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Assessing the Relationship between Socioeconomic Variables and Risk of Overweight among Children 6 Years of Age

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Master of Public Health Research Project

Assessing the Relationship between Socioeconomic Variables and Risk of Overweight among Children Six Years of Age

by

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Submission Statement
Master of Public Health Research Project

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Number of semester hours (3-6): ___3___ Semester: ___Fall___ Year: ___2005___

Please complete the following outline. **Do not exceed 2 pages (A-H)**.

A. PROJECT TITLE: Assessing the Relationship between Socioeconomic Variables and Risk of Overweight among Children 5 and 6 Years of Age

B. PURPOSE (state hypothesis/research question):
What socioeconomic variables are associated with risk of being overweight among children ages 5 and 6 years of age?

C. SPECIFIC OBJECTIVES (list major aims of the study):
1. Identify the prevalence of overweight children in the 5-6 year old age group.
2. Determine the effect of socioeconomic variables on being overweight and risk of being overweight in children 5-6 years old

D. DESCRIPTION OF METHODS
   D.1. Identify source(s) of data (eg, existing data set, data collection plans, etc):
Data from the National Survey of Children Health, a survey module of State and Local Area Integrated Telephone Survey (SLAITS), conducted by Center for Disease Control and Prevention's National Center for Health Statistics from January 2003 to July 2004 will be used.

   D.2. State the type of study design (eg, cross-sectional, cohort, case-control, intervention, etc):
This will be a cross-sectional study.

   D.3. Describe the study population and sample size:
The study population is a national sample of 5 and 6 year olds (n=10283).

   D.4. List variables to be included (If a qualitative study, describe types of information to be collected)
Dependent Variables: Children with a BMI at or above the 85th percentile classified in either the 'overweight' or 'at-risk for overweight' categories.
Independent Variables: **age** (5-6 years), **sex** (M/F), **race** (White, Black/African-American, American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander), **socioeconomic variables** (Parent education, child's health care coverage, Medicaid, child's school status [private, public, or home school], welfare, food stamps, free/reduced lunch, WIC, household income).

***D.5. Describe methods to be used for data analysis (If a qualitative study, describe general
approach to compiling the information collected)***

-I will use SAS to generate descriptive statistics. Multiple linear regression will be done to determine how socioeconomic variables are associated with BMI while controlling for potential confounding variables. A socioeconomic composite index will also be created and its association with BMI will be assessed.

-Although the analysis will not be adequately powered, similar analysis will be conducted on Virginia specific data.

E. ANTICIPATED RESULTS:

Based on a literature review and a basic understanding of the demographic variables of children, I anticipate the results to show a *positive* association between low socioeconomic status/variables and children at risk of being overweight among the 5 and 6 year old age group.

F. SIGNIFICANCE OF PROJECT TO PUBLIC HEALTH:

The prevalence of childhood obesity, a preventable condition, is becoming an increasingly important public health issue. Obesity in children is measured using the Body Mass Index (BMI), a calculation of weight based on a child's height, age, and gender. The term 'obese' is usually, not used for children.[1] Instead, children with a BMI at or above the 95th percentile are defined as 'overweight.'[1] Children with a BMI from the 85th to 95th percentile for gender and age are defined as 'at-risk for overweight.'[1] NHANES data showed an increase in overweight among children aged 6 to 11 from 4% of the population in 1971 through 1974 to 15% in 1999 through 2000.[2]

As a recent FDA report stated, the problem of obesity has no single cause. Rather, it is the result of numerous factors acting together over time. Many predictors exist that may contribute to increased BMI measurements for overweight children. The need to recognize socioeconomic risk factors among specific populations is relevant to understanding childhood obesity. The effect of race/ethnicity on the prevalence of childhood overweight requires greater study, particularly in relation to socioeconomic status.[3, 4] National studies of child overweight and inadequate household resources available to purchase healthy foods, or food insecurity, have provided inconsistent findings.[5] Jones et al. found a lower risk of overweight in school-aged food insecure girls who participate in food assistance. These results support the notion that food assistance programs play a protective role for low-income children's health.[5] Low-income school children have historically been regarded as at-risk for undernutrition,[6] however, the prevalence of overweight in this group has recently also increased.[5] Children from a WIC sample and those whose mothers had less education were more often overweight.[7] However, a study by Baughcum et al. found health insurance status was not associated with overweight during childhood.[3] Characteristics of the social environment, including various socioeconomic and sociocultural factors such as parents' education, time constraints, and ethnicity influence the types of foods children eat.[8] By identifying risk factors for overweight and obesity, local health officials and school board members could implement the best tactics for promoting good health and nutrition in our youth to prevent greater spread of this childhood epidemic.

(See **REFERENCES** below)

G. IRB Status:

1) Do you plan to collect data through direct intervention or interaction with human subjects? ___yes __x_no

2) Will you have access to any existing identifiable private information? ___yes _x__no

If you answered "no" to both of the questions above, IRB review is not required.
If you answered "yes" to either one of these questions, your proposed study must be reviewed by the VCU Institutional Review Board (IRB). Please contact Dr. Turf or Dr. Buzzard for assistance with this procedure.

Please indicate your IRB status:
___ to be submitted (targeted date_____)
___ submitted (date of submission _____; VCU IRB # _____)
___ IRB exempt review approved (date_____)
___ IRB expedited review approved (date_____)
___ IRB approval not required

H. PROPOSED SCHEDULE: Start Date: _Aug 2005_____Anticipated End Date: Dec 2005
I. INDICATE WHICH OF THE FOLLOWING AREAS OF PUBLIC HEALTH KNOWLEDGE WILL BE DEMONSTRATED:

1. Biostatistics – collection, storage, retrieval, analysis and interpretation of health data; design and analysis of health-related surveys and experiments; and concepts and practice of statistical data analysis.
    _X_yes ___no (if yes, briefly describe):
A statistical software package, SAS, will be used to assess whether socioeconomic variables and a composite index are associated with risk of being overweight in children ages 5 and 6. In addition to descriptive statistics. Multiple linear regression will be used to determine how socioeconomic variables are associated with BMI after adjusting for potential confounders. A p-value of <0.05 will be used to determine statistical significance.

