship and have worked to increase child and adolescent participation in physical activity through outreach and publicized recommendations.

One such organization, the National Association of Sport and Physical Education (NASPE), recommends that children ages 5 to 12 participate in at least 60 minutes of daily physical activity, if not more (NASPE & Council on Physical Education for Children, 2000; United States Department of Agriculture [USDA], 2005). Furthermore, the USDHHS constructed the *Healthy People 2010* initiative to address higher rates of

overweight and develop goals for a healthier country. One section of the initiative is dedicated to the improvement of health through physical activity and includes goals to work toward daily moderate to vigorous exercise (USDHHS, 2000). Additionally, the American Heart Association (AHA) started programs such as Jump Rope for Heart and Hoops for Heart to get children more involved in enjoyable physical activities and correspondingly reduce time spent in sedentary activities.

#### The Child Nutrition and WIC Reauthorization Act of 2004

The U.S. government also responded to the health needs of children by enacting the *Child Nutrition and WIC Reauthorization Act* (Public Law 108-265) in 2004. This law increases the accountability of school systems participating in the National School Lunch and School Breakfast programs, requiring them to provide nutritious meals and physical activity (*CNWICRA*, 2004). The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) originally developed to provide women and children with nutrition, health care referrals, and health education free of charge (United States Department of Agriculture, 2009). WIC legislation culminated efforts initially included in the National School Lunch Act of 1946 (and renamed the Richard B. Russell National School Lunch in 1999), the Child Nutrition Act of 1966, and Section 32 of the act of August 25, 1935 (Richardson, 2006). The 2004 Reauthorization amended original legislation and seeks to improve children's overall health, especially targeting low-income families.

The 2004 Act requires schools to develop local wellness policies which were to be implemented by July 1, 2006 (Metos & Nanney, 2007). The wellness policies target

nutrition and physical activity in the schools and require goals, evaluations, and parent involvement in the dissemination of information on healthy eating and activity.

Specifically, the legislation outlined five major components to be covered in the wellness policies including: (1) goals for all programs associated with the wellness policies, (2) nutritional guidelines to be followed when serving food in the school, (3) assurance that meals served in schools would meet U.S. Department of Agriculture guidelines and recommendations, (4) progress monitoring tools in place, and (5) the wellness policy content should be devised by parents, school nutrition personnel, students, school administrators and personnel, and community members (*CNWICRA*, 2004). Wellness policies were to be implemented in all areas of the country, rural and urban, but without any additional funding (Moag-Stahlberg et al., 2008).

In order to assist schools in implementing these mandates, model wellness policies were developed by professional organizations, such as the National Alliance for Nutrition and Activity (NANA). The model wellness policies are available for customization for each state's individual needs, and websites have even been designed to provide guidance and advice on changing the school environment. NANA designed the website [www.schoolwellnesspolicies.org](http://www.schoolwellnesspolicies.org) in order to supply schools with specific ways in which they can implement better nutrition and physical activity opportunities (NANA, 2006). The wellness policies target a variety of healthy lifestyle behaviors in the school environment. Schools should provide more nutritious meals including a variety of fruits and vegetables and low and fat-free milk, while also being attractive to children (NANA,

2006). Similarly, vending machine food and beverages also should be limited to nutritious options.

Physical activity is another key component of the wellness policies mandated by the *Child Nutrition and WIC Reauthorization Act*. The model policies suggest that all students in grades kindergarten through 12<sup>th</sup> grade receive daily physical education as taught by a qualified physical education teacher (NANA, 2006). Daily recess in elementary schools is also recommended by model guidelines (NANA, 2006). In addition, physical activities should be incorporated in other classrooms besides physical education.

Certain states have done a more thorough job of implementing the mandates than others. Metos and Nanney (2007) examined the strength of Utah's school wellness policies and found mandatory compliance highest in school districts with high participation in free- and reduced-price programs. Overall, 77% of Utah's school districts complied with all five components outlined in federal legislation. The researchers noted that compliance may be a positive step in providing a more healthy school environment and provides support for the need for stronger mandates of wellness policies in all school districts. In South Carolina, the legislature and governor enacted *South Carolina's Students' Health and Fitness Act of 2005* requiring specific changes to physical education and food service requirements, parent involvement in student health assessments, and evaluation of physical fitness in the schools (IOM, 2007). These state-level changes increase awareness of and participation in healthy eating and physical activity. According to the National Association of State Boards of Education (NASBE), South Carolina,

Arkansas, and Rhode Island lead the way in developing and providing comprehensive school wellness policies in their districts. These three states exemplify the model school environment by establishing standards above federal recommendations and building systems of accountability to measure progress and growth (Action for Healthy Kids, 2008).

Thus far, there have not been many studies specifically assessing the results of the *Child Nutrition and WIC Reauthorization Act* changes because of the delay in wellness policy implementation. A study done by Moag-Stahlberg et al. (2008) evaluated the effectiveness of wellness policies across the U. S. Samples of policies were taken and compared to mandates outlined in the *Child Nutrition and WIC Reauthorization Act* and policies outlined in Action for Healthy Kids' *Wellness Policy Fundamentals* which provides best practices in nutrition and activity. The researchers found that 68% of the policies reviewed met mandate requirements outlined in the *Child Nutrition and WIC Reauthorization Act* (Moag-Stahlberg et al., 2008). In the area of physical activity, none of the policies assessed met best practices standards set forth in the *Wellness Policy Fundamentals* (Moag-Stahlberg et al., 2008). One of the most notable gaps in policies as noted by the researchers was that only 45% of policies assessed included specific requirements on time or intensity of physical education. Direct implications of the mandate need to be understood in order to guide future obesity prevention and treatment efforts in the school.

