The School Health Environment and Student Outcomes Related to Childhood Overweight in Southwest Virginia

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ABSTRACT

Objective: Measure the association between School Health Index (SHI) scores and student health outcomes related to physical activity (PA) and nutrition.
Design: Cross-sectional design utilized to collect SHI scores and administer questionnaires regarding nutrition and PA behaviors, knowledge and the home environment in 5 counties of southwest Virginia.
Participants: Staff, administrators and students (grades 4, 7, 10; n = 1094) in 27 schools in 5 school divisions.
Main Outcome Measures: SHI scores were obtained from school surveys while LWP score, student BMI percentile and fitness (mile run, PACER) measures were obtained from school data. The School Physical Activity and Nutrition questionnaire was used to measure student nutrition, PA behaviors and knowledge, and the home food environment was measured through a validated questionnaire.
Analysis: Two-sided Pearson's correlation ($p<0.05$) measuring associations between SHI score and student health outcomes of BMI percentile, one mile/PACER, nutrition and PA behaviors and health knowledge and beliefs.
Results: SHI was negatively correlated with BMI percentile for 4th grade students (-0.472, $p<0.001$) and positively correlated with BMI percentile for 8th grade students (0.679, $p<0.001$). SHI was positively correlated with 4th grade mile run (0.412, $p<0.001$), 8th grade mile run (0.218, $p<0.001$) and 4thgrade PACER (0.414, $p<0.001$).
Conclusion: Behavioral influences are multifactorial and factors outside the school environment may affect the correlations between these variables.
Application: Data concerning the influence of the school health environment can be used towards making evidence-based changes to school health programs.
Key Words: School Health Index, dietary behaviors, physical activity behaviors, physical fitness, BMI

Attribution

My journey as an undergraduate and graduate student at Virginia Tech has been more than I could have possibly imagined. I am honored and blessed to be part of such a wonderful department and to be surrounded by many amazing mentors. The faculty of HNFE has been encouraging through each challenging semester and has pushed me to grow as a student and as a person. Thank you for instilling in me not only a passion for health and nutrition, but also a sense of integrity and pride as a dietetics student and future professional.

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CHAPTER 1: INTRODUCTION

With the obesity epidemic on the rise, action needs to be taken early to reduce the prevalence of obesity in youth, rather than reversing the trend later life. Overweight and obesity is no longer a trend of adulthood, with currently one third of children and adolescents being considered overweight or obese.[1-3] Obesity is associated with short-term and long-term consequences, both psycho-social and physiological in nature, thus immediate action is pertinent for affected individuals.

Obesity prevention should start in early in life because this is an ideal time to shape lifelong healthy nutrition and physical activity habits within children. Public schools provide a unique captive audience, with more than 95% of children and adolescents attending school and 49.3 million enrolled in 2008-2009.[4,5] Likewise, children typically eat two of three meals and consume 19-50% of their total daily calories at school (between meals and snacks).[5] Thus, schools have the potential to significantly impact the lifestyles of youth by offering healthy foods, plentiful opportunities for physical activity, and extensive provision of health education.

School health policies can assist children and adolescents in growing healthier, not larger. The Institute of Medicine report on obesity prevention provides a model for school policies by recommending adequate physical education and recess periods and the establishment of nutritional standards for all foods served at school, including foods from vending machines and other competitive foods.[6] Doing so would not only benefit the weight status of youth, but also provide children with a head start in the prevention of the chronic diseases, such as heart disease, type 2 diabetes, cancer and osteoporosis, that are increasing in prevalence in adults and becoming increasingly more common early in life.[7, 8]

The causes of childhood obesity are multi-faceted, thus reversing the obesity epidemic will require coordinated and sweeping environmental and policy changes. As stated by George Blackburn, "success in the fight against obesity will require alliances between stakeholders, including academia, industry, government, parents, schools and health care professionals. It will require the mobilization of all who can serve as agents of change."[9]

The United States is slowly establishing initiatives to address the impact of the school health environment on student health outcomes. In 2004, Childhood Nutrition and WIC Reauthorization Act of 2004 mandated every school participating in the National School Lunch Program (NSLP) and National School Breakfast Program (NSBP) to adopt a Local Wellness Policy by first day of school following June 30, 2006.[10] This same policy was reinforced in the Healthy, Hunger-Free Kids Act of 2010 along with additional mandates to study the effectiveness, strengths and weaknesses of Local Wellness Policies. However, research on the adoption and implementation of these policies indicate that schools are falling short of the extensive and comprehensive change that needs to take place.[11] The evaluation of school health programs and policies is mandated by both the Childhood Nutrition and WIC Reauthorization Act and the Healthy, Hunger-Free Kids Act, yet many schools are still lacking a structured procedure for program evaluation.[12]

The School Health Index, a school health environment assessment tool developed by the Centers for Disease Control (CDC), is an ideal tool to for schools to measure the breadth wellness policies in order to promote positive change in school health environments. The School Health Index is a comprehensive measure of school health policies with eight different modules covering the topics of school health and safety policies/environment, health education, physical education, nutrition services, health services, counseling, psychological, and social services, health promotion for staff, and family and community involvement.[13] While this survey is effective in gathering quantitative data concerning school health environments, little research has been conducted to evaluate the relationship between School Health Index score and the student health behavioral outcomes of nutrition and physical activity behaviors, physical fitness level, and BMI percentile. By characterizing student health outcomes as related to School Health Index score, gaps in school health environments and Local Wellness Policies can be identified to allow for the adoption of more effective strategies in improving student health behaviors.

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CHAPTER II: REVIEW OF LITERATURE

Characterization of Childhood Overweight and Obesity

From 1966 to 2006, the prevalence of obesity has tripled among adolescents (12-19yrs), increasing from 4.6% to 17.6%[1]. One in three (34.9%) adolescents were overweight or obese in 2006.[1-3] Currently, overweight and obesity in children and adolescents are determined by body mass index (BMI) for age and gender percentiles due to the fact that children are still growing, have an unstable height and weight, and variable, acceptable levels of adiposity throughout childhood.[14] Percentile categories are as follows: Underweight <5th; Healthy Weight 5th to <85th; Overweight 85th to 95th; Obese ≥95th.[15] According to these cutoffs and the 2007-2008 NHANES survey, 32.1% and 17.8% of males and 31.3% and 15.9% of females 2-19 years old were overweight and obese, respectively[15].