2. Epidemiology distributions and determinants of disease, disabilities and death in human populations; the characteristics and dynamics of human populations; and the natural history of disease and the biologic basis of health. _X_yes ___no (if yes, briefly describe):
I will examine the prevalence rates of childhood overweight using weight at or above the 85th percentile as the definition for overweight. Further, I will assess the differences between two groups: those above at or above the 85th percentile of weight and those below with respect to socioeconomic factors such as parent education, child's health care coverage, Medicaid, child's school status [private, public, or home school], welfare, food stamps, free/reduced lunch, WIC, and household income.

3. Environmental Health Sciences – environmental factors including biological, physical and chemical factors which affect the health of a community. ___yes _X_no (if yes, briefly describe):

4. Health Services Administration – planning, organization, administration, management, evaluation and policy analysis of health programs. ___yes _X_no (if yes, briefly describe):

5. Social/Behavioral Sciences – concepts and methods of social and behavioral sciences relevant to the identification and the solution of public health problems. ___yes _X_no (if yes, briefly describe):

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Dedication

I dedicate this paper to my family for their absolute love, support, and advice, which has given me the strength and faith to always believe in myself.

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Acknowledgements

I would like to thank Dr. Resa Jones for all her help in choosing the topic of interest, working through the analysis, and producing the finished product. Without her support, guidance, and incredible willingness to always help her students, this project would not have been completed. From finally selecting a topic, to learning a new program, to working through long office hours, to stressed out emails and phone calls, I have not only learned from a great professor, but have made a great friend along the way.

I would also like to thank my MPH girls I have come to know and love through this graduate program, my roommate Christine for our engaging late night conversations about life and the future, and Abby, my best friend who continues to always be there for me. Thank you for seeing me through this long and arduous journey.

Abstract

Background: The percentage of overweight children has tripled in the last thirty years. Inconsistent findings are published regarding the relationship between socioeconomic variables and being overweight in childhood.

Objective: To determine whether socioeconomic variables are associated with risk of being overweight among six year olds.

Methods: Six year olds with BMI data were selected from the National Survey of Children's Health (n=4,362). Variables were coded and a low socioeconomic index was created. Using population weights, descriptive statistics were generated and regression was utilized to assess the relationship between socioeconomic variables and being 'at risk' for overweight. Socioeconomic variables were also compared by risk status.

Results: Approximately 47% of the sample was 'at risk' of overweight (BMI $\geq 85^{th}$ percentile). Males and nonwhites were more likely to be 'at risk' than their counterparts. After adjustment, the proportion of those with Medicaid was greater among the 'at risk' group compared to those who were 'not at risk' (38.3% vs. 35.3%, p-value=0.010). Those 'at risk' were also more likely to have free/reduced-cost breakfast/lunch (60.3% vs. 51.8%, p-value=<0.0001). Overall, those 'at risk' had a higher mean low socioeconomic index score than those 'not at risk' (2.0 vs. 1.9, p-value=0.059). No other statistically significant differences in socioeconomic variables were found by 'at risk' status.

Conclusion: Several low socioeconomic indicators as well as a composite index were associated with being 'at risk' for childhood overweight. With the current obesity epidemic, governmental agencies should identify low socioeconomic groups and target interventions specific to these vulnerable populations.

Background

Definition of Childhood 'Overweight' and 'At risk of Overweight'

Body Mass Index (BMI) is the standard obesity measure for adults, and its use in children provides a consistent measure across age groups.[1] BMI for children is,a calculation of weight based on a child's height, age, and gender.[2] The term "obese" is usually, not used for children. Specifically, due to potential negative connotations associated with the term "obesity," "at risk of overweight" and "overweight" are the terms preferred to refer to children and adolescents whose excess body weight could pose medical risks.[2]

The 2000 Centers for Disease Control and Prevention (CDC) Growth Charts for the are used to define "overweight" and "at risk for overweight" for children in the United States. The sex-specific BMI-for-age growth charts are based on national data from 1963 to 1994.[3,4] "At risk for overweight" is defined as BMI at or above the 85th percentile, but less than the 95th percentile of the sex-specific BMI for age. The category "at risk for overweight" is intended to identify children who should be referred for a second level of screening to determine if there are any additional health risks that would warrant intervention.[4] "Overweight" is defined as BMI at or above the 95th percentile of the sex-specific BMI-for-age growth chart.[4]

Prevalence of Problem

The high levels of overweight among children remain a major public health concern. With an estimated 315 million people worldwide who are obese, there is warrant for strong and comprehensive prevention efforts.[5] The National Health and Nutrition Examination Survey (NHANES) data, collected from 1999-2002, showed an increase in overweight among children aged six to eleven from 4% of the population in 1971 through 1974 to 16% in 1999 through 2002.[3] Currently, 15.3 % of six to eleven years olds are at or above the 95th percentile for Body

Mass Index (BMI) on standard growth charts based on reference data from the 1970's with even higher rates among subpopulations of minority and economically disadvantaged children.[6] Racial/ethnic and economic disparities exist among children with BMI above the 85th percentile. For example, by 1998, overweight prevalence had increased by more than 120% among African Americans and Hispanics, and by more than 50% among whites.[7]

Public Health Implications of Childhood Overweight

With the growing prevalence of childhood overweight, the public health implications are numerous. After age five, being overweight is indicative of persistent obesity throughout adulthood.[5] Data from the Bogalusa Heart Study showed that approximately 60% of overweight five to ten year-old children had one cardiovascular risk factor, such as high blood pressure, hyperlipidemia, or elevated insulin levels.[8] From the same cohort of five to ten year olds, more than 20% of overweight children had two or more cardiovascular risk factors.[8]