Despite legislative changes to the school environment, children and adolescents are not meeting the physical activity criteria set forth in the recommendations. As

reported in the 2005 YRBSS data, only 35.8% of students surveyed (9<sup>th</sup>-12<sup>th</sup> graders) had been physically active for at least 60 minutes per day on five or more of the last seven days (Eaton et al., 2006). This decline is more dramatic in the transitional period between childhood and adolescence. Kimm et al., (2000) developed a 10-year longitudinal study to analyze physical activity patterns in females beginning at ages 9 and 10 and ending at ages 18 and 19 years. The researchers found that daily physical activity declined by 35% in the participants during the 10 year period (Kimm et al., 2000).

Just as geographic disparities in obesity have not been widely studied, neither have regional differences in vigorous physical activity participation among youth and adolescents (Singh, Kogan, Siahpush, & van Dyck, 2009). Singh, Kogan, Siahpush, and van Dyck used data from the 2003 National Survey of Children's Health to analyze state and regional disparities in vigorous physical activity in children aged 6 to 17 (2009). Vigorous physical activity (VPA) was defined as activity that made the child sweat or breathe rapidly and prevalence was measured by participation in VPA for three or more days during a week. Results indicated that the East Southcentral region, including Kentucky, Tennessee, Alabama, and Mississippi, had the highest prevalence of no days of VPA (12.6%) and the West Northcentral region, including Minnesota, Idaho, Montana, North Dakota, South Dakota, Nebraska, and Kansas, had the lowest prevalence of no days of VPA (9.7%) (Singh, Kogan, Siahpush, & van Dyck, 2009). Researchers indicate that this was the first study to document such geographic patterns in vigorous physical activity.

Evidence and professional recommendations regarding physical activity are not applied without barriers. Many children do not have appropriate access or opportunities to participate in physical activity. According to Dietz and Gortmaker (2001), children living less than a mile from school rarely walk to or from school. Similarly, neighborhood violence and structure may lead to less physical activity in the everyday life of children (Dietz & Gortmaker, 2001). More interventions directed at children and adolescents need to emphasize settings where the majority of all types of children can be accessed.

#### *The School Environment as a Venue for Change*

In order to target childhood overweight, reliable interventions need to be implemented where the most children will benefit and share in the outcomes. As many as 53.2 billion children attended public or private schools in the year 2000, making the school a strategic place to target overweight prevention efforts (Koplan et al., 2005). The schools offer a structured environment where children can learn more about healthy living and establishing healthy routines at an early age. By targeting school systems, interventions will reach a large and captive audience in a cost-effective manner (Pyle et al., 2006). The *Child Nutrition and WIC Reauthorization* sought to take advantage of this environment.

Many studies find that schools offer the structure and time needed in order to implement successful prevention programs (Budd & Volpe, 2006; CDC, 1997; NASPE & AHA, 2006; Pate, Davis, Robinson, Stone, McKenzie, & Young, 2006; Pyle et al., 2006; Segal & Gadola, 2008; Story, Kaphingst, & French, 2006). According to the Institute of

Medicine's 2005 report *Preventing Childhood Obesity: Health in the Balance* (as cited in IOM, 2007), in addition to an academic learning environment, schools should provide a base where students learn healthy eating behavior and provide opportunities for regular physical activity. This report includes multiple recommendations, such as increasing opportunities for physical activity throughout the school day and performing yearly assessments of student BMI percentiles. Despite recommendations, the number of methodologically sound research studies focused on obesity prevention at the school level is small (Kropski et al., 2008). In response, school districts throughout the country have embarked on exploratory interventions to expand the research base on school-based overweight programs (IOM, 2007).

Although schools offer an ideal opportunity for overweight prevention strategies, there are challenges associated with using this system. Teachers report difficult time constraints along with financial concerns as primary barriers to implementing many school-based efforts to prevent overweight (IOM, 2007). Administrators, educators, and local boards of education may find the academic pressures asserted in the *Elementary and Secondary Education Act (ESEA)* difficult to incorporate. The reauthorization of *ESEA (No Child Left Behind)* places more emphasis on standardized tests and academic achievement within major academic subject areas versus health and physical education (United States Department of Education, n.d.). Time, therefore, is taken away from these areas in order to increase academic achievement.

On the contrary, research shows a link between physical activity and academic achievement. One meta-analysis covering approximately 200 studies showed a small

positive effect size (.25) of physical activity on cognition, per author report (Etnier, Salazar, Landers, Petruzzello, Han, & Nowell, 1997). In another literature review, Trudeau and Shepard (2008) found that dedicating time during the school day to physical activity pursuits (e.g. physical activity, physical education, sports participation) did not significantly decrease students' performance in academic areas, and instead improved behavior, memory, and concentration on tasks. Likewise, Mahar, Murphy, Rowe, Golden, Shields, and Raedeke (2006) demonstrated that third and fourth graders who participated in physical activity breaks during academic instruction exhibited an increase in time on-task than those students who did not participate, thus adding support to the positive academic effects of physical activity.

