

# Prevalence and Trends in Obesity among Mississippi Public School Students, 2005-2009

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## **A** BSTRACT

The purpose of this research was to determine the prevalence of overweight and obesity in Mississippi children and youth in grades K - 12, and to assess any changes in the prevalence during 2005, 2007, and -2009. Body Mass Index was calculated using measured height and weight data for 3,703 public school students, and the prevalence of overweight and obesity was estimated. Additional analysis compared prevalence estimates by gender, race, and grade for the 2009 data, and comparisons were made between the 2005, 2007, and 2009 data. In 2009, the prevalence of obesity for all students in grades K - 12 was 23.9%, as compared to 23.5% in 2007 and 25.5% in 2005. However, no statistically significant differences were found over the three time periods. The disparity between races, appears to be increasing over time, with the prevalence remaining level for Nonwhite students while dropping each year for White students.

**KEY WORDS:** OBESITY, CHILDHOOD, OVERWEIGHT

## **INTRODUCTION**

It is well established that the prevalence of childhood obesity had increased across the nation between 1980 and 2004.<sup>1</sup> More recently, however, the National Health and Nutrition Examination Survey (NHANES) showed no significant changes in the percentage of obesity

among US children aged 2 to 19 years between 2003-2004 and 2005-2006.<sup>2</sup> Similarly, the national Youth Risk Behavior Survey (YRBS) has reported no significant changes in the percentage of obesity among US students in grades 9-12 who attended public and private schools between 2005 and 2007.<sup>1</sup>

In contrast to national child obesity trends, analysis of Mississippi's YRBS data revealed that self-reported prevalence of obesity among public high school students has continued to rise and has shown an upward linear trend between 2001 and 2007.<sup>1</sup> It should be noted that the incremental rise in obesity between 2007 and 2009 (0.4%) was less than that between 2001 and 2003 (1.7%). Further, it is encouraging that the difference in obesity prevalence observed between 2007 and 2009 was not statistically significant. The YRBS, however, does not include elementary level children and, in 2005, the state did not obtain weighted YRBS data on high and middle school students. Consequently, it is difficult to determine, based only on high school self-reports, whether or not the latest changes in childhood obesity in Mississippi.

In Mississippi, a second source of obesity data is the Child and Youth Prevalence of Obesity Surveys (CAYPOS).<sup>3,5</sup> Every other year since 2003, actual heights and weights have been collected on weighted, representative samples of public school students. Between 2003 and 2005, the CAYPOS indicated that the prevalence of obesity among children and youth in the public schools was increasing.<sup>3,5</sup> In 2003, 24% of students in grades 1 - 8 were obese and 14.7% were overweight. By 2005, 25.5% of Mississippi students in grades K - 12 were obese and 18.4% were overweight. In the 2005 study, the highest prevalence was among middle school students (28.9%), followed by elementary students (25.0%), and then high school students (23.5%).

In the 2007 CAYPOS, however, a modest decrease in the prevalence of obesity was reported. Between 2005 and 2007, the prevalence of obese children and youth declined from 25.5% to 23.5%. The prevalence dropped from 28.9% to 22.8% in the middle school and from 23.5% to 20.8% in the high school, yet was relatively unchanged among the elementary level (25.0% to 25.3%). While the prevalence rates were still very high, the decline in middle and high school sug-

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gested that like data from the National YRBS and other national studies, the prevalence may be leveling off or beginning to drop in Mississippi.<sup>4</sup>

Whether or not the obesity rates are continuing to increase, leveling off, or declining may have a significant impact on the health and well-being among children, youth and adults. Evidence has been progressively accumulating that obese children do not necessarily have to wait until adulthood to suffer serious health consequences from their excess weight. Obese children are more likely to suffer complications from obesity related cardiovascular, pulmonary, and metabolic diseases, as well as depression and low self-esteem.<sup>6-11</sup> Based on NHANES estimates of overweight and obesity through 2004, projection analysis predicts 86.3% of adults (> 20 years old) will be overweight or obese by 2030. In addition, health care costs associated with the rise in obesity are expected to reach one trillion dollars annually by 2030.<sup>12</sup>