In addition to physiological implications, study findings indicate substantial psychological and psychosocial consequences of childhood obesity. Overweight or obese children are stereotyped as unhealthy, academically unsuccessful, socially inept, unhygienic, and lazy.[9] "The most immediate consequence of overweight, as perceived by children themselves, is social discrimination."[10] Psychological problems for overweight children include: negative self-esteem, withdrawal from interaction with peers, depression, and anxiety.[11]

In addition to the health and social costs of the obesity epidemic, the financial impact of the disease is also overwhelming. In 2000, according to the Surgeon General's Call to Action, the total cost of obesity was estimated to be about $117 billion.[11] The federal government, through the Medicaid and Medicare programs, spends $84 billion annually on five major chronic

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conditions (diabetes, heart disease, depression, cancer, and arthritis) that could be significantly improved by decrease in overweight.[12]

Overall, the physiological, psychological and economic "costs" of childhood overweight reinforces not only the need for primary prevention in early childhood, but also the need to identify children who may be more likely to become overweight. This identification could help target intervention efforts.

Gaps in the Literature

According to a report by the United States Food and Drug Administration (FDA), the problem of obesity has no single cause; rather, it is the result of numerous factors acting together over time.[13] Understanding these links is crucial to developing effective interventions to prevent childhood overweight beginning at an early age. The United States Department of Agriculture (USDA) Food and Nutrition Service (FNS) proposed that the "relationship between poverty (as measured by multiple socioeconomic factors) and overweight/obesity was a critical issue that must be explored."[14]

In developing countries low income traditionally is associated with underweight as a result of poor diet.[15] However, research has pointed to a paradox in the United States, which is that low income and obesity can coexist in the same population.[16] Food insecurity, which is the uncertain ability to acquire acceptable food because of lack of money is a prevalent problem, occurring in17.6% of children's families.[17] Low income is the major factor contributing to this condition.[18] As opposed to eating practices of low income or poor people in developing countries, low income people in the United States eat processed foods that have added sugars and fats. Many of these foods are far more affordable than are the recommended "healthful" diets based on lean meats, whole grains, and fresh vegetables and fruit.[19] High-income families have

access to more consistent high-quality sources of food.[17] In short, low income or insecure

income may lead to the consumption of low-quality, high-fat food or to binge eating when food

is available, which can lead to obesity.[16,20,21]

A comprehensive review of the relationship between childhood obesity and

socioeconomic status (SES), published in 1989, reported that about one third of the studies

showed no relationship, one third demonstrated increased obesity associated with low SES, and

one third demonstrated increased obesity associated with high SES.[22] While recent studies

suggest a positive association between low SES variables and children 'at risk' of being

overweight, inconsistent findings highlight the need for additional research. Further, food

insecurity may be a core variable for understanding the overweight and nutritional status of low

income populations.[23]

Casey and colleagues reported significantly higher prevalence of risk of overweight (BMI

$\geq 85^{th}$ percentile) among children from low income (at or below 130% of the federal poverty

level), food insufficient households than in those from high income, food sufficient households in

the Continuing Survey of Food Intake by Individuals (1994-1996).[24] They also found that food

insufficiency was associated with lower income, a less educated household, single parent

mothers, and welfare.[24] Strauss et al. reported similar findings – "a significant inverse

relationship between the development of obesity in children and markers of SES such as family

income level, occupational status, single minority mothers, and maternal education."[25]

Interestingly, in a study conducted by Jones et al., a lower risk of overweight was found in

school-aged food insecure girls who participated in food assistance.[26] These results support the

notion that food assistance programs play a protective role against overweight for low income

children. Matheson et al. found that children from food insecure households had lower body

weight than their peers from food secure households.[27] However, there are also cases where no statistically significant relationship was detected between obesity and food insecurity. For example, Alaimo and others did not find an increased prevalence of overweight with food insufficiency in young non-Hispanic white children, non-Hispanic black children or Mexican American children.[28] Overall, taken as a whole there is good evidence for the relationship between food insufficient households and poverty.[24,29]

Having a low income is a major factor determining eligibility for food programs designed to reduce food insecurity and prevent hunger. It is important to take income into account when examining the effects of programs or we will "falsely attribute effects to food programs that simply result from low income."[17] Programs using income guidelines to determine eligibility include: the Food Stamp Program (FSP), the National School Lunch Program and School Breakfast Program, and the Children's Health Insurance Program (CHIP).[30]

The Food Stamp Program (FSP) is designed to provide assistance so families can purchase a nutritionally adequate diet. To be eligible for the FSP a family's gross income cannot exceed 130% of poverty and their net income (gross income minus a set of deductions for housing and employment expenses and for a share of earnings) cannot exceed the poverty line.[21] There are discrepancies in previous research between the association between the FSP and childhood overweight.[17] For example, Gibson found a statistically significant association between long term food stamp program participation in five to eleven year old girls and childhood overweight [31] whereas Jones et al. findings were opposite. [26]

The National School Lunch Program (NSLP) provides meals to 25 million students each day. School lunches are expected to provide one-third of the recommended dietary allowances of protein, Vitamin A, Vitamin C, iron, calcium, and calories. The NSLP is offered at reduced

cost to children in families whose gross incomes are below 185% of the poverty line and is free to those whose incomes are below 130% of the poverty line.[17] Previous literature has not established an association between participation in the NSLP and childhood overweight.[17]

The School Breakfast Program (SBP) provides meals for 8.2 million children in participating schools using the same eligibility criteria as NSLP. School breakfasts must meet the same dietary guidelines as do lunches but they are expected to provide only one-fourth of the recommended dietary allowance for protein, calcium, iron, Vitamin A, Vitamin C, and calories.[17]

The majority of low income children (those from families below 200% of poverty) are eligible for coverage through Medicaid or Children's Health Insurance Program (CHIP).[30] CHIP targets uninsured children under the age of 19 with family incomes below 200% of poverty who are not eligible for Medicaid or covered by private insurance.[30] However, public programs that provide cash assistance such as welfare/Temporary Assistance for Needy Families (TANF) do not use the poverty guidelines in determining eligibility.[32]

Various assistance programs and researchers use different definitions for what constitutes low income, some of which have already been highlighted. More examples include the Department of Health and Human Services (DHHS) federal guidelines; people are classified as "poor" if their household income is less than 133% of the poverty level.[32] Some researchers have used income at or below 140% of poverty whereas Haas et. al used 125% below the poverty level as a cut-off for high and low income in their study of the association of race, socioeconomic status, and health insurance with prevalence of overweight among children and adolescents.[33] These varying definitions of low income make it difficult to assess the impact of income on overweight in a standardized way.