Implications for childhood obesity extend into adulthood. Recent studies show that up to 70% of overweight adolescents become overweight or obese adults, and this risk increases to 80% if one or both parents are overweight.[8, 16, 17] The risk factors contributing to childhood overweight are multifaceted, but certain socio-demographic groups are more likely than others to be at increased risk. Non-Hispanic Blacks, Hispanics, Mexican Americans and American Indian children have higher overweight and obesity rates than non-Hispanic White youth ages 2-19 years.[1, 15, 16, 18] In general, obesity is highest among low-income households, but this association has been found to vary by race-ethnicity and gender.[1] While no strong associations have been identified between socio-economic status and overweight in adolescent boys, low income girls have been shown to have higher risk and prevalence (20%) for overweight than medium (14.2%) and high-income (12.9%) girls. This trend is reversed among African American adolescents, with high-income girls (38%) showing an increased incidence of overweight as compared to lower-income (24.5%) girls.[16, 18] Overall, children from families below the poverty level are found to have a 69% greater chance of being obese.[18]

Research suggests that, in general, children attending school in more rural locations of Virginia are more likely to be overweight than those attending schools in urban and suburban areas.[11,19] One explanation for the difference, along with differences in socioeconomic status, may be in a geographic difference in the allotment of funds and state-level policies because

urban school districts are more frequently allotted greater resources for the implementation of wellness programs than that of rural districts.[11, 18] This is supported by the 2000 School Health Policies and Programs Study (SHPPS), which reported that rural schools across the country have lower scores for most school health program components, including lower scores for school policy and environment, faculty and staff health promotion, mental health and social services, and family and community involvement as compared to urban schools.[20] These differences in school health environment between urban and rural school districts may be a supporting factor in the health disparities found among low-income populations.

Causes and Consequences of Overweight and Obesity

Though the causes and risk factors for obesity are multi-faceted and complex, energy imbalance from insufficient physical activity and excess caloric intake are considered at the forefront.[1,21] Changing food patterns, such as the increasing availability and consumption of energy-dense snacks and sugar-sweetened beverages, along with growing portion sizes, serve as a major contributors to tipping the balance in favor of increasing obesity prevalence.[3] Many social changes including dual income households, increased frequency of meals eaten outside the home, and changes in the school environment favor both passive and intentional increased energy consumption.[1, 6] Changes in built-environments have also have had a negative impact by making it increasingly harder to be physically active to compensate for excess calories consumed. Children and adolescents are shifting toward spending a large majority of their leisure time in front of the television or computer rather than moving, playing or participating in sports.[1] Unfortunately, while the environment is making it increasingly difficult to live a healthy lifestyle, adolescents are particularly vulnerable to negative influences on nutrition and physical activity behaviors.[1] According to the *The Surgeon General's Vision for a Healthy and Fit Nation*:

> "Adolescence is a time of vulnerability to the development of psychiatric disorders, including eating disorders, depression, drug and alcohol abuse. Adolescent boys and girls are subjected to significant peer pressure related to eating and exercise, and most school systems provide limited opportunities for physical activity. Teenagers often drink more carbonated and caffeinated beverages and eat more fast foods. These multiple stresses

and unhealthy habits make teenagers particularly vulnerable to becoming sedentary, overweight, and obese."[2]

Youth obesity and overweight is associated with widespread consequences. Children with a high BMI are more likely to have acanthosis nigricans, insulin resistance, high blood pressure, elevated triglyceride levels, sleep apnea, steatohepatitis, and gallstones.[2,22] More than 75% of children and adolescents with type 2 diabetes are obese and, according to the 1999-2006 NHANES surveys, 20% of children had one or more abnormal lipid panel value.[23] Obesity also has mental and emotional consequences, with overweight children experiencing higher rates of physical illness, social stigmatism and discrimination, psychological problems, lower self-esteem, and lower academic performance.[3] Schwimmer et al characterized the psycho-social impact of obesity and overweight on adolescents by reporting that the likelihood of impaired quality of life for obese children was 5.5 times greater than that of a healthy child, and equally likely to be as impaired as that of children fighting cancer.[24] These consequences often extend into adulthood with obese children often becoming obese adults.[8, 16, 17]

Benefits of Nutrition and Physical Activity: More than Obesity Prevention

Childhood obesity prevention is a balance between maintaining energy balance and providing children with nutrients essential to ensuring optimal health, growth, development and nutritional status.[6] Optimizing the quality of calories consumed is essential. However, the benefits of meeting nutrition and physical activity requirements extend far beyond obesity prevention and should also be taken into account.

In general, foods served to children should be low in saturated and trans fats, sodium, and added sugars, with emphasis on whole, unprocessed foods meeting daily recommendations from each food group. The American Heart Association states children and adolescents should consume a variety of fruits and vegetables per day, at least one serving of each per meal, three servings per day of low-fat dairy products for healthy bone growth and five to seven ounces of grains per day, with half of those servings being whole grains.[25] Overall fat consumption should be limited to 25 to 35% of total calories, preferably from mono-unsaturated and poly-unsaturated sources like nuts, fish and vegetable oils, while limiting saturated and trans fats.[25]

Meeting dietary recommendations is associated with a decreased risk of the chronic diseases most commonly affecting Americans today.[7, 8] Attainment of the recommended daily

allowance of calcium along with bone strengthening physical activities can be effective in reducing the risk of future osteoporosis, while a diet low in sodium and high in fiber-rich fruits, vegetables and whole grains has been shown to play an effective role in the risk reduction of obesity, type 2 diabetes, cardiovascular disease, cancer, and hypertension.[7] Among adolescents, optimal nutritional intakes, and especially breakfast consumption, are associated with an increase in students' capacity to learn, improved test grades, reduced absenteeism, decreased tardiness, and improvements in physical endurance and aspects of mental health such as mood, alertness, hyperactivity and depression.[5, 7, 13, 26, 27] Additionally, kids who consume breakfast are more likely to have better overall diet quality and meet daily micronutrient and macronutrient recommendations.[5, 26]

Daily physical activity is also essential for youth to attain and maintain a healthy weight, build cardiovascular health, and decrease risk of chronic disease. Keeping youth active while limiting sedentary activities builds healthy habits that can extend into adulthood. The CDC recommends youth engage in age-appropriate moderate to vigorous activities for sixty minutes per day, seven days per week. Muscle strengthening and bone strengthening exercises such as push-ups, gymnastics, jump rope and running have a positive effect on bone mineral density and should be incorporated physical activity at least three days per week to aid in the prevention of osteoporosis.[7, 28] Along with prevention of weight gain, regular physical activity is an effective agent in lowering cardiovascular disease risks, preventing and managing diabetes and preventing other chronic diseases and cancers.[7, 28]

Childhood Nutrition and Physical Activity Behaviors

The Youth Risk Behavioral Surveillance System (YRBSS) is a comprehensive survey that monitors six categories of high-priority health risk areas among children and adolescents. Results of these surveys have yielded consistent data since 1991, allowing for the analysis of trends over time.