### **Educational Initiatives**

With children spending the majority of their waking hours at school, across the nation many policy efforts have been geared toward changes in the school setting. These range from mandatory Body Mass Index (BMI) assessments in all schools to limiting the availability of competitive foods on school campuses to increasing physical activity in schools. However, limited research on the outcomes of these initiatives is currently available.<sup>13-18</sup>

Through a mix of state and federal legislation, Mississippi recently began implementing several state-wide school-based initiatives to address the problem of childhood obesity. In 2004, Congress enacted the Child Nutrition and WIC Reauthorization Act (Section 204 of Public Law 108-265) mandating any local education agency participating in a program authorized by the Richard B. Russell National School Lunch Act (NSLA) or the Child Nutrition Act of 1966 (CNA) to establish a school wellness policy no later than the first day of the school year beginning after June 30, 2006.<sup>19</sup> The primary objective of the law was to prevent inactivity and obesity among children. The law established that, at a minimum, the local wellness policies shall contain: goals for nutrition education and physical activity; nutrition guidelines for foods available at each school; assurance that guidelines for the wellness policy are not less restrictive than those set forth by the NSLA or the CNA; plans for measuring implementation of the local wellness policy; and involvement of a representative group of community and school stakeholders in the development of the school wellness policy.<sup>20</sup>

In 2006, the Mississippi State Board of Education also approved Beverage Regulations for Mississippi Schools. This legislation established phased implementation of strict guidelines for the types of beverages that could be served at school campuses during the regular and extended school day. In Phase One, beginning in August 2007, sale of all full-calorie, sugared carbonated beverages was prohibited to students at Mississippi schools during the school day. In phase two, beverage vending was further restricted to only include bottled water, low-fat and non-fat milk, and 100% fruit juice in age-appropriate servings for elementary and middle schools. High schools are allowed bottled water, no- or low-calorie beverages and age-appropriate servings of low- or non-fat milk, 100% juice, light juice/light sports drinks, and at least 50% of beverages must be water or no-calorie options.<sup>21</sup>

In 2007, the Mississippi Code of 1972 was amended (section 37-13-134, The Mississippi Healthy Students Act) and the Mississippi Public School Accountability Standards were revised by establishing stricter nutrition, physical activity, and physical education standards for Mississippi schools.<sup>22,23</sup> Based on this legislation, the Mississippi Department of Education created two interpretive documents: 1) Nutrition Standards and, 2) Physical Education/Comprehensive Health Education Rules and Regulations.<sup>24,25</sup>

The Nutrition Standards established specific requirements for food choices offered in the cafeteria and on campus, how food is prepared at schools, marketing of healthy foods to students and staff, minimum and maximum time allotments for students' and staff meal periods, and methods for increasing participation in the child nutrition school breakfast and lunch programs. The Physical Education/Comprehensive Health Education Rules and Regulations provided time requirements, sample curriculum, and schedules for physical education, physical activity, and activity-based instruction for students in grades K-8; fitness testing for fifth grade students; and guidelines for physical education, comprehensive health education, and fitness testing for students in grades 9-12.<sup>25</sup> By the fall of 2008, all standards and requirements had been phased in by the public schools in Mississippi.

In light of the recent educational initiatives in Mississippi, the purpose of this research was to once again determine the prevalence of overweight and obesity of children and youth in grades K - 12, and to assess any changes in the prevalence between 2005, 2007, and 2009.

### **METHODS**

The sampling frame consisted of 475,680 students in 894 public schools offering kindergarten or any combination of grades 1 through 12 in Mississippi. As with the 2003, 2005, and 2007 CAYPOS, the sample design was a two-stage stratified probability design. The first stage included the random selection of 96 schools. A systematic sample of schools was drawn with probability proportional to the enrollment in grades K - 12 of each school. In the second stage of sampling, classes were randomly selected within the sampled schools. Classes were selected using equal probability systematic sampling. All eligible students in the selected classes were asked to participate in the survey. The sample was designed to yield a self-weighting sample so that every eligible student had an equal chance of selection, thereby, improving the precision of the estimates.