Children represent 27% of the United States population and account for 40% of all Americans in poverty.[24] According the USDA FNS panel, "future research is needed to explore the simultaneous effects of three major elements—nutrition assistance program participation, poverty, and obesity—on one another."[14] However, given inconsistent findings, research should actually be more comprehensive to assess multiple program participation as well as health insurance coverage and income. Also, although it is clear that the prevalence of childhood overweight is increasing and represents a serious health risk, the extent of the problem in younger children is less clear.

Obesity is a very complex problem with multiple influences without one single, simple solution. It is not known if the combined impact of multiple SES indicators influences overweight specific to this child population. To clarify the relationship between socioeconomic variables and the development of childhood overweight we used data from the 2003 National Survey of Children Health (NSCH), a survey module of State and Local Area Integrated Telephone Survey, conducted by Center for Disease Control and Prevention's (CDC).[34] This paper explores the relationship between low socioeconomic variables and childhood overweight among a nationally representative sample of six year olds.

Methods

Study Sample

The data for this research originate from the 2003 National Survey of Children Health (NSCH), a survey module using the State and Local Area Integrated Telephone Survey (SLAITS) mechanism of the CDC's National Center for Health Statistics.[34] The NSCH uses random-digit-dialing survey methodology and surveys are conducted by trained interviewers using computer-assisted telephone interviewing software. The NSCH includes information from

households with children less than 18 years of age from each of the 50 States and the District of Columbia. Using the SLAITS platform, interviews on approximately 2,000 children were conducted in each state and the District of Columbia. Given the desire to have a representative national sample, particular areas of the country are oversampled. A total of 102,353 adults provided information on a child in their household. Specifically, during the telephone interview, one child was randomly selected from all children in each identified household to be the subject of the survey. The respondent was the parent or guardian who knew the most about the child's health and health care. This cross-sectional study utilizes the data for all six year olds in the national sample for whom BMI data was available (4,362 of 5,050 children). Early recognition and prevention efforts are key in addressing public health issues. Most children enter school at six years of age, and therefore examining this population could help local health officials and school board members implement the best tactics to identify risk factors for overweight and obesity in children.

In addition to BMI, the NSCH included information on the child's health and use of programs available to those with low incomes as well as household socioeconomic variables and demographics.

Data Coding

Dependent variable

The primary outcome measure was prevalence of being at risk of overweight. Given definition labels for children's BMI, those children with BMI at or above the 85th percentile for gender and age ('at risk of overweight' and 'overweight') were coded as '1,' "at risk." for this study. Those children in the "underweight" and "normal" BMI classifications were coded together as '0,' "not at risk." This coding decision was based on the utility of BMI as a measure

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for obesity with fairly reliable indication of adiposity, correlating with measure of total body fat.[1,31] Further, it is important to detect the children who begin to show the signs of childhood overweight, and therefore those children classified in both 'overweight' and 'at risk of overweight' were coded together.

Independent variables

The independent variable survey questions are given in Appendix A. The following section provides details on the coding of these variables.

Child's Demographic Variables

Gender was a binary variable (female=0, male=1). The various race/ethnicity response categories (white, Black/African-American, American Indian, Alaska Native, Asian, Native Hawaiian, and Pacific Islander) were collapsed into two categories (white =0, Non-white=1).

Child's Health Variables

The variable describing the child's health was dichotomized as poor health = 1 (Good, Fair, Poor) and other response categories (Excellent, Very Good) were coded as '0.' The child's use of medicine prescribed by a doctor, other than vitamins and whether a doctor or health professional had ever said the child had diabetes were both binary variables.

Child's Health Insurance Coverage

Whether a child had health insurance coverage was coded dichotomously (No=1, Yes=0). Similarly, having Medicaid or the State Children's Health Insurance (S-CHIP) was dichotomized (Yes SCHIP =1, No SCHIP = 0).

Other Child Variables

The child's school attendance was also coded as a binary variable (public school=1, private, home-schooled, child not enrolled in school=0). The variable measuring the child's

physical activity assessed the number of days per week the child exercised for at least 20 minutes. Given the CDC's guidelines, which states that children need to exercise seven days a week to stay healthy, children who exercised seven days a week were coded as '0' and those who exercised less than recommended were coded as '1.' The item measuring the respondent's concern of eating disorders for the child was coded as '1' if the respondent expressed "a lot" or "a little" concern and those who said they were "not at all" concerned were coded as '0.'

Other Household Information

The respondent's relationship to the child was coded so that Mother (Biological, Step, Foster, Adoptive) was '1' and Father (Biological, Step, Foster, Adoptive) and all other relationships were coded as '0.' This coding scheme was utilized because, in general, a mother or female guardian is better able to accurately answer questions about their child. The total number of adults in household included (1, 2, 3 or more adults, don't know, and refused). We assumed that two adults in a household was a two parent household whereas a varying number of adults represented a different and potentially less favorable situation. Therefore, a variable measuring whether a child lived in a two-adult household was created. Children living in a two adult household was coded as '0,' and children not living in a two adult household was coded as '1.'

Socioeconomic Variables

The potential socioeconomic predictors of childhood "at risk" of overweight considered in this analysis included seven variables – poverty level, highest level of education in the household, the child's healthcare coverage, child's involvement in Medicaid or SCHIP, participation in the free or reduced priced breakfast or lunch program, food stamp participation, and welfare participation.