*Physical education in the schools.* One important common theme in the literature is the need for school-based efforts to increase physical activity. There are a variety of ways in which physical activity can be implemented in the schools, but physical education is the most commonly used intervention across grade levels. Physical education has long been offered within schools. A quality physical education program provides the setting where students can learn to engage in and enjoy a physically active lifestyle (CDC, 1997). Unfortunately, little progress has been made in establishing physical education requirements (IOM, 2007).

Physical education requirements vary from state to state and participation may depend on grade level as there are no federal laws requiring the availability of physical education in public schools. As reported in the *Shape of the Nation Report* (SONR) (NASPE & AHA, 2006), 42 states require physical education at the high school level,

while only 33 and 36 states require the same of middle and elementary schools, respectively. Few states have requirements concerning the amount of time spent in physical education or the frequency with which students attend (IOM, 2007). Physical education in the high school grades is mandated by 35 states, but with less specificity about implementation details (NASPE & AHA, 2006).

Daily physical education participation dropped by almost half, from 42% to 28%, between the years of 1991 to 2003 (NASPE & AHA, 2006). Very few schools implement daily physical education for the entire school year (NASPE & AHA, 2006). When specifically analyzing year-long physical education requirements, only 3.8% of elementary, 7.9% of middle, and 2.1% of high schools offered physical education for a full school year (Lee, Burgeson, Fulton, & Spain, 2007).

The National Association of State Boards of Education (NASBE) and the American Academy of Pediatrics also suggest that all students receive daily physical education. Both NASBE and NASPE recommend schools provide at least 225 minutes per week at the high school level and at least 150 minutes per week at the elementary level (Burgeson et al., 2001).

*The positive benefits of physical education.* Physical education is the most common way in which to implement physical activity in the schools. Cawley, Meyerhoefer, and Newhouse (2007) used the YRBSS data for the years 1999, 2001, and 2003 along with the 2001 *Shape of the Nation Report* and state requirements for physical education to find the influence of state physical education requirements on physical activity, weight, and the probability of being overweight. Results of the Cawley et al.

study (2007) showed that students with a physical education requirement reported more time being physically active in physical education class; boys reported 26.9 additional minutes and girls reported 37 minutes per week. As physical education requirements contributed to more time spent being physically active for girls, it also increased daily participation in sustained vigorous physical activity and strength-building activity.

Datar and Sturm (2004) used data from the Early Childhood Longitudinal Study – Kindergarten Class (ECLS-K) to study the effects of physical education instruction time on BMI changes in a one-year period. Data was collected from 9,751 kindergartners and measures were taken in the fall and spring of kindergarten and later in the fall of first, third, and fifth grades. Physical education exposure was measured as number of minutes per day and number of times during the week. Only 16% of kindergartners participated in daily PE classes in 1998, and 13% had physical education either less than one day a week or never (Datar & Sturm, 2004).

Analysis showed that, between kindergarten and first grade, a 1-hour increase in physical education time per week led to a .31-point ( $p < .001$ ) greater reduction in BMI in girls who were overweight or at risk for overweight (Datar & Sturm, 2004). The effect on boys who were overweight or at risk for overweight was smaller and not significant ( $-0.07, p = .25$ ) (Datar & Sturm, 2004). Similarly, children with normal BMI or low BMI were not affected by the increase in physical education time. Datar and Sturm (2004) demonstrated a potential impact of physical education on those girls who were at risk of or were overweight.

Physical education participation also leads to positive long term outcomes as demonstrated by Menschik, Ahmed, Alexander, and Blum (2008). They found that physical education participation in adolescence decreased the likelihood of becoming overweight as an adult. Results of the National Longitudinal Study of Adolescent Health were used to compare BMIs across participants during adolescence and again ten years later. The researchers found that for each weekday a normal weight adolescent participated in physical education, the odds of becoming overweight in adulthood decreased by 5% (Menschik et al., 2008).

Physical education is a prevention tool that can be used to fight the obesity epidemic. Research demonstrates positive outcomes associated with physical education and government initiatives cite physical education as one way in which to improve the health status of our nation's schools. Therefore, physical education participation serves as a health indicator of our schools and one way in which to gauge impact of the *Child Nutrition and WIC Reauthorization Act*.

### Conclusion

Given the public health problem of obesity in children and the 50 billion children attending United States schools, this seems an optimal venue for healthy weight promotion. The *Child Nutrition and WIC Reauthorization Act* required school involvement in obesity prevention: schools receiving federal funding were required to provide nutritious meals and opportunities for physical activity such as physical education. Schools were required to do this by the start of the 2006 school year. The *Child Nutrition and WIC Reauthorization Act* expires on September 30, 2009 which calls

for immediate action to determine implementation effectiveness in the schools. The present analysis was the first to analyze geographic variations in legislative compliance in regards to physical education participation and resultant BMI percentiles. This information is crucial in directing further obesity prevention strategies.

## CHAPTER III: METHOD

### Instrument

Data from the 2003 and 2007 Youth Risk Behavior Surveillance System (YRBSS) were used in this analysis. The YRBSS is a self-report, school-based survey conducted biennially by the Centers for Disease Control and Prevention since 1991. The survey monitors six health-risk behaviors including: physical activity levels, sexual behaviors, behaviors associated with violence and injury, tobacco use, alcohol and drug use, and dietary behaviors. Additional information on race, height, and weight are also surveyed within the instrument.