As in each of the previous years, the weighting process was intended to develop sample weights so that the weighted sample estimates accurately represented the entire K - 12 public school students in Mississippi. Every eligible student was assigned a base weight, which was equal to the inverse of the probability of selection for the student. Adjustments were made to the initial weights to remove bias from the estimates and reduce the variability of the estimates.

The CAYPOS was conducted in April 2009 in Mississippi. The study received continued institutional review board approval through the Human Subjects Committee at The University of Southern Mississippi, as the study protocol matched the 2003, 2005, and 2007 CAYPOS.<sup>3,4</sup> As with the previous studies, once selected schools agreed to participate and classes were chosen, measuring equipment (i.e., digital scales and stadiometers) and passive consent forms were delivered to

the schools. Each school designated a school nurse who was responsible for collecting data and had been trained on the use of equipment. Two or three days before data collection began, students in the selected classes were read a prepared paragraph containing information about the study. Each student was then given a passive parental consent form to take home to parents or guardians. If a parent did not want his or her child to participate in the study, the parent was instructed to indicate such on the form, sign it, and have the child return it to the teacher. Prior to the collection of heights and weights, the nurse would check with the teacher to determine if any students returned a signed form. Students who returned a signed form did not participate in the study. There were neither consequences for nonparticipation nor rewards for participation.

As with the previous studies, the protocol for making measurements required that the weight scale be placed on a hard, smooth surface; carpeted areas were not to be used. The scale was calibrated to zero before use and recalibrated after every 10th student. All students were weighed and measured in a location where the information gathered would be confidential. Other students were not able to read the scale or height measurement or hear a weight or height given. Nurses reported the height and weight, rounded to the nearest whole inch or pound, respectively, along with age, sex, date of birth, racial or ethnic background, and the school code number. No allowance was made for weight of clothing; however, students were asked to remove belts, heavy jewelry, jackets, and shoes. No student names were written on the data collection forms.

In previous years, nurses recorded all data on Optiscan forms and mailed them to the study authors. In the 2009 CAYPOS, nurses were sent an email with a link to a secure website developed and maintained by Qualtrics, Inc.<sup>26</sup> to record and submit their data. These data were compiled in aggregate form by the Qualtrics software and made available in excel format to the study authors for analysis.

## DATA ANALYSIS

Body Mass Index was computed for each responding student based on height (in meters) and weight (in kilograms). The height in feet and inches was first converted to meters. The weight in pounds was then converted to kilograms. BMI was calculated using the SAS program, gc-calculate-BIV.sas as follows:  $BMI = \text{Weight (in kg)} / [\text{Height (in m)}]^2$ . BMI values were checked to ensure that the results were biologically plausible, using the limits developed by the CDC. BMI percentiles were computed using the SAS program, gc-calculate-BIV.sas. Children and adolescents are classified into four categories: (1) underweight (BMI is less than the 5<sup>th</sup> percentile); (2) normal weight (BMI is equal to or greater than the 5<sup>th</sup> but less than the 85<sup>th</sup> percentile); (3) overweight (BMI is greater than the 85<sup>th</sup> but less than the 95<sup>th</sup> percentile); and (4) obese (BMI is greater than or equal to the 95<sup>th</sup> percentile).<sup>27</sup>

SUDAAN 10.0<sup>28</sup> was used to calculate weighted estimates and standard errors, and Proc Crosstab procedure was used to compare prevalence of child overweight among different subgroups. As in previous years, differences between summary statistics were considered statistically significant if the p-value from Chi-square test was less than 0.05. For comparisons between 2009, 2007, and 2005, differences be-

tween summary statistics were considered statistically significant if their associated 95% confidence intervals did not overlap.