Dietary intake. Students consume from 19% to 50% of their total daily calories at school, so food choices can significantly impact their health and caloric intake.[5] According to the 2009 YRBSS, 33.9% of school age students consumed two or more servings of fruit or 100% fruit juice per day, 13.8% consumed three or more servings of vegetables and 22.3% consumed five

or more servings of fruit and vegetables combined.[29] Low intakes of fruits and vegetables, an excellent source of dietary fiber, may also explain why only 39% of children 2-17 years of age are meeting USDA fiber recommendations.[30] Additionally, while only 14.5% of students consume the recommended three servings of milk per day, 29.2% of students nationwide consume one or more cans or bottles of soda per day.[29] The consumption of sugar sweetened beverages is negatively associated with milk consumption and positively associated with dental carries, and children who consume added sugars from these types of beverages also tend to consume more grains and meats while consuming less vegetables, fruits, vitamin A, calcium and folate.[7, 8]

While most youth have deficient intakes of vitamin E, calcium, magnesium, potassium, and fiber, 67% of students aged 6-19 years are exceeding the recommended intake for fat and 72% are exceeding the recommended intake for saturated fat.[8, 31] Diet-related risk factors for chronic disease, including overweight, high blood pressure and high blood cholesterol, are becoming increasingly more prevalent among the youth population.[7] With the beneficial role of diet and physical activity in chronic disease prevention being well-known, the development of healthy lifestyle habits preventing cardiovascular disease, cancer, stroke, diabetes, hypertension, and osteoporosis need to be established in early childhood.[7]

Physical activity. The Centers for Disease Control (CDC) recommends children and adolescents to be active for sixty-minutes per day, every day, yet only 18.4% of students actually meet those requirements.[29] Males are more likely to meet activity requirements (24.8%) than females (11.4%). Meanwhile, 37% of students are active for sixty minutes on five days per week and 23.1% of students meet the sixty-minute activity requirement on no days. In terms of physical education (PE) class attendance, 56.4% of students attend PE one day per week and 33.3% of students attend PE daily.[29]

Limiting sedentary activity is just as important as physical activity promotion for obesity prevention. Currently, twenty-five percent of students report using the computer for three or more hours per day (outside of school related activities) and 32.8% report watching TV for three or more hours per day.[29]

Influence of the School Health Environment on Student Health Behaviors

The school health environment and dietary behavior. The school cafeteria can serve as a potent tool in the reduction of obesity and in improvement of the nutritional health of children and adolescents. Research has suggested that greater exposure to fruits and vegetables increases their acceptance and consumption.[32] Yet while many schools want to serve healthier food options, budget shortfalls, competing interests, a general lack of knowledge and resources, and the beneficial income of selling a la carte items often serve as an obstacle.[5, 7]

Approximately 99% of all public schools and 83% of public and private schools participate in the National School Lunch Program through the US Department of Agriculture (USDA), with 78% of these schools also offering the National School Breakfast Program.[5] In 2009, these programs served over 31.3 million school-aged youth in the US.[33] The USDA mandates that school meals must meet the minimal recommendations of the Dietary Guidelines, meaning they provide no more than thirty percent of calories from fat and less than ten percent from saturated fat, while also providing one-fourth and one-third, respectively, of the recommended dietary allowance of calories, protein, calcium, iron, Vitamin A, and Vitamin C for this age group.[33] And while the USDA allows local schools to decide specific foods served, it mandates competitive foods of "little nutritional value" to not be sold within food service areas during meal periods.[5, 33]

The National School Lunch and Breakfast Programs should be an effective tool in improving students' diets, especially for low-income students who rely on their calorie intake at school to stave off hunger. However, budget constraints often complicate efforts to improve students' diets by forcing schools to raise money through increasing participation in the school meal programs, increasing the price of meals, or by selling a la carte items to generate a profit.[5] Many schools choose to sell competitive a la carte items in cafeterias, vending machines and snack shops thereby exposing youth to high calorie, high fat foods that do not fall under USDA regulations.[6] In 2006, the SHPPS reported that 32.7% of elementary schools, 71.3% of middle schools, and 89.4% of high schools had either a vending machine or other school snack shop allowing for the purchase of food or beverages outside of meals.[34] These nutrient deficient, energy-dense foods are competing with and replacing school lunches, and its in states that restrict the sale of a la carte items, such as Mississippi, Louisiana, and West Virginia that have

highest rates of school lunch participation.[5] Sales of competitive foods should be limited as they typically replace fruit, vegetable and milk consumption and are positively associated with increased body weight.[3]

The school health environment and physical activity. Lack of physical activity is a key contributor to overweight and obesity with low levels of physical activity and greater participation in physical activity being predictive of higher body weights.[35] Though high-quality physical education (PE) provides youth the opportunity to learn necessary skills for establishing and maintaining a physically active lifestyle, less than 10% of adolescents are meeting activity requirements, indicating that schools may not be providing adequate opportunities for physical activity during the school-day.[2]

According to the SHPPS 2006, only 3.8% of elementary schools, 7.9% of middle schools, and 2.1% of high schools provided daily physical education (PE) class that meet weekly physical activity recommendations (150 and 225 minutes per week, respectively, for elementary and middle/high schools).[34] Among elementary schools, 79.1% provided daily recess for students in all grade levels and 48.4% of all schools offered some sort of intramural or after school activities to students.[34] Finally, 77.0% and 91.3% of middle schools and high schools, respectively, offer at least one competitive sport for students to participate in.[34] Improving the frequency and quality of PE and increasing participation in intramural and competitive sports are ideal ways to increase the activity rates of our youth, yet this also comes at a time when many schools are cutting time spent in physical education and recess in favor of greater emphasis on academic achievement.[36]

The school health environment and health education. A school curriculum educating children and adolescents of proper nutrition and healthful weight maintenance is beneficial in assisting youth to select appropriate foods and engage in greater physical activity. Strong curricula should be included in schools to emphasize, reinforce and maximize the effectiveness of the healthy food options provided through school breakfast and lunch programs and physical education.[3]

Currently 70% of states and 84% of schools require teaching nutrition as a part of health education, while only approximately 60% of states and 80% of schools require health education concerning physical activity and fitness.[34] Among elementary, middle and high schools, only

6.4%, 20.6% and 35.8%, respectively, require health education curricula that comprehensively cover all fourteen potential health topics.[34]

Current Initiatives and Strategies to Address Student Health

The US Child Nutrition and WIC Reauthorization Act of 2004 that mandated all schools participating in the National School Lunch Program to establish a Local Wellness Policy (LWP) no later than the first day of school following June 30, 2006. This mandate was a major milestone the nation's attempt to build healthier school environments.[10, 11, 19] Local Wellness Policies are meant to address five specific areas concerning health education, physical activity and nutrition standards in order to build a healthier school environment for students, and must include: goals for nutrition education, physical activity and other wellness programs; goals and nutritional guidelines for foods provided within school; goals to ensure guidelines for school meals meet USDA standards; goals for developing and monitoring policies; and goals to include parents, students, nutrition services representatives, school board, school administers and the public in the development and implementation of policies (School Health Advisory Board).[11]