Poverty level was a derived variable based on a series of household income questions. Children were considered to be in a low income household if they were below 133% of poverty level and not in a low income household if they were at or above 133% of the poverty level. This coding decision was based on Department of Health and Human Services (DHHS) guidelines as well as the fact that most federal assistance programs use this cutoff for eligibility.

The highest level of education attained by anyone in the household, previously five categories (less than high school, twelve years (high school grad), more than high school, don't know, and refused) was coded dichotomously. Specifically, education was coded so that people were considered to have a lower education level if the highest grade of school they completed was high school graduate or less. Those with more than a high school education were considered to have a higher education level.

If the child had any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid was dichotomized. Those with coverage were coded as '1' and those without coverage were coded as '0'. Three additional variables assessing whether children received various types of assistance were also dichotomized. Specifically, if the household had received any cash assistance from a state or county welfare program, such as Temporary Assistance for Needy Families (TANF) in the last twelve months, the welfare variable was coded as '1.' If the child or any child in the household received Food Stamps in the last twelve months, the variable was coded as '1.' Lastly, if the child or any child in the household received free or reduced-cost breakfasts or lunches at school in the last year, the variable was coded as '1.'

Negative Socioeconomic Index

One might assume that children with lower or more negative socioeconomic indicators would be at greater risk for overweight than those with higher socioeconomic indicators. In an attempt to quantify various independent measures related to socioeconomics, a composite index was created. Table 1 includes the survey items utilized to create the negative socioeconomic index. We included a total of five variables in our index: income level, participation in the free or reduced priced breakfast or lunch program, food stamp participation, welfare participation, and a measure of health care coverage (combining whether or not the child had healthcare coverage and Medicaid/SCHIP variables). When assessing child healthcare coverage, the question was presented as whether or not the child had healthcare coverage, and if so, was that coverage Medicaid or SCHIP. Children with no coverage whatsoever were classified as having poor insurance coverage (code=1). Similarly, children who had coverage as part of the SCHIP program were coded as having poor insurance status (code=1). However, if the child had health insurance coverage that was not part of SCHIP, they were not considered as having poor insurance coverage and were coded as '0.'

All the items in the index were coded as either '0' or '1' and were summed to create an average index score, which could range from 0 to 5. Therefore, given our coding scheme, a mean index score closer to 5 would represent a more disadvantaged child with more negative socioeconomic indicators whereas a mean score closer to 0 would represent a child with fewer negative socioeconomic indicators.

Statistical Analysis

SAS was used to generate descriptive statistics. The relationships between the socioeconomic variables and being at risk of overweight were analyzed using generalized linear mixed-model regression specifying a logit link function and a binomial variance function (SAS

PROC MIXED and SAS GLIMMIX) for the dichotomous variables.[35] This relationship was also

adjusted for race and household education level. Linear mixed-model regression was also used

to assess the relationship between the negative socioeconomic index that was created and being

at risk of overweight while controlling for gender race and household education level. Given the

sampling scheme with oversampling, all analyses were weighted to avoid variance bias and to

obtain population-based estimates. The sampling weight was composed of a base sampling

weight, an adjustment for multiple telephone lines within a household, and various adjustments

for non-response.

Results

The total national sample size of children six years of age was 5,050; however, the

primary outcome measure, BMI, was given for 4,362 children. Therefore, this study sample

includes 4,362 children.

Table 2 includes a summary of unadjusted weighted characteristics for the overall sample

of six year olds. Overall, 46.7% of the sample had BMI at or above the 85th percentile and were

classified in the 'at risk' of overweight group. Approximately half of the sample was male and

the majority were white. Very few six year olds were diabetic (0.2%) and 20.1% were currently

on prescribed medication other than vitamins. The majority of the children reportedly had

'excellent' health (89.5%). Approximately two-thirds of the overall sample, 65.6% of children,

exercised seven days a week for at least 20 minutes to the point of sweating and breathing hard.

The majority of the children in our sample attended public school (82.6%) and lived in a

household where the highest level of education was above a high school degree (72.0%). Most

of the respondents who completed the questionnaire were mothers or female guardians (80.8%)

and the majority of children were in households with two adults (74.2%).

Table 3 includes the unadjusted and adjusted relationship between indicators and being 'at risk' of overweight. Males are at greater risk of being overweight than females (48.2% versus 45.2%, p-value = 0.0519). Non-white children were more likely to be at risk of overweight than whites (54.3% versus 43.3%, p-value = 0.009). Household education level was indicative of being 'at risk' for overweight. Children in a household with high school degree as the highest level of education were more likely to be at risk than those in households with higher overall education (52.2% versus 44.6, p-value <0.0001). After adjusting for race and household education, those children not living in a two adult household were more likely to be 'at risk' of overweight compared to those in a household with two adults (55.4% versus 47.9%, p-value <0.0001). Children in public school were at a greater risk of being 'at risk' of overweight compared to those who were in private or home school (51.3% versus 46.2%, p-value = 0.0118).

Recipients of Medicaid or SCHIP were more likely to be at risk of overweight after adjustment compared to those not receiving Medicaid or SCHIP (53.7% versus 49.0%, p-value = 0.0196). Similarly, those children participating in the free or reduced priced breakfast or lunch programs were found to be statistically more likely to be 'at risk' compared to those without free or reduced priced lunch or breakfast (57.7% versus 47.6%, p-value <0.0001). Having a household income less than 133% of poverty level was not statistically significant after adjusting for race and household education level. Likewise, exercise, whether or not the child had health insurance coverage, and if during the past 12 months the household received food stamps or received any cash assistance from a state or county welfare program, such as TANF was not statistically significant after adjustment.