The YRBSS is updated to reflect national and local trends and concerns before each biennial distribution. A systematic review took place in 1997, and additions, deletions, and corrections were made for the 1999 survey; this included the addition of the height and weight questions which addressed the growing concern for obesity (CDC, 2004). Minor changes have been made after the 1999 survey. In general, the YRBSS consists of 87 core, multiple choice questions based on health-related behaviors. The 2007 survey included 11 additional questions. Only those surveys with correct documentation, a response rate of 60%, and a sample that was scientifically drawn were included. Responses were weighted (a.) to ensure representativeness of the sample from which they were drawn and (b.) to adjust for non-response.

The CDC has conducted several studies on the reliability and validity of the instrument. One study, conducted in 1992, found that 75% of the survey had a substantial reliability ( $\kappa = .61$  to  $1.00$ ) (CDC, 2004). In 2000, the 1999 survey was tested for

reliability and significant differences between time one and time two were found ( $\kappa < .61$ ). Certain items were then adjusted or deleted in subsequent surveys (CDC, 2004).

Establishing the reliability of self-report measures, such as the YRBSS, is complicated. In 2003, the CDC searched the literature to find situational and cognitive factors that may influence adolescent reports of behavior, and it is important to understand that factors can influence responses. The reliability of the questions about height and weight from the YRBSS was also studied by the CDC. After completing the survey, students were weighed and measured. Researchers determined that self-reported height and weight and resultant BMI was substantially reliable (CDC, 2004).

#### *Data collection methods of the YRBSS*

Participant schools in both 2003 and 2007 utilized a similar three-stage, cluster design to ensure nationally representative data. Surveys were distributed by trained data-collectors in February through May of odd-numbered years. Survey procedures protected anonymity and were completely voluntary. Parent permission was obtained before surveys were distributed. Students filled out computer-scannable survey booklets in one class period.

#### *Participants*

Participants consisted of a national sample of students in the 9<sup>th</sup> through 12<sup>th</sup> grades from public, private, and Catholic schools across the U. S. A total of 83,253 surveys were analyzed. With regard to surveys containing complete data, the 2003 sample (N=37,717) included 50.7% females (n= 19,230) and 48.3% males (n=18,305). Examining complete records, the 2007 sample (N=45,536) included 50.6% females

(n=23,025) and 48.7% males (n=22,159). Participants in 2003 included 30.5% 9<sup>th</sup> graders, 27.3% 10<sup>th</sup> graders, 21.8% 11<sup>th</sup> graders, 18.6% 12<sup>th</sup> graders, and 0.6% were not in a specific grade. The 2007 participants included 28.7% 9<sup>th</sup> graders, 26.8% 10<sup>th</sup> graders, 24.4% 11<sup>th</sup> graders, 18.8% 12<sup>th</sup> graders, and 0.4% were not in a specific grade.

### *Design of the Study*

*Variables.* The variables used in this study were defined by the CDC. They are as follows.

Body Mass Index (BMI). BMI was calculated by combining self-report height and weight data. Students answered the questions “How tall are you without your shoes on?” and “How much do you weigh without your shoes on?” (CDC & USDHHS, 2007). Height was reported in feet and inches and was converted to meters using the following formula: [(feet × 12) + inches] × 0.0254 m/in (CDC & USDHHS, 2008). Children and adolescent BMI is based on percentile ranks so comparisons between age and gender can be used.

CDC data from the 2007 YRBSS included BMI percentiles, while 2003 data only provided variables based on BMI classifications “overweight” and “at risk of becoming overweight.” Therefore, researchers transformed the data ex post facto in order to make 2003 and 2007 comparable, using a program provided by the CDC (CDC, 2009).

Physical education participation. Physical education participation was measured by student response to the question “In an average week when you are in school, on how many days do you go to physical education (PE) classes?” Responses included 0, 1, 2, 3, 4, or 5 days (CDC & USDHHS, 2007).

Geographic location. Geographic location for the YRBSS data was categorized by U.S. Census Bureau classifications and available data. Results were organized according to the four regions listed in the introduction. State data were included only for those states that collected data in 2003 and 2007 for the questions of interest (United States Census Bureau, 2007).

#### Analysis of Data

The YRBSS required specialized software capable of handling complex sampling procedures. By design, samples analyzed with appropriate software, per CDC recommendations, produced reliable results (CDC, 2009). Five specific statistical program packages and/or add-on utilities were recommended and used with the YRBSS. In these packages, variances were calculated taking stratification, clustering, and variability of sampling weights into account, resulting in more accurate estimates. Base modules of many popular programs were not recommended and therefore not used. In this study, SPSS Complex Samples© was used for all analyses. Data analyses included descriptive procedures and Analyses of Variance (ANOVA). A one-way ANOVA was conducted to compare days of physical education participation in the years of 2003 and 2007. Additionally, an ANOVA was computed to analyze differences in BMI percentiles pre- and post-legislation. To analyze geographic differences in physical education participation between the years of 2003 and 2007, a 2 x 4 ANOVA was computed. BMI percentiles were also analyzed through ANOVAs for each region to detect differences between those same years.

## CHAPTER IV: RESULTS

As previously mentioned, the current study utilized data from the YRBSS: the present analyses included states with complete data available from surveys administered in 2003 and 2007. Tables 1 and 2 below depict demographic characteristics associated with participants from 2003 and 2007, respectively.

Table 1.