Though adoption of these policies was mandatory, the gap between their adoption and implementation remains large. In Virginia, a recent survey of 132 school districts revealed that only two schools had fully adopted a policy by 2006, while 96.7% had begun some work but had not adopted a policy.[11] A difference in implementation was shown in rural versus urban divisions of Virginia. According to the study, with rural school divisions being less likely to have drafted a LWP, less likely to have adopted specific wellness goals, and more likely to have a greater number of representatives on the School Health Advisory Board (10 vs. 7.8, respectively) than urban and suburban schools.[11]

While the intentions of the Child Nutrition and WIC Reauthorization Act of 2004 were positive, problems now exist with the implementation of local wellness policies. Slow implementation indicates that schools may be lacking the technical knowledge and resources necessary to adopt a wellness policy, or that these policies may not be of high priority.[11] Few specific government standards were set for each arena of student health to be addressed, and this lack of specificity makes it difficult to provide schools with technical assistance throughout the writing, adoption and implementation phases. Little information has been provided to districts

concerning specific standards for nutrition, health education and physical education, making the translation of concepts into reality a vague process in which outside assistance from nutrition experts may be necessary.[11] Finally, adopting a wellness policy is simply not enough. The implementation and evaluation of these policies requires resources and time that, in the midst of widespread budget cuts and competing academic interests, many schools do not have.[36]

A few specific gaps in wellness policies have been identified. While schools appear to be focusing on meeting a few of the guidelines, addressing the entire set of School Health Index recommendations is necessary to build a comprehensive and complementary school health environment.[37] More work is necessary to assist schools nationwide in developing comprehensive policies that cover the entire breadth of a coordinated school health program. Healthy eating and physical activity need to be encouraged through policy, health education, and health promotion in a consistent and complementary manner promoting nutritional integrity.[6] For example, schools need to be stressing the importance of healthy food choices through nutrition education and through the provision of only foods of high nutritional quality meeting USDA standards in cafeterias, vending machines and snack shops alike.[37]

Guidelines for developing LWP's require school divisions to establish a method to assess and evaluate the strengths and weaknesses of current policies. The USDA has recommended the School Health Index (SHI) as an effective tool for schools to self-assess the school health environment and monitor progress related to the Local Wellness Policy. The SHI, developed by the CDC, was created with the purpose of helping schools identify strengths and weaknesses in their health and safety programs, assisting in the development of action plans to improve student health and to better engage faculty, staff, parents and the community in improving the school health environment.[13] Currently the SHI addresses the areas of school health and safety policies and environment, health education, physical education, nutrition services, health services, counseling, psychological, and social services, health promotion for staff, and family and community involvement.[13]

Collection of standardized school health environment information from individual schools is vital to guide resource allocation and decisions regarding specific policies and programs in order to optimize student health behaviors and outcomes. This may be especially important in rural areas where resources are even more limited and need to be wisely used.

The School Health Policies and Programs Study (SHPPS) has collected nationwide data since 1994 related to the school health environment and programs at the state, district, school, and classroom levels, with the purpose of measuring the change of wellness policies over time to identify weaknesses in programs and areas of improvement.[38] While the SHPPS is effective in observing student behaviors and the school health environment, SHPPS studies are not designed for individual schools and do not measure the association between changes in School Health Index Score and student health outcomes and behaviors. Research regarding School Health Index score and student health outcomes can be used to identify the best practices and policies for individual schools lending towards significant improvements in student health. Widespread implementation of the School Health Index can provide a wealth of data concerning the health environment of specific schools and school districts, which may encourage state and national governments to allocate more resources towards program implementation and evaluation, especially if found to be valid and sensitive.

Concluding Statements

The obesity epidemic is a significant concern for the current and future health of the nation's youth. The built environment surrounding children strongly influences their everyday nutrition and physical activity behaviors. Unless considerations of the obesogenic aspects of school health environments are considered (I.e. a la carte snack shops and vending machines, insufficient provision of physical activity, inadequate fresh fruits and vegetables choices), the success of community and school-based programs educating students about healthy lifestyle choices are likely to be unsuccessful.

Schools should be at the forefront in the fight against childhood obesity, and policies eliciting a change in the school health environment surrounding children and adolescents is necessary to reinforce health education provided by schools.[1] According to the Institute of Medicine, US Surgeon General, and the World Health Organization, environmental and policy interventions must be at the center of efforts to reverse the growing prevalence of child and adolescent obesity.[2] In the long term, these interventions will not only reduce the risk of obesity and disease, leading to lower health costs, but also create an environment supportive of more effective learning and happier, healthier children.

While the Child Nutrition and WIC Reauthorization Act of 2004 was a huge step toward requiring schools and districts to adopt local wellness policies, many gaps currently exist preventing these policies from being truly effective. The School Health Index is an effective tool for schools to assess their school health environment, identify policy gaps, and develop a strong coordinated school health program with complementary policies that address the entire breadth of student health. Application of the School Health Index on a national scale can help the government identify weaker socio-demographic areas and assist in more effective resource allocation. Strong data is still to be collected concerning the relationship between School Health Index scores and student outcomes in the areas of nutrition and physical activity behaviors and wellness beliefs and attitudes.

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The School Health Environment and Student Outcomes Related to Childhood Overweight in Southwest Virginia

Chapter 3:

Introduction

The obesity epidemic is a significant concern for the nation's youth with one in three (34.9%) adolescents being considered overweight or obese in 2006.[1-3] The physical and emotional consequences of obesity are severe, and overweight and obese youth are exhibiting signs of chronic disease including acanthosis nigricans, insulin resistance, diabetes, high blood pressure, elevated triglyceride levels, sleep apnea, steatohepatitis, and gallstones.[2,4] Overweight children also experience higher rates of physical illness, social stigmatism and discrimination, psychological problems, lower self-esteem, and lower academic performance.[3] With diet and exercise habits being well-known risk factors for the development of cardiovascular disease, cancer, stroke, diabetes, hypertension, and osteoporosis, the development of healthy nutrition and activity patterns preventing these chronic illnesses need to be established early in childhood.[5]

Societal and environmental changes leading to the increased frequency of meals eaten outside the home, increased availability of energy-dense snacks and sugar-sweetened beverages, growing portion sizes and increased sedentary behaviors are among several major factors favoring weight gain.[3, 6] Currently, despite clear guidelines established by the American Dietetics Association (ADA) and Centers for Disease Control (CDC) regarding nutrition and physical activity for youth, few children and adolescents are meeting fruit/vegetable (22.3%) and whole grain (39%) recommendations.[7,8] Meanwhile, 67% of students are exceeding recommended intakes of fat, 29.2% consume one or more can of soda per day and only 24.8% of males and 11.4% of females meet physical activity recommendations, further tipping the scale in favor of excess weight gain.[7,8]