Table 4 includes the socioeconomic factors by risk status adjusted for race and household education. After adjustment, a greater proportion of those receiving Medicaid or SCHIP

program and those children participating in the free or reduced priced breakfast or lunch were 'at risk' of overweight. Specifically, there was a greater proportion of children participating in Medicaid or SCHIP who were 'at risk' compared to those who are 'not at risk' of overweight (38.3% versus 35.3%, p-value = 0.0196). Similarly, more children received free or reduced price lunch or breakfast in the 'at risk' group compared to those 'not at risk' (60.3% versus 51.8%, p-value = <0.0001). Other socioeconomic variables were not statistically associated with 'at risk' status after controlling for race and household education.

The negative socioeconomic index scores ranged from 0 to 5. After adjusting for race and household education, we found that the mean negative socioeconomic index score was statistically higher for those 'at risk' of overweight (2.0) compared to those 'not at risk' for overweight (1.9) (p-value = 0.059).

Discussion

The primary objective of this study was to determine whether there was an association between low socioeconomic variables and 'at risk' of overweight for six year old children. This study varies from previously published work in that it assesses whether health insurance coverage, participation in Medicaid or SCHIP, cash assistance programs (i.e. welfare/TANF), food programs (i.e. food stamps, free or reduced priced breakfast or lunch), and poverty level impact whether six year olds are 'at risk' for overweight. Previous studies focus primarily on participation in food programs and household income without taking into account the association between health insurance status with 'at risk' of overweight in childhood.[17,26] Further, a negative socioeconomic index was created to determine whether those with more undesirable socioeconomic situations were more likely to be 'at risk' of overweight compared to those with more favorable socioeconomic situations.

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Almost half of the children in this national sample were either 'at risk' of overweight or 'overweight' based on BMI measurements (at or above the 85th percentile for BMI). Along with other evidence on the increasing prevalence of childhood overweight, this highlights an urgent need to take action to halt the spread of this epidemic. In assessing gender, males were more likely to be overweight than females. This finding supports previously published literature suggesting an increased rate of childhood overweight among boys.[7,17] This gender difference could possibly be due to declining recreational outdoor activity and more time spent watching television, sitting in front of the computer, or playing video games.[35,37]

Race was found to be significantly related to being 'at risk' of overweight. Nonwhites were at greater risk of 'at risk' of overweight compared to whites, which is similar to previous research on racial differences.[7,17,32] The reasons for that difference are beyond the scope of this study, but previous literature links lifestyle, acculturation, cultural beliefs, and practices to significant ethnic disparities in overweight status. Different food preferences or attitudes toward obesity may also lead to a greater or lesser risk of being overweight for children. In our study, the category nonwhite was collapsed as Black, multiracial. Further analysis to assess the relationship between different ethnic backgrounds and practices as well as socioeconomic variables with 'at risk' of overweight should be measured.

Education was found to be significant supporting previous research that children of parents with fewer years of education are more likely to be overweight.[25,32] Parents with less education may be less knowledgeable about the role nutrition and physical fitness play in weight loss and more educated parents may be more concerned about food quality than quantity. In our study, we were unable to assess the specific number of years education may play in the

household, which may contribute to a more nutritional and physical active background for a parent in teaching their child about healthier lifestyles.

Those attending public school were at greater risk of overweight. The various socioeconomic and sociocultural determinants specific to public school students are beyond the scope of this study. However, this finding should prompt school systems to play a more influential role in providing students with more nutritional and fitness information since more than 80% of the children sampled attended public school.

The number of adults in the household was associated with risk of being overweight. This finding is similar to those of previous studies where children living in a two adult household were less likely to be overweight[17,32] compared to children living in a one or three adult household. This suggests the possibility that single working mothers spend less time on food preparation and depend on less nutritious meals leading to a greater chance of childhood overweight. However, this study did not discern one adult households from three adult households, and a child 'at risk' of overweight may be attributed to a variety of other factors found in single parent homes.

Exercise level was not statistically related to being 'at risk.' This is not congruent with other studies that show the more a child exercises the less likely they are to be overweight.[35,37] This may indicate that among younger children, factors associated with family history and genetic susceptibility are more important. However, the majority of children were exercising seven days a week so the insignificance could be a result of a homogeneous sample. This finding was unexpected and merits further attention perhaps using linear models that assess if there is an inverse relationship with increasing days of exercise and BMI.

In looking at each of our socioeconomic variables, important results emerged in this study. Our first variable was assessing health care coverage. We found that there was no statistical significance with whether or not a child had health care coverage and 'at risk' of overweight. This agrees with previous literature by Haas and colleagues where they found no association between insurance status (uninsured, public insurance, private insurance) and children overweight.[32] Regardless of insurance status, this suggests that younger children have better access to the medical care system and health information because of the need for routine immunizations required for school attendance.[31] However, in our second variable, there was statistical significance when assessing whether that insurance was Medicaid or SCHIP. This suggests that those with Medicaid or SCHIP (public insurance) are at a greater risk to be 'at risk' of overweight than those who have private insurance. This does not support the previous literature by Haas and colleagues because they found no association between public insurance or private insurance with childhood overweight.[32] This suggests that the type of health insurance plays a key role in the prevention and treatment of childhood overweight. There is a need for public insurance programs to address childhood obesity and healthier lifestyles to target children from the most vulnerable SES groups.

In our third variable, we found that participation in the Food Stamp Program was not associated with being 'at risk' of overweight. Children in families receiving Food Stamp Program benefits are neither more nor less likely to be overweight than those who do not receive Food Stamp Program benefits. The Food Stamp Program follows strict criteria and may be reason why our findings report no significance. A family on the Food Stamp Program may hold certain characteristics that differ from our other food assistance programs. Our findings are supported by Hofferth and Curtin that found a similar conclusion. Other findings however, has

found Food Stamp Program participation to be significantly related to childhood overweight.[26,31] Given the difference in findings among several previous studies, additional research still needs to be conducted.