### *YRBSS 2003 participant demographics in percentages*

	FEMALE	MALE	9th	10th	11th	12th	WHITE	BLACK	HISPANIC	OTHER
Alaska	48.1	51.9	30	25.8	22.6	21	61.1	1.9	2.9	34
Arizona	51.1	48.9	28.6	26	23.7	21.6	55.5	2.6	32.2	9.7
Montana	48.2	51.8	26.3	25.5	24.3	23.4	87.4	0.4	1.2	11
Utah	49.7	50.3	24	23.5	23.7	23	85.4	0.6	8.7	5.3
Idaho	48.3	51.7	27.1	25.8	23.9	23.2	89.5	0.4	8.3	1.8
Delaware	49.5	50.5	29.9	25.2	23.3	21.4	63.1	28.9	5.7	2.3
Kentucky	49.2	50.8	29.1	26	22.5	21.4	88.7	9	0.6	1.7
Mississippi	51	49	30.8	26.1	22.6	20.4	49.8	48.5	0.4	1.3
Tennessee	49.5	50.5	29.5	26.5	23	20.7	74.3	22.4	1.3	2.1
NC	49.5	50.5	31.5	26.3	22.6	19.3	63.8	29.4	2.3	4.5
West Virginia	48.6	51.4	27	25.3	25.3	22.1	94.7	3.9	0.1	1.2
Indiana	48.8	51.2	28.3	25.5	23.7	22.4	83.9	10.2	2.6	3.3
Maine	48.9	51.1	27.3	25.2	24.6	22.7	96.1	0.5	0.8	2.6
Massachusetts	49.5	50.5	28.9	25.4	23.6	21.6	76.5	8.7	10.4	4.3
NY	49.8	50.2	31	27.2	21.3	19.6	58.7	18.4	17	5.9
TOTAL	49.3	50.7	28.6	25.7	23.4	21.6	75.2	12.4	6.3	6.1

Table 2.

*YRBSS 2007 participant demographics in percentages*

	FEMALE	MALE	9th	10th	11th	12th	WHITE	BLACK	HISPANIC	OTHER
Alaska	48.6	51.4	27.8	26.2	23.8	22	58.7	2.1	4.3	34.9
Arizona	49.1	50.9	27.5	26.1	23.2	22.5	50.6	3.3	35.3	10.8
Montana	48.8	51.2	27	25.3	24.5	22.8	85.7	0.3	2.2	11.9
Utah	48.7	51.3	25.5	24.9	24.8	23.3	84.2	0.4	10	5.5
Idaho	48.4	51.6	26.9	25.6	24.2	22.8	84.4	0.4	11.4	3.7
Delaware	48.5	51.5	31.5	26.2	21.8	20.2	53.3	27.1	10.3	9.3
Kentucky	49.2	50.8	30.2	25.9	22.5	21.2	86.6	9.9	1.7	1.8
Mississippi	51.2	48.8	31.5	26.4	22.2	19.7	46.3	50.8	1.6	1.3
Tennessee	49.3	50.7	29.3	26.4	23.5	20.5	70.9	24.4	2.7	2
NC	49.6	50.4	30.3	25.9	23.1	20.4	58.5	31.9	6.4	3.3
West Virginia	48.9	51.1	28.6	25.6	23.4	22	93.8	4.5	0.7	1
Indiana	49.4	50.6	28.5	26	23.8	21.5	81	11.4	4.8	2.8
Maine	48.8	51.2	26.3	25.3	24.2	23.9	94.2	0.7	2.2	2.9
Massachusetts	49.3	50.7	27.5	25.3	24.4	22.5	72.8	8.5	12.5	6.2
NY	49.8	50.2	28.8	26.8	22.8	21.2	57.9	18.3	16	7.8
TOTAL	49.2	50.8	28.5	25.9	23.5	21.8	71.9	12.9	8.1	7.0

Analyses examining the days of physical education participation and associated BMI percentiles were conducted. As predicted in  $H_1$ , the one-way ANOVA indicated that the self-reported average number of physical education days was not significantly different from 2003 to 2007,  $F(1, 365) = .519, p = .472$ .

In addition to physical education participation, BMI percentiles were also analyzed as a way to monitor overweight prevalence. ANOVA results for the BMI percentiles of participants in 2003 versus those of participants in 2007 indicated a significant difference between BMI percentiles between the years 2003 and 2007,  $F(1, 363) = 5.69, p = .018$ . While the effect size was minimal ( $d=.04$ ), BMI percentiles significantly decreased between these years.

Geographic differences in each research question were also analyzed. Tables 4 and 5 present results of both the days of physical education participation and BMI percentiles for the four geographic regions. Specifically, Table 3 indicates differences in physical education participation. The results of the Year (2003 vs. 2007) x Region (West, South, Midwest, Northeast) ANOVA indicated a significant main effect for region,  $F(3,363) = 63.801, p = .000$ , specifically the Northeast region was significantly higher than all other regions, but not for year  $F(1, 365) = .132, p = .717$ . While results were statistically significant for region, the strength of the effect was negligible (Partial Eta Squared = .039). There was not a statistically significant interaction for Year (2003 vs. 2007) x Region (West, South, Midwest, Northeast):  $F(3, 363) = 1.875, p = .133$ .

Table 3.