In 2009, 49.3 million youth were enrolled in school and over 31.3 million participated in the National School Lunch and Breakfast Programs, thus establishing schools as a potentially potent tool in the primary prevention of obesity and chronic disease.[9, 10] Yet, among other things, budget shortfalls, competing interests, a general lack of knowledge and resources, and the beneficial income of selling a la carte items serve as obstacles to the effectiveness of school

health programs.[5, 9] In light of budget shortfalls, schools are selling profitable a la carte items that are unregulated by the USDA. In 2006, 32.7% of elementary schools, 71.3% of middle schools, and 89.4% of high schools had either a vending machine or snack shop allowing for the purchase of these items outside of meals.[11] Meanwhile, competing academic interests have led schools to cut physical education programs, and in 2006 only 3.8% of elementary schools, 7.9% of middle schools, and 2.1% of high schools provided enough daily physical education (PE) class to meet weekly physical activity recommendations.[11]

In an effort to improve the school health environment, the Child Nutrition and WIC Reauthorization Act of 2004 mandated all schools participating in the National School Lunch Program to establish a Local Wellness Policy (LWP) no later than the first day of school following June 30, 2006.[12] However, a recent study in Virginia shows the gap between LWP adoption and implementation to be large, especially in more rural counties.[13] While schools appear to be focusing on meeting a few specific guidelines, addressing the entire breadth of School Health Index recommendations is necessary to build a comprehensive and complementary school health environment.[14] The School Health Index (SHI) is a nationally recognized tool for schools to measure and self-assess the school health environment as related to LWP's. Currently, no research has been conducted to effectively characterize the relationship between the school health environments, as measured by the School Health Index, and the student health outcomes of nutrition and physical activity behaviors, knowledge and beliefs, student body mass index, and student fitness. Characterizing this relationship between LWP strength, SHI score and student health outcomes may provide insight necessary to adopt more effective policies and procedures favoring positive student health outcomes, and advocate for the adoption of stronger LWP's leading to the reduction of obesity among the nations' youth.

For this study, rural counties of southwest Virginia were chosen due to the level of rural poverty in the region and the association between socioeconomic status and mental and physical health. Rural southwest Virginia is reported as having an overall higher prevalence of poverty, child poverty, obesity, and lower county health rankings than other parts of the state.[15, 16] Additionally, Serrano et al reported rural schools in Virginia as being behind in drafting LWP's while having less policy goals, indicating potentially greater challenges in school health promotion for rural schools over urban counterparts.[13]

METHODS

STUDY DESIGN

Using a cross sectional design, data were collected from elementary, middle & high schools in five southwest Virginia counties. Variables measured include student BMI percentile, student fitness (mile run and PACER), student nutrition and physical activity behaviors, student dietary knowledge and beliefs, the home food environment and parent nutritional behaviors, School Health Index score, Local (school) Wellness Policy strength and comprehensiveness, and county level health indicators such as county health ranking, adult obesity rate, healthy food access and percent children in poverty. The study protocol was approved by the Institutional Review Board of the Virginia College of Osteopathic Medicine.

SETTING AND PARTICIPANTS

School districts in southwest Virginia were targeted, with eight divisions throughout the region being initially invited to participate in the study. These school divisions were selected to obtain a regionally even distribution of school divisions throughout southwest Virginia. Researchers contacted superintendents of these divisions with information regarding the research study. Of the eight school divisions invited, five agreed to participate and were included in the study. These five counties are above the state average for adult obesity prevalence (27.6% versus 25% statewide), child poverty prevalence (22.2% versus 13% statewide), and National School Lunch Program (NSLP) eligibility (54.6% versus 37.0% statewide).[15, 17] These three factors serve to characterize the overall socioeconomic status of the region.

After divisions were recruited, the principals of fifty-nine schools within these districts were individually invited to participate. Schools were offered monetary incentives for participation as well as technical assistance for the planning, implementation and improvement of areas of school health post-data analysis. Financial incentives for participation were as follows: $705 for full completion of study components; $605 for completion of all components except height and weight or fitness data; an additional $25 per class returning 80% or more of parent surveys. Principals at a total of twenty-seven schools agreed to participate and were sent

an information packet and contacted once more to confirm participation. Students in two classes of participating grades (fourth, seventh or ninth) at each school completed a questionnaire related to nutrition and physical activity. No identifying information about individual students was collected. Principals and teachers identified the two classes to be included in the study. Passive consent was obtained from parents for anonymous student data collection by informational letters sent home to the parents/guardians of all eligible students. Parents were asked to respond if they did not want their child to participate, and all children whose parents did not respond were considered to be eligible to participate.

DEMOGRAPHIC INFORMATION

Demographic information of student participants was obtained from School Physical Activity and Nutrition (SPAN) questionnaires. Demographic data was collected for all participating students of the participating schools with reported information being age, gender, race, ethnicity, primary language spoken, grade level, and self-reported height and weight (8^{th}/11^{th} grades only). County level demographic data was collected for county health ranking, adult obesity prevalence, child poverty prevalence, healthy food access and NSLP eligibility.

ASSESSMENT OF NUTRITION AND PHYSICAL ACTIVITY BEHAVIORS

The School Physical Activity and Nutrition (SPAN) Questionnaire was chosen to measure dietary and physical activity behaviors, knowledge and beliefs. The survey has both a 4^{th} grade and 8^{th}/11^{th} grade version and measures student demographics, dietary intake from five different food groups, physical activity engagement, sedentary activity engagement and dietary knowledge and beliefs. The 8^{th}/11^{th} grade version contains an additional question asking for self-reported height and weight to calculate BMI. Both questionnaires have shown acceptable reproducibility, reliability and validity, with agreement for questions regarding foods consumed in the previous day being 70% to 98% and agreement for questions regarding physical activity engagement being 66% to 89%.[18]

Due to inclement weather and scheduling conflicts, only twenty-one of the twenty-seven schools initially participating were visited. Student surveys were administered by a research assistant to classes identified by the principal or PE teacher in the 4th grade (n=8 schools), 7th grade (n=8), 10th grade (n=3) and 7th/10th grade (n=2). Students who participated received a small prize and standard administration protocol according to the SPAN project Student Survey Administration Protocol was followed.[19]

ASSESSMENT OF THE HOME FOOD ENVIRONMENT

A short parent questionnaire that measured parent dietary habits and the home food environment was sent home with all students who completed the SPAN questionnaire. Questions were taken from questionnaires that have been validated among low-income adults.[18, 20] Questions related to parents' daily consumption of fruits, vegetables, milk, fish and soda, as well as information concerning food security and the types of foods kept in the house and/or served at meals on a daily basis. Parents not wishing to participate were instructed to sign the blank survey and return to the school and all completed surveys were mailed back by the school to the principal investigator for analysis.