Our fourth variable, participation in the free or reduced priced breakfast or lunch programs was significant. The National School Lunch Program has recently been criticized for providing lunches higher in fat than recommended [38] and it is possible that those children participating in the program may be selective in eating fattier foods at breakfast or lunch. However, our study does not discern between breakfast or lunch, and further analysis should assess if there is a significant difference between the two meals. Also, targeting is not perfect and not all kids eat lunch at school with only about half of school lunches being served to children from low income families.[38] Further analysis should assess those varying differences between income groups.

Fifth, welfare and receiving funding such as TANF was not significantly related to being 'at risk' of overweight. As mentioned, TANF is a federal cash assistance program not dependent on poverty guidelines, but vary differently in each state based on gross and net income. Since there are no poverty guidelines in determining the eligibility for TANF, those children with families receiving cash assistance may have characteristics that differ from other families on public assistance programs.

After adjustment for household education, low income was not associated with 'at risk' of overweight in children. These results are inconsistent with early research of Jones and colleagues and Matheson et. al, stating that poor families are less likely to be overweight.[17,26] In our study, we used 133% as a cut-off for low and high income. Eligibility program requirements were used in choosing this cut-off number. Previous literature used different cut-off numbers in

assessing the relationship between household incomes and 'at risk' of overweight.[17,24] In this study, a dichotomous variable was used and further analysis using a linear scale may show different results for income groups.

Lastly, we presumed that a higher score on the negative socioeconomic index would disadvantage the child and as a result they would be worse off they would be in terms of being 'at risk' of overweight. While statistically significant, the difference in the index scores for is not very meaningful in an applied sense. Specifically, the difference between 2.0 and 1.9 on a 5-point scale does not have much "clinical" meaning. We were hoping to see a greater discrepancy in index scores by risk status, which would have provided stronger evidence for a dose-response relationship between children participating in government assistance programs, certain household characteristics (such as family income and education level) and 'at risk' of overweight.

The information for this study is from a nationally representative sample of six years olds. This data is fairly generalizable to six year olds in the United States. However, this study has several limitations. First, this study utilizes a cross-sectional sample and did not follow the children 'at risk' over time. Therefore, temporality is uncertain. Second, this data was based on parental report and no physical examination was done. Therefore, the data could be biased because of inaccurate reporting. Also, respondents may have been reluctant to report their household income level. Under- or over-reporting income would have resulted in classification error. Third, our sample of six year olds was originally 5,050, but only 4,362 had BMI information. Thus, we could not include all six year olds in the analysis because of missing data. It could be that those who did not report information on height and weight, for example, had lower education, which would increase the likelihood of misclassification. Fourth, the

information used in this study was from a telephone survey. Therefore, only those with landline telephones were included. Historically, people with lower incomes are less likely to have telephones. Because we were assessing whether low socioeconomic factors impact a children's 'at risk' for overweight, not being able to survey people who might be at lower incomes would bias our results. Fifth, the criteria for whether or not children are eligible for certain public assistance programs vary by state, therefore, the response to these variables could differ by residence. We also were unable to measure other potential confounders and predisposing factors such as nutrition and family history, which are key, factors in determining the physiological make-up of the child. Last, while we weighted given the NSCH sampling scheme, we were unable to take into account the oversampling given state stratum.

Conclusion

In conclusion, this study found an association between several low socioeconomic indicators and being 'at risk' of overweight among six year olds. Males, nonwhites, children attending public school, children in households where the highest level of education was high school or less, and children living in households without two adults were at greater risk of overweight. Exercise did not impact risk in this population. Children who have Medicaid or SCHIP or receive free or reduced cost breakfast or lunch were at greater risk. Being at or below poverty level was significantly related to the 'at risk' population before adjusting for highest household education. Overall, those 'at risk' had a higher negative socioeconomic index than those 'not at risk' (2.0 vs. 1.9, p-value = 0.059)

Further, this study improves our understanding of socioeconomic determinants that may contribute to children 'at risk' of overweight. This study is also one of the few studies to include health insurance coverage with other socioeconomic variables.

There is universal agreement that rates of overweight are increasing dramatically in our young population. Our results suggest that certain population and income inequalities exist. Governmental agencies should target interventions aimed at dealing with economic hardships for vulnerable socioeconomic groups. There is need for policy implementation at the federal, state, and local levels to improve public assistance programs such as the nutritional content of school meals or to provide child heath insurance services to encourage healthier lifestyles. In promoting good health and nutrition in children six years of age, it is important to understand that overweight may be influenced from multiple socioeconomic variables and sociocultural behaviors. Efforts to reduce the risk of behaviors that damage health in our youth are needed to prevent greater spread of this childhood epidemic, especially in low socioeconomic groups. To that end, by identifying socioeconomic risk factors for overweight and obesity, local health officials and school board members could implement the best tactics for promoting good health and nutrition; targeting youth from the most vulnerable socioeconomic groups to prevent greater spread of this childhood epidemic.

Table 1. Survey Items Utilized to Create the Negative Socioeconomic Index

Negative Socioeconomic Index

Item	Text
296	Derived. Poverty level of this household based on DHHS guidelines
297	At any time during the past 12 months, even for one month, did anyone in this household receive any cash assistance from a state or county welfare program, such as [state TANF name]?
298	During the past 12 months, did [[CHILD]/ any child in the household] receive Food Stamps?
299	During the past 12 months, [did any child in the household/[CHILD]] receive free or reduced-cost breakfasts or lunches at school?
73	Does [CHILD] have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid?
74	[Is that coverage,/Is [he/she] insured by] Medicaid or the State Children's Health Insurance Program, S-CHIP? In this state, the program is sometimes called [FILL MEDICAID NAME, SCHIP NAME].
10	What is the highest level of education attained by anyone in your household?