*Means by Region and Year for Number of Days Per Week of Physical Education Participation*

Geographic Region		Mean	Std. Error	95% Confidence Interval	
				Lower	Upper
West	2003	2.89	0.06	2.77	3.01
	2007	3.06	0.106	2.85	3.27
South	2003	2.69	0.074	2.54	2.83
	2007	2.60	0.052	2.50	2.70
Midwest	2003	2.56	0.154	2.25	2.86
	2007	2.67	0.124	2.43	2.92
Northeast	2003	3.48	0.058	3.36	3.59
	2007	3.39	0.063	3.26	3.51

Table 4 presents regional differences in BMI percentiles according to year. A Year (2003 vs. 2007) x Region (West, South, Midwest, Northeast) ANOVA for BMI

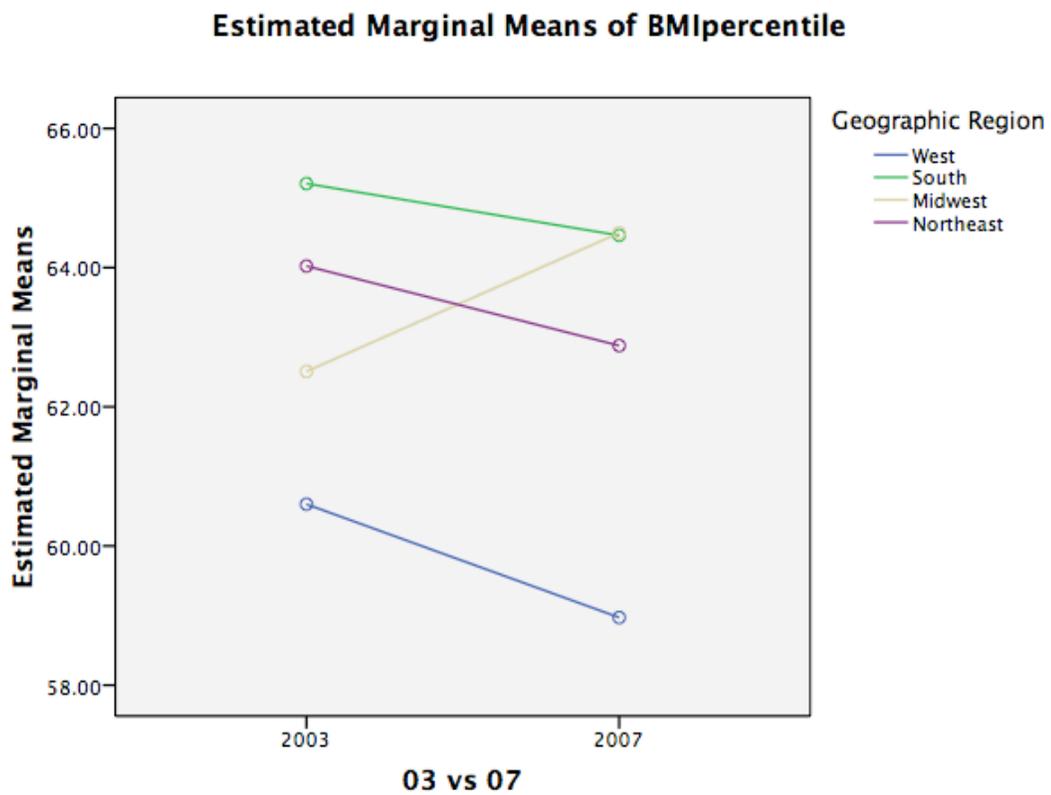
percentiles yielded a significant main effect for geographic region,  $F(3, 361) = 17.50, p = .000$ , but not year,  $F(1,363) = 3.19, p = .075$ . A significant interaction between year and region was found,  $F(3, 361) = 3.66, p = .013$ . Again, though negligible effect was detected (Partial Eta Squared = .01), geographic location was differentially influential on BMI percentiles depending on the year of the YRBSS survey.

Table 4.

*Means by Region and Year for BMI Percentiles*

Geographic Region		Mean	Std. Error	95% Confidence Interval	
				Lower	Upper
West	2003	61.03	0.61	59.82	62.23
	2007	57.85	1.03	55.83	65.29
South	2003	64.67	0.39	63.90	65.43
	2007	64.42	0.44	63.56	65.29
Midwest	2003	61.95	1.07	59.84	64.07
	2007	63.62	0.67	62.31	64.94
Northeast	2003	64.64	0.43	63.80	65.48
	2007	62.82	0.57	61.70	63.94

Figure 1 displays the year by geographic region interaction and associated influences on BMI percentiles. Post-hoc analyses were split by year in order to detect specific differences in regional BMI percentiles. ANOVA results for the West region indicate a significant decrease in BMI percentiles between 2003 and 2007,  $F(1,363) = 7.26, p = .007 (d = .12)$ . Self-reported BMI percentile means in the West were 61.03 (SE=.61) and 57.85 (SE=1.03) in 2003 and 2007, respectively. Participants in 2003 from the South, Midwest, and Northeast were compared with 2007 participants in these regions, but no significant differences were detected.



*Figure 1. Year by Geographic Region Interaction on BMI Percentiles*

## CHAPTER V: DISCUSSION

Obesity prevalence among U.S. adolescents has become a national epidemic with far-reaching consequences. In order to reverse this trend, national initiatives to combat the obesity epidemic have been implemented. In 2004, Congress enacted the *Child Nutrition and WIC Reauthorization Act* to direct attention to the important role schools play in the fight against obesity. The legislation required schools participating in the National School Lunch and School Breakfast programs to implement school wellness policies at the local level to target individual school district strengths and weaknesses in the areas of nutrition and physical activity (*CNWICRA*, 2004). Implementation was not without barriers as funding and academic requirements caused many states to refrain from immediate implementation requirements (IOM, 2007; United States Department of Education, n.d.).