ASSESSMENT OF BODY COMPOSITION AND PHYSICAL FITNESS

Body composition and physical fitness data were collected due to their strong correlation with overall health and chronic disease risk.[5] Each school was asked to provide data regarding height, weight, date of birth and fitness score from the 2009-2010 school year for all students in grades 4, 7 or 10. Height, weight and date of birth data were entered into a standard BMI percentile calculator on the CDC website to determine the BMI percentile for individual students.[21] Fitness scores (mile run time or PACER test results) were analyzed to determine whether or not students met Healthy Fitness Zone (HFZ) requirements for aerobic capacity for age and gender.[22] The HFZ represents minimal levels of fitness that may offer long-term benefits through protection against chronic diseases related to sedentary behavior, such as heart disease or diabetes.[22]

ASSESSMENT OF THE SCHOOL HEALTH ENVIRONMENT

The School Health Index was used to assess school health environment and modules were customized to focus on nutrition and physical activity. A school representative was given four copies of the SHI questions and one master copy. Individuals representing school health within each school were asked to complete SHI modules related to their role in the school, and one faculty representative was asked to combine scores onto the master copy to be mailed back to the principal investigator.

ASSESSMENT OF LOCAL WELLNESS POLICIES

A copy of each division's Local Wellness Policy was obtained and evaluated according to a checklist point system that measures the comprehensiveness and strength of the policies in seven different subcategories: nutrition education, USDA meal standards, competitive foods, physical education, physical activity, communication and promotion, and evaluation.[23] This coding system has been shown to be reliable for evaluating school wellness policies on a single or multistate level.[23] Ninety-six topic areas were coded with a zero, one or two based on the following criteria: 0=no mention of the topic; 1= topic is mentioned but with vague language; 2= topic is addressed with specific language and goals. A maximum of ninety-six 1's, 2's or 0's could be assigned for each LWP.

COMMUNITY HEALTH INDICATORS

County level health rankings and various indicators of community health related to nutrition and physical activity were obtained for the participating divisions in southwest Virginia. Variables included adult obesity prevalence, childhood poverty prevalence and access to healthy foods.[15] These variables were used to characterize the study population against Virginia as a whole.

DATA ANALYSIS

DATA MANAGEMENT

Parent and student survey responses were coded according to a scale so that higher scores indicate overall healthier behaviors, knowledge and beliefs and lower scores indicate less healthy behaviors. Ambiguous questions were excluded and an overall score was generated for student and parent questionnaires. For schools generating greater than fifty student questionnaires, fifty questionnaires were randomly selected for data entry and analysis. One middle school was included in the elementary school database because students completed the 4th grade surveys instead of the 8th grade version. Mean score per school was calculated for students' overall survey score and for the categories of student nutrition behavior, student physical activity behavior, and student knowledge and beliefs and for parents' nutrition behavior and the home environment.

BMI percentiles for individual students were used to calculate mean BMI percentile per school.[21] Individual mile run and PACER scores for individual students were analyzed dichotomously according to whether or not Healthy Fitness Zone (HFZ) requirements for age and gender were met. SHI scores were presented as a percentage of total possible points for each of the eight modules and overall total score. LWP comprehensiveness scores were analyzed by calculating the proportion of topics assigned with a one or two, while strength scores were analyzed by calculating the proportion of topics assigned with a two (of 96 total possible). Scores were presented as the proportion of total possible points (ninety-six) for comprehensiveness and strength for each school division.

DESCRIPTIVE ANALYSIS

County level data were compiled to include LWP score, mean SHI score and overall county health ranking, adult obesity prevalence, childhood poverty prevalence, and healthy food access. County level data were excluded from statistical analyses due to nesting and unequal sample sizes by county. School level data were compiled for student BMI percentile, the proportion of students meeting Healthy Fitness Zone requirements, mean student one mile run

time, mean student PACER test score, mean student nutrition and physical activity behavioral scores, and mean knowledge and beliefs score.

STATISTICAL ANALYSIS

All analyses were performed via SPSS (Version 18.0, Chicago, Illinois) with statistical significance set at $p < 0.05$. Variables for primary analyses included SHI score by school, mean student BMI percentile, mean one mile run score and mean PACER test score, mean student nutrition and physical activity behavior scores, mean student knowledge and beliefs score, as generated by the schools (n=21), and county level LWP comprehensiveness and strength. Data used for additional analyses included parent nutrition behavior score and nutritional home environment score.

Pearson's 2-sided correlation was conducted for overall SHI score and against primary variables of interest. Pearson's 2-sided correlation was also conducted for parent nutritional behavior and student nutritional behavior, home food environment and student nutritional behavior, parent nutritional behavior and student knowledge/beliefs, and home food environment and student knowledge/beliefs.

RESULTS

STUDY SAMPLE

Twenty-seven schools agreed to participate in the research study. Twenty-one schools completed all aspects of the study and were included for analysis. Of those schools, three failed to return parent surveys, three were missing fitness data, and one had missing BMI data. Characteristics of the sample population are summarized in Tables 1 and 2. Four of the five participating counties are ranked in the lowest 25% of Virginia counties in terms of overall health.[15] All counties had an obesity prevalence and child poverty prevalence higher than that of Virginia as a whole (25% and 13%, respectively).[15] Additionally, ranges of 46% to 68% percent of students were eligible for free or reduced lunch among the counties.[17]

DESCRIPTIVE ANALYSIS

Descriptive data are presented in tables 1 and 2 to provide a better description of the study population as a whole. The proportion of study participants classified as overweight or obese (85th percentile or above) was 46.1%, with 53.9% being categorized as normal or underweight (84th percentile or lower).

The average SHI score was 80% across all participating schools. On average, 53.8% of students met HFZ requirements for either the mile run or PACER test. Mean scores for nutrition behavior, PA behavior, knowledge & beliefs for the study sample were as follows: nutrition behavior 4th: 34 out of 61 (56%); 8th: 25 out of 72 (35%); PA behavior 4th: 25 out of 41 (61%); 8th: 32 out of 59 (54%). knowledge & beliefs 4th: 10 out of 11 (91%); 8th: 10 out of 20 (50%). Mean scores for parent nutritional behavior and home food environment for the study sample were as follows: parent nutrition behavior: 21 out of 52 (40%) and home environment: 16 out of 24 (67%).

Table 1: County Level Characteristics of the Sample Population

County	1	2	3	4	5
No. Schools for data collection	11	4	3	2	1
No. Surveys completed	303	125	88	41	20
Gender					
Male (%)	51	48	63	49	54
Female (%)	49	52	37	51	46
Race (%)					
White, non-Hispanic, non-Latino	86	77	87	78.7	62.5
American Indian/Alaska Native	2.7	3.9	4.3	5.3	12.5
Black	3.6	<1	0	9.3	0
Mexican American, Latino, Hispanic	<1	<1	2.6	1.3	12.5
Native Hawaiian/Pacific Islander, Asian, Other	6.3	16	5.2	5.3	12.5
VA county health ranking*[15]	103	122	112	114	87
County health percentile rank (%)[15]	22%	8%	15%	16%	33%
Adult obesity (%)[15]	27%	31%	27%	28%	25%
Child poverty (%)[15]	18%	28%	22%	23%	23%
Healthy food access (%)[15]	33%	63%	80%	25%	17%
LWP comprehensiveness	0.39	0.35	0.38	0.5	0.26
LWP strength	0.22	0.01	0.27	0.5	0.0
Mean SHI score	78	79	83	84	89
Free/reduced lunch eligibility (% total students)[17]	46	52	57	50	68

*Out of 132 total counties in VA. Lower rankings indicate lower overall health status.