Table 2. Baseline Characteristics of Six Year Olds in SLAITS for Entire Sample and by Risk of Being Overweight[1]

	Overall (n=4362)	'At Risk' (n=1965)	'Not at risk' (n=2397)	p-value
Male (%)	50.9	52.5	49.5	0.0519
Nonwhite (%)	25.7	30.2	21.8	<0.0001
Diabetic (%)	0.2	0.3	0.2	0.4536
Currently on prescribed medication other than vitamins (%)	20.1	20.0	20.2	0.8637
Reportedly have "poor" health (%)	10.5	12.3	9.0	0.0004
Did not exercise at least 20 minutes each day in the last week to the point of sweating and breathing hard (%)	34.4	66.2	65.0	0.3908
Attend public school (%)	82.6	84.5	80.9	0.0019
Highest household education is high school degree or less (%)	28.0	31.2	25.1	<0.0001
Questionnaire NOT completed by mother or female guardian (%)	19.2	21.0	17.7	0.0061
Household does not contain 2 adults	25.8	29.9	22.2	<0.0001

[1]   Weighted values given survey sampling scheme, unadjusted

Table 3. Predictors of Being 'At Risk of Overweight': Unadjusted and Adjusted

	'At Risk' Percent (SE) Unadjusted[1]	p-value	'At Risk' Percent (SE) Adjusted[2]	p-value
Gender				
Female	48.2 (0.011)		NA	NA
Male	45.2 (0.011)	0.0519	NA	NA
Race				
White	43.3 (0.009)		NA	NA
Non-white	54.3 (0.015)	<0.0001	NA	NA
Household Education				
High School or less	52.2 (0.014)		NA	NA
Higher than High School	44.6 (0.009)	<0.0001	NA	NA
Exercise				
At least 7 days/week	45.8 (0.013)		49.1 (0.014)	
Less than 7 days/week	47.2 (0.009)	0.3908	51.4 (0.011)	0.1639
Insurance Coverage				
Insurance coverage	46.6 (0.008)		50.5 (0.010)	
No insurance coverage	48.2 (0.031)	0.6369	50.9 (0.033)	0.9149
Medicaid/SCHIP				
No Medicaid/SCHIP	44.6 (0.009)		49.0 (0.012)	
Medicaid/SCHIP	52.6 (0.015)	<0.0001	53.7 (0.016)	0.0196
School				
Private/Home school	41.6 (0.018)		46.2 (0.020)	
Public	47.8 (0.008)	0.0019	51.3 (0.010)	0.0118
Free School Lunch				
No free lunch in school	46.3 (0.016)		47.6 (0.019)	
Free lunch in school	57.6 (0.016)	<0.0001	57.7 (0.017)	<0.0001
Food stamps				
No food stamps	51.1 (0.013)		52.7 (0.015)	
Food stamps	54.4 (0.022)	0.1924	54.5 (0.023)	0.4985
Welfare				
Not on welfare	51.9 (0.012)		53.4 (0.013)	
On welfare	52.9 (0.033)	0.7682	52.4 (0.034)	0.7750
Household Income				
≥ 133% of poverty level	44.7 (0.009)		49.8 (0.012)	
< 133% of poverty level	54.0 (0.018)	<0.0001	53.3 (0.018)	0.1151
Total number of Adults				
2 Adults	44.1 (0.009)		47.9 (0.012)	

| Not 2 Adults | 54.2 (0.015) | <0.0001 | 55.4 (0.015) | <0.0001 |

[1] Weighted values given survey sampling scheme, unadjusted

[2] Weighted values given survey sampling scheme, adjusted for race and household education level

Table 4. Socioeconomic Factors: At Risk of Being Overweight vs. Not At Risk of Being Overweight [1]

	'At Risk' Percent (SE) (n=1965)	'Not at risk' Percent (SE) (n=2397)	p-value
No health care coverage	6.2 (0.006)	6.2 (0.006)	0.9428
Have Medicaid/SCHIP	38.3 (0.010)	35.3 (0.010)	0.0196
Receive food stamps	32.5 (0.013)	31.3 (0.014)	0.4985
Receive free or reduced-cost breakfast or lunch	60.3 (0.015)	51.8 (0.016)	<0.0001
Have Welfare/TANF	13.8 (0.010)	14.2 (0.011)	0.7750
At or below poverty level	30.7 (0.009)	28.9 (0.009)	0.1151

[1] Weighted values given survey sampling scheme, adjusted for race and household education level

Appendix A

Child's Demographic Variables

Item	Text
7	Is [Survey Child] male or female?
4	Derived. Age in years of selected child
287	Race classification (White, Black, Multiracial, Other)

Child's Health Variables

Item	Text
12	In general, how would you describe [CHILD]'s health? Would you say [his/her] health is excellent, very good, good, fair, or poor?
17	Derived. BMI for age classification for sample child
18	Does [CHILD] currently need or use medicine prescribed by a doctor, other than vitamins?
39	Has a doctor or health professional ever told you that [CHILD] has diabetes?

Child's Health Insurance Coverage

Item	Text
73	Does [CHILD] have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid?
74	[Is that coverage,/Is [he/she] insured by] Medicaid or the State Children's Health Insurance Program, S-CHIP? In this state, the program is sometimes called [FILL MEDICAID NAME, SCHIP NAME].

Other Child Variables

Item	Text
202	What kind of school is [CHILD] currently enrolled in? Is it a public school, private school, or home-school?
218	During the past week, on how many days did [CHILD] exercise or participate in physical activity for at least 20 minutes that made [him/her] sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?
234	Are you concerned a lot, a little, or not at all about eating disorders?

Household Socioeconomic Variables

Item	Text
296	Derived. Poverty level of this household based on DHHS guidelines
297	At any time during the past 12 months, even for one month, did anyone in this household receive any cash assistance from a state or county welfare program, such as [state TANF name]?
298	During the past 12 months, did [[CHILD]/ any child in the household] receive Food Stamps?

300   During the past 12 months, [did any child in the household/[CHILD]] receive free or reduced-cost breakfasts or lunches at school?

Other Household Information
8   Derived. Respondent's Relationship to Child
9   Total number of adults in the household (top coded to 3)
10   What is the highest level of education attained by anyone in your household?

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