## RESULTS

### *Characteristics of Participants from the 2009 CAYPOS*

Eighty-two of the 96 schools sampled participated in the study (85%). The student response rate was 87% (3,703 usable records/4,266 eligible sampled students). Thus, the overall response rate was 74% (product of school response rate and student response rate), which was above the threshold of 60% required to obtain weighted estimates. The final sample consisted of 3,703 students in grades K - 12, including 1,839 males (49.8%), 1,864 females (50.2%), 2,053 Nonwhites (56.3%) and 1,648 Whites (43.7%) (Table 1). For this report, the category Nonwhite is considered a close measure for African American because 93% of Nonwhite students were African American. The number of students in other race categories was too small for separate analysis.

**TABLE 1: CHARACTERISTIC OF PARTICIPANTS, CAYPOS, GRADES K-12, MISSISSIPPI, 2009**

Characteristic	Unweighted count	Weighted percent
Gender		
Male	1,839	49.8
Female	1,864	50.2
Race		
White	1,648	43.7
Non-White <sup>a</sup>	2,053	56.3
Missing	2	0.0
Grade		
Elementary		
K	163	4.2
1st	274	7.9
2nd	338	8.5
3rd	271	7.3
4th	447	11.7
5th	163	4.5
Middle school		
6th	143	3.7
7th	344	8.9
8th	501	13.6
High school		
9th	435	12.3
10th	263	7.6
11th	153	4.1
12th	208	5.7
<b>Total</b>	<b>3,703</b>	<b>100</b>

<sup>a</sup>Ninety-three percent of non-White students were African American.

### *Results of 2009 CAYPOS Based on Subgroups of Participants*

As a group, 23.9% of the children and youth in grades K - 12 were classified as obese and another 18.5% of the children were classified as overweight giving a combined total of 42.4% of the children and youth at or above the 85<sup>th</sup> percentile for BMI for age and gender. A more detailed analysis of the data by gender, race, and grade level is discussed below.

#### *Gender*

In 2009, 23.0% of females were classified as obese, with another 18.8% as overweight. Among males, 24.8% were obese and another 18.2% were overweight (Table 1).

#### *Race*

In terms of race, 19.5% of the White students were classified as obese, with another 17.9% as overweight. Among the Non-white stu-

dents, 27.4% were obese and 19% were overweight. There is a statistically significant difference between the prevalence of obesity among the White and Nonwhite students (Table 2).

**TABLE 2: PREVALENCE OF OVERWEIGHT AND OBESITY BY GRADE LEVEL AND RACE, CAYPOS, MISSISSIPPI 2005, 2007, AND 2009**

	All (K-12) (%, 95% CI)	Elementary (K-5) (%, 95% CI)	Middle school (6-8) (%, 95% CI)	High school (9-12) (%, 95% CI)
<b>All</b>				
<b>Overweight*</b>				
2005	18.4 (17.0-19.8)	18.0 (16.2-19.8)	19.4 (16.5-22.3)	18.1 (15.9-20.3)
2007	18.6 (17.1-20.1)	18.3 (16.6-20.1)	19.2 (17.4-21.1)	18.7 (14.4-23.9)
2009	18.5 (17.3-19.7)	17.7 (15.7-19.9)	18.0 (15.4-20.8)	20.1 (18.8-21.5)
<b>Obesity†</b>				
2005	25.5 (23.3-27.7)	25.0 (22.3-27.7)	28.9 (24.8-33.0)	23.5 (20.6-26.4)
2007	23.5 (21.6-25.7)	25.3 (22.1-28.7)	22.8 (19.8-26.1)	20.8 (17.6-24.5)
2009	23.9 (22.0-25.9)	24.1 (21.2-27.2)	25.4 (22.0-29.2)	22.3 (19.1-25.9)
<b>White</b>				
<b>Overweight</b>				
2005	17.7 (15.5-19.9)	17.9 (14.4-22.0)	18.2 (13.8-23.7)	16.9 (14.6-19.6)
2007	18.3 (16.5-20.2)	17.8 (15.8-19.9)	20.1 (15.7-25.2)	17.5 (13.2-22.7)
2009	17.9 (16.3-19.5)	18.3 (15.2-21.8)	16.7 (13.9-19.9)	18.4 (15.9-21.3)
<b>Obesity</b>				
2005	22.9 (20.4-25.4)	22.9 (20.5-25.6)	28.4 (23.6-33.8)	19.9 (16.6-23.7)
2007	21.0 (18.5-23.7)	21.9 (18.4-25.9)	19.5 (13.8-27.0)	20.1 (16.2-24.8)
2009	19.5 (17.1-22.1)	17.8 (14.0-22.3)	21.6 (17.6-26.2)	19.6 (15.7-24.1)
<b>Nonwhite‡</b>				
<b>Overweight</b>				
2005	18.8 (17.2-20.4)	18.2 (16.2-20.5)	20.1 (16.9-23.7)	18.9 (15.8-22.6)
2007	18.9 (16.7-21.3)	18.9 (15.9-22.2)	18.3 (15.7-21.3)	19.6 (14.4-26.0)
2009	19.0 (17.3-20.9)	17.4 (14.8-20.3)	19.2 (15.0-24.2)	21.6 (18.7-24.7)
<b>Obesity</b>				
2005	27.4 (24.5-30.3)	27.4 (24.4-30.6)	29.3 (23.4-36.0)	25.9 (21.8-30.5)
2007	25.7 (22.9-28.7)	28.4 (23.8-33.5)	25.4 (21.2-30.0)	21.4 (16.5-27.3)
2009	27.4 (25.1-29.8)	28.1 (24.7-31.9)	29.0 (24.9-33.5)	24.7 (21.0-28.8)