This study sought to analyze the impact of the *Child Nutrition and WIC Reauthorization Act* by utilizing self-reported data from the CDC's YRBSS both pre- and post-legislation. Research questions addressed physical activity-related objectives, specifically school-based physical education, outlined in the wellness policies mandated in the *Child Nutrition and WIC Reauthorization Act*. Variables analyzed included physical education participation and BMI percentiles as measures of legislation effectiveness. This study was the first to analyze the impact of this legislation in these areas, and it comes at a crucial point in time before the Act expires in September 2009.

### Legislative Effects on Physical Education Participation

One general objective of school wellness policies addressed physical activity needs and recommendations, but specific guidelines did not accompany this objective. In this study, physical education participation was used as a gauge of legislative compliance in the area of physical activity. As expected, a significant difference in the number of days per week of physical education participation was not detected. Adolescents did not report greater participation in physical education in 2007 after the implementation of the *Child Nutrition and WIC Reauthorization Act* than participants in 2003. These results support the research of the IOM (2007) and the United States Department of Education (n.d.) in which both signified the importance of barriers such as economic restraints and academic pressures in deterring schools from providing additional physical education requirements. At a time when financial resources are not abundant, non-academic classes do not appear to be of top priority.

### Legislative Effects on BMI Percentiles

Preliminary data suggest that the *Child Nutrition and WIC Reauthorization Act* may have had a significant effect on BMI percentiles in adolescents. Despite no effect on physical education participation, results indicate a decrease in BMI percentiles based on the YRBSS. In 2003, the YRBSS revealed an average adolescent BMI percentile rank of 63.59 according to sex- and age- related adolescent categorization. Wellness policies were required to be enacted at the start of the 2006 school year, at the latest, though some were initiated in the 2005 school year. According to the Spring 2007 YRBSS results, the average adolescent BMI percentile rank was 62.57 – a statistically significant decline

from 2003. The BMI percentile rank of 62.57 still falls within the upper limits of the normal range of BMI percentiles. While a decline is a positive result, this small change may not be the meaningful change the policymakers had hoped for in the creation of the wellness policies. The wellness policies incorporated under the mandate were not specific. Therefore local educational agencies were left to devise their own plans and thus, changes in BMI percentiles may reflect adjustments in other areas besides physical education participation. Despite the growing prevalence of obesity in adolescents, our results suggest that current legislative efforts are worthy of continued investigation.

#### Geographic Variations in Results

Without specific policy language, many local school districts created wellness policies targeting their own needs. Though this approach allowed the policies to be more individualized, it also led to differential implementation procedures and requirements across various regions of the country.

Results indicate significant differences between four regions of the United States including the West, South, Midwest, and Northeast. Promising results were found only in the West region, which included the states of Alaska, Arizona, Montana, Utah, and Idaho. The 2009 data may show further advancements and should be studied.

These results support the findings outlined by Moag-Stahlberg et al. (2008). These researchers found that only 45% of those policies analyzed addressed requirements for physical education, reflecting the outcome of this study as well. Perhaps more specific guidelines for wellness policies would have significantly impacted physical education participation across all regions.

Utah appears to be a model state for school wellness policies. As indicated by Metos and Nanney (2007), 78% of Utah's schools complied with guidelines set forth in the *Child Nutrition and WIC Reauthorization Act*. In this analysis, Utah was included as part of the West region, which demonstrated a preliminary pattern in increasing physical education participation. Thus, this state may provide a positive model for other school systems.

In addition to physical education participation, results – based on a statistically significant year by geographic region interaction - also suggest differential outcomes in BMI percentiles. In general, the West, Southeast, and Northeast regions reported downward trends in BMI percentiles. Only the Midwest reported an upward trend, but again, this data is only based on one state. Participants in the West reported significantly lower BMI percentiles after the implementation of the legislation even when childhood obesity is at epidemic proportions. These findings are consistent with regional research done by Singh, Kogan, and van Dyck (2008) who analyzed adolescent BMI percentiles according to state and regional data. Those researchers found the lowest prevalence of obesity among adolescents in the Mountain region which is analogous to the West region in this study.

The positive patterns presented in this study may indicate stronger compliance with legislative mandates in the West which may be associated with the lower BMI percentiles found in this region. The overall goal of the *Child Nutrition and WIC Reauthorization Act* was to provide a way in which schools could combat the growing number of overweight and obese children in the U.S. Though consistent results were not

detected across regions, the results of the West region provide preliminary support for the school wellness policies as a preventative tool in the fight against the obesity epidemic when addressed and implemented with integrity.

#### Limitations and Directions for Future Research

The primary limitation of this research is the reliability and validity of the self-reported data in the YRBSS. As with all self-report data, there may be response biases, especially with fluctuating variables such as height and weight. Even though the CDC assessed the validity of YRBSS results and reported confidence in their findings (CDC, 2004), it is difficult to judge with assurance. However, it is difficult to match the breadth of coverage of the YRBSS: the YRBSS included nationally representative data presenting a comprehensive picture of adolescents in high school. This study analyzed data from 86,253 participants. Without the YRBSS, this would not have been feasible. No other tool of this magnitude exists.