Table 2: School Level Descriptive Analysis

School ID	SHI Score	BMI Percentile	Fitness Zone (%)	Student Surveys (#)	Nutrition Behavior+	PA Behavior+	Knowledge & Beliefs+	Parent Response Rate (%)	Parent Nutrition Behavior	Home food Environment
County 1										
1	88	-	55	43	34	32	12	44	19	15
2	84	69	44	24	34	31	10	-	-	-
3	82	70	17	50	36	34	11	35	21	15
4	77	67	36	41	34	27	6	-	-	-
5	70	63	72	50	36	33	12	62	22	16
6	80	57	55	30	35	25	4	67	22	17
7	79	76	68	38	34	26	5	74	22	16
8	71	84	95	38	35	28	5	82	22	17
9	90	75	23	26	32	24	5	73	21	17
10	76	68	58	33	33	26	6	82	23	17
11	62	83	-	32	33	25	5	22	22	17
County 2										
1	57	70	83	40	33	22	6	68	22	17
2	90	63	45	50	32	25	5	35	21	17
3	80	71	80	50	36	34	12	16	21	18
4	87	71	39	50	35	37	12	14	18	16
County 3										
1	85	79	38	50	36	34	11	14	19	14
2	86	74	45	41	35	35	10	24	21	16
3	79	75	-	29	34	25	5	62	24	17
County 4										
1	85	68	56	50	37	33	11	15	20	17
2	83	74	-	42	37	34	11	-	-	-
County 5										
1	89	64	60	24	34	24	5	38	23	17

*A maximum of 50 surveys were analyzed for schools returning greater than this amount. Surveys for analysis were chosen by random selection.

+Max Scores: 4th= Nutrition Behavior-61, PA-41, Knowledge- & Beliefs-11; 8th/11th= Nutrition Behavior-72, PA-59, Knowledge- & Beliefs-20; Parent nutritional behavior- 52, Home environment-24

ASSOCIATION BETWEEN SCHOOL HEALTH INDEX SCORE AND STUDENT HEALTH OUTCOMES

BMI percentile and SHI score were negatively correlated among 4th grade students but positively correlated among 8th/11th grade students (table 3). Both correlations were found to be statistically significant. Both mile run score and PACER score were positively correlated to SHI score and both correlations were statistically significant (table 3). A higher mile run score is associated with lower fitness, while a higher PACER score is associated with greater fitness.

There was little to no correlation between SHI score and nutrition and physical activity behaviors and knowledge and beliefs. Student nutrition behaviors were weakly negatively correlated with SHI for both the 4th grade and 8th/11th grade participants (table 3). Student physical activity behaviors were weakly positively correlated with SHI score for both the 4th grade and 8th/11th grade participants (table 3). Student knowledge and beliefs concerning nutrition and physical activity were weakly negatively correlated with SHI score for both the 4th grade and 8th/11th grade participants (table 3). None of the correlations between SHI and student health behaviors, as measured by the SPAN questionnaire, were found to be statistically significant.

SHI and LWP scores were negatively correlated among elementary schools for both LWP comprehensiveness (-0.247, $p<0.001$) and LWP strength (-0.078, $p=0.126$). SHI and LWP scores were positively correlated among middle and high schools for both LWP comprehensiveness (0.056, $p=0.234$) and LWP strength (0.076, $p=0.103$). Only the correlation between elementary school SHI and LWP comprehensive score was found to be statistically significant.

ASSOCIATION BETWEEN STUDENT HEALTH BEHAVIORS AND THE HOME ENVIRONMENT

There were no significant correlations found between student health behaviors and parent behaviors or the home food environment for both the 4th grade and 8th/11th grade participants (table 4).

Table 3: Association between School Health Index Score and Student Health Outcomes

Primary Outcomes	4th Grade	P-value	8th/11th Grade	P-value
BMI vs. SHI	-0.472	<0.001	0.679	<0.001
Fitness- Mile vs. SHI	0.412	<0.001	0.248	<0.001
Fitness- PACER vs. SHI	0.414	<0.001	1.00	<0.001
Student Nutrition Behavior vs. SHI	-0.038	0.487	-0.044	0.402
Student PA Behavior vs. SHI	0.04	0.449	0.040	0.421
Student Knowledge and Beliefs vs. SHI	-0.054	0.312	-0.050	0.327

Table 4: Association between Student Health Behaviors and the Home Environment

Secondary Outcomes	4th Grade	P-value	8th/11th Grade	P-value
Parent Nutrition Behavior vs. Student Nutrition Behavior	0.078	0.174	0.037	0.529
Parent Home Environment vs. Student Nutrition Score	-0.084	0.144	0.051	0.382
Parent Home Environment vs. Student Knowledge & Beliefs	-0.038	0.497	0.010	0.856
Parent Nutrition Behavior vs. Student Knowledge & Beliefs	-0.027	0.631	-0.097	0.082

DISCUSSION

SHI score was significantly negatively correlated with BMI percentile for 4th grade students but significantly positively correlated with BMI percentile for 8th/11th grade students. This relationship was observed despite the fact that average school SHI score was lower among elementary schools (78.25) than among middle and high schools (81.07). These results suggest that school health environments may have a stronger influence on the weight management of younger elementary school students but are less effective in doing so among middle and high school students. In general, health behaviors tend to decline from childhood to adolescence, potentially due to the increase autonomy that comes with age.[24] Changing lifestyles along with development, social and environmental changes that occur in the transition from childhood to adolescence, including the increased dietary options available at school, increased frequency of meals eaten outside the home, busier schedules, and the greater need for peer acceptance may be to blame.[24]

Conflicting evidence was found concerning the effect of the school health environment on cardiovascular fitness. Mile run scores were expected to be negatively correlated with SHI because faster (lower) mile run scores are indicative of greater cardiovascular fitness. Meanwhile PACER results were expected to be positively correlated with SHI because higher PACER scores are indicative of greater cardiovascular fitness. Since both scores were positively correlated with SHI, insufficient evidence exists to determine the true direction of the relationship between the school health environment and fitness outcomes. Differences likely stem from the different protocol followed by the PACER versus mile run tests. The stronger correlation seen among elementary schools may be because PE is typically emphasized more among younger children (elementary schools), whereas it becomes less of a priority among older middle and high school students due to the increased stress of meeting academic standards.

Student nutrition behavior and knowledge and beliefs were both weakly negatively correlated to SHI score. A positive relationship was expected so that as SHI score increased, positive nutritional behaviors and knowledge and beliefs towards nutrition and PA would also increase. The negative correlation may be due to the complex social-environmental and intrapersonal factors that also influence behavioral patterns, as explained through the framework of the Social Cognitive Theory (SCT).[24] It is very possible that the pervasive effect of these other

factors may be outweighing the attempts of the school health environment to shape healthier behaviors. Family is known to be a major influence on youth eating and physical activity habits through the provision of available foods (home food environment) and family influences on attitudes (parent nutritional behaviors).[24] To address this relationship, parent surveys were administered to identify any correlations between parent behaviors, the home environment and student outcomes. Peer influence is also a strong opposing factor to the efforts of schools and older adolescents in particular have a strong need for peer acceptance and tend to be heavily swayed my social norms.[24]

A weakly positive correlation existed between student physical activity behaviors and SHI score. This correlation was as expected (as SHI score increases, positive PA behaviors also increase). But the correlations were not strong nor statistically significant. Lack of a strong correlation may be explained by the fact that many individuals need to be active outside of school in order to meet PA recommendations. Also, many of the PA questions on the questionnaire referred to activities that typically take place outside of school, such as time spent engaging in sedentary activities (TV, video games, computer) and organized activities (martial arts, dance, gymnastics). Overall, while the data suggest that the school health environment may partially influence PA behaviors, stronger evidence is necessary to support this claim.

A positive correlation was expected between SHI scores and LWP scores with stronger and more comprehensive LWP's resulting in higher SHI scores among schools in the respective districts. The negative correlation among elementary schools may mean that schools are not adapting their school policies to meet LWP guidelines, whereas the positive correlation between SHI and LWP's among middle and high schools indicates that these schools are likely positively affected by stronger LWP's. Stronger LWP's should lead to a healthier school environment, so the lack of a strong positive correlation ($<|0.3|$) among these variables is suggestive of the poor implementation of LWP's, even among districts that have adopted strong local wellness policies. In counties with both elementary, middle, and high schools represented, middle and high schools combined consistently scored higher on the SHI than elementary schools, despite being under the same LWP: County 1- 80 versus 76; County 2- 84 versus 74; County 3- 86 versus 79. One explanation for the difference may be that elementary schools are typically smaller with fewer

resources than their middle and high school counterparts, which may serve as an obstacle to LWP implementation.

The weak correlation ($<|0.1|$) between parent nutritional behaviors, the home environment, student nutritional behaviors and student knowledge and beliefs was surprising considering the strong influence the home environment typically has on youth behavior.[24] The lack of a strong correlation may be due to the fact that parent responses and student responses were not matched during data analysis. A few schools did not implement the matching process correctly making this analysis difficult, however future data analysis and research studies should explore this relationship in more detail.

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Chapter 4:

SUMMARY

Schools are an invaluable and necessary resource in the battle to reverse the obesity epidemic. Children and adolescents are vulnerable to the built environment and need to be submersed in an environment that promotes healthy eating choices, adequate physical activity and positive attitudes towards food and exercise. National policy mandates all school districts participating in the National School Lunch Program to have adopted a Local Wellness Policy, yet gaps in their adoption and implementation have resulted in little improvement in school health environments. The School Health Index serves as a tool for schools to evaluate their health environment, allowing for the identification of weak areas and areas of improvement.

This study attempted to measure the relationship between school health environments and the health behavioral outcomes of their respective students. Main findings include the statistically significant correlation between student BMI percentile and SHI score, which was a negative correlation for elementary schools and a positive correlation for middle/high schools. Also statistically significant was the positive correlation of physical fitness (mile run, PACER score) and SHI score for both elementary and middle/high school students. All results from the study are relevant because they can be used to assist the respective counties in making improvements in the school health environment. Data concerning student behavioral outcomes is useful in helping schools to identify specific weak areas to better direct funding and interventions to improve student health.

Strengths of this study are the high participant number (>1000) and the use of the SHI as a survey tool for the school health environment. The SHI is nationally recognized and widely used, making data from this study easily comparable to other studies using the SHI. This study is different from other school health environment studies in that the home environment was also taken into account, although to a lesser extent than the school environment.

Study results are limited by factors outside the school environment affecting youth health behaviors such as intrapersonal factors, peer influences, and the home and community environments. Even though students spend a majority of their time at school, the school health environment is only one piece of the behavioral puzzle. Future studies will need to keep the

Social Cognitive Theory in mind and account for interfering factors in their designs. Another major limitation was the uneven recruitment between counties and school levels. Recruitment is a difficult process and in future studies more aggressive recruitment will be necessary to achieve a higher level of participation and more even recruitment across counties.

Future studies should feature a greater emphasis on the parent-home environment to further identify the role this plays in shaping student health behaviors and potential interplays with the school health environment. Similar sampling protocol for all primary variables (BMI percentile, student behaviors, fitness variables) may allow for a more in-depth analysis of the interaction of these variables on an individual basis.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Schools should be at the forefront of the reversal of childhood obesity trends, and stronger policies eliciting a change in the school health environment are necessary to reinforce the health education provided by schools and promote nutritional integrity. According to the Institute of Medicine, US Surgeon General, and the World Health Organization, environmental and policy interventions must be at the center of efforts to reverse the growing prevalence of child and adolescent obesity. In the long term, these interventions will not only reduce the risk of obesity and disease, leading to lowered health costs, but also create an environment supportive of more effective learning and happier, healthier children.

The establishment of local wellness policies, as mandated by the Child Nutrition and WIC Reauthorization Act of 2004, was a step towards improving school health environments. However, many gaps exist in the strength and comprehensiveness of these policies along with their implementation in schools. Application of the SHI data on a national level can help the government to identify weaker socio-demographic areas to assist in better resource allocation, making policy implementation more effective. Meanwhile, when applied on a local level, the SHI serves as a powerful tool for schools to individually assess and independently make improvements to their health environments. Greater emphasis on the evaluation and improvement of the school health environment will be especially necessary in meeting goals outlined in Healthy People 2020. Improvements in the school health environment will lead to the attainment of such objectives as increasing the educational achievements of adolescents and young adults, increasing the number of schools (of all levels) requiring health education, increasing the proportion of adolescents who participate in daily PE or are active for 50% or more of the time spent in PE and increasing the variety and contribution of fruits, vegetables and whole grains to child and adolescent diets.

Finally, the SCT asserts that intrapersonal, social-environmental and societal factors alike are influential on behavioral outcomes. Due to the complex reciprocal relationship between these factors, the effectiveness of the school health environment in molding positive student health outcomes may be limited. Future school-based interventions and policies will need to address those factors most predictive of positive youth behavioral outcomes to be most effective. Further

studies exploring aspects of the school health environment most influential in shaping youth health behaviors will result in greater evidence-based research to support and advocate for positive changes in the school health environment surrounding the nation's children.

APPENDICES