Additionally, other variables such as gender, race, and socioeconomic status may have influenced results in this study and were not controlled in these analyses.

Socioeconomic status is of particular concern due to the fact that the *Child Nutrition and WIC Reauthorization Act* applies only to schools who receive federal funding.

Unfortunately socioeconomic status was not included in the YRBSS questionnaire.

Future research should control for these extraneous variables in order to obtain a clearer understanding of legislation effects.

Within the YRBSS domains, physical education was only measured by days of participation and not actual moderate to vigorous physical activity during class time. In

order to better understand the relationship between physical education and resultant BMI, physical exertion levels should be measured. Future research may target this area to support physical education as a tool in preventing obesity.

This study was dependent on the availability of state YRBSS data via the CDC. A more comprehensive understanding may have emerged if more states published health-related data such as YRBSS results. The Midwest, for example, only included one state due to lack of participation or publication of data. Therefore, Midwest results are not truly representative of the region and should be interpreted with caution.

The present study analyzed the impact of the federal mandate on physical education and BMI, merely one component of the wellness policy guidelines. Guidelines outlined in model school wellness policies addressed nutritional opportunities in addition to physical activity. Just as Moag-Stahlberg et al. (2008) assessed *Child Nutrition and WIC Reauthorization Act* compliance across geographic regions in 2008, future research should update their findings to assess progress each year in nutrition and physical activity compliance. Nutrition is an important part of the energy balance and thus should be assessed in order to completely understand national policy compliance.

Finally, when noting limitations, as outlined in the *Child Nutrition and WIC Reauthorization Act*, school wellness policies were to be implemented by the start of the 2006-07 school year. Analyses of the 2007 YRBSS may have been too premature in detecting any impact of legislation. YRBSS data from 2009 is forthcoming and will provide more data to inform the current analysis, ultimately evaluating legislative impact.

Unfortunately, *the Child Nutrition and WIC Reauthorization Act* expires on September 30, 2009 and, without support, may come to an end.

### Implications

This is the first study to analyze the direct impact of the *Child Nutrition and WIC Reauthorization Act* on physical education participation and BMI percentiles. These results are tied to strong economic, policy, social, and health implications. Preliminary findings may imply that some areas of the country have made greater strides towards policy compliance. Positive patterns in physical education participation and lower BMI percentiles in the Western region (including Alaska, Arizona, Montana, Utah, and Idaho) may indicate stricter adherence to policy mandates. More investigation into specific state wellness policies is needed to confirm preliminary findings.

Most importantly, the results of this study reveal that prevention and educational programs in the schools have the potential to help fight the obesity epidemic. How might we take better advantage of this environment in order to bring about more meaningful, lasting change? In order to make a more significant impact on the epidemic, more programs and research need to be implemented. These findings demonstrate the important role schools play in overall youth health and development and provide support for additional research on school-based preventative efforts in fighting obesity.

### Conclusions

The *Child Nutrition and WIC Reauthorization Act* sought to transform schools into healthy environments where children and parents learn about and adopt healthy behaviors by providing nutritional food choices and opportunities for physical

activity. Without financial support or specific guidelines to follow, the success of the mandate was difficult to predict. The results found in this study indicate that school wellness policies are important in fighting the child and adolescent obesity epidemic.

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APPENDIX: IRB APPROVAL FORM



University and Medical Center Institutional Review Board  
 East Carolina University  
 Ed Warren Life Sciences Building • 600 Moye Boulevard • LSB 104 • Greenville, NC 27834  
 Office 252-744-2914 • Fax 252-744-2284 • www.ecu.edu/irb  
 Chair and Director of Biomedical IRB: L. Wiley Nifong, MD  
 Chair and Director of Behavioral and Social Science IRB: Susan L. McCammon, PhD

TO: Laura Anderson, PhD, Dept of Psychology, ECU—104 Rawl Building  
 FROM: UMCIRB κκκ  
 DATE: January 12, 2009  
 RE: Human Research Activities Determined to Meet Exempt Criteria  
 TITLE: "Geographic Patterns in Physical Education Participation: Have Legal Mandates Made a Difference?"

UMCIRB #08-0778

This research study has undergone IRB review on 1.2.09. It is the determination of the IRB Chairperson (or designee) that these activities meet the criteria set forth in the federal regulations for exemption from 45 CFR 46 Subpart A. These human research activities meet the criteria for an exempt status because it is a research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. *NOTE: 1) This information must be existing on the date this IRB application is submitted. 2) The data collection tool may not have an identifier or code that links data to the source of the information.*

The Chairperson (or designee) deemed this unfunded study no more than minimal risk. This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any changes must be submitted to the UMCIRB for review prior to implementation to allow determination that proposed changes do not impact the activities eligibility for exempt status. Should it found that a proposed change does require more substantive review, you will be notified in writing within five business days.

The following items were reviewed in determination exempt certification:

- Internal Processing Form (dated 12.17.08)
- Thesis Presented to Dept of Psychology (Dec 08)
- 2007 National YRBS Data Manual

It was furthermore determined that the reviewer does not have a potential for conflict of interest on this study.

The UMCIRB applies 45 CFR 46, Subparts A-D, to all research reviewed by the UMCIRB regardless of the funding source. 21 CFR 50 and 21 CFR 56 are applied to all research studies that fall under the purview of Food and Drug Administration regulations. The UMCIRB follows applicable International Conference on Harmonisation Good Clinical Practice guidelines.