\*Body mass index (BMI) ≥ 85th percentile and < 95th percentile for age and gender.

†Body mass index (BMI) ≥ 95th percentile for age and gender.

‡95% confidence interval.

§In 2009, 2007, and 2005, about 93%, 94%, and 95% of Nonwhite students were African American, respectively.

### Gender and Race

As for gender and race, Nonwhite females had significantly higher prevalence rates than White females (28.1% vs. 16.4%). Among males, 26.6% of Nonwhite males and 22.5% of White males were obese (Table 3).

### Grade Level

Among elementary level students (grades K – 5), 24.1% were classified as obese, with 17.7% classified as overweight. Among the middle school students (grades 6 – 8), 25.4% were obese and 18.0% were overweight. Among the high school students (grades 9 -12), 22.3% were obese and 20.1% were overweight. (Table 3)

### Gender and Grade Level

Among females, the highest rates were at the elementary level, followed by the middle school and high school. For males, the highest rates were at the middle school, followed by the elementary school and high school. Specifically, at the elementary level, 24.0% of females were obese and 17.4% were overweight. For males, 24.2% were obese and 18.0% were overweight. Among middle school students, 23.7% of girls were obese and 18.9% were overweight. For males, 27.1% were obese and 17.1% were overweight. At the high school level, 21.1% of females were obese, with 20.5% overweight. For males, 23.7% were obese and 19.5% were overweight. (Table 3)

### Race and Grade Level

Among both White and Nonwhite students, the highest rates were at the middle school level, followed by the elementary school and

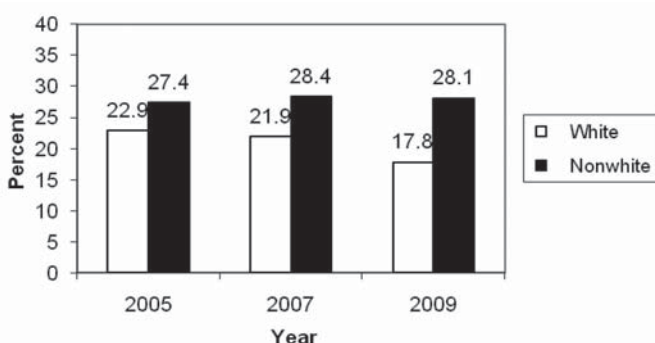
**TABLE 3: PREVALENCE OF OVERWEIGHT AND OBESITY BY GRADE LEVEL, GENDER, AND RACE, CAYPOS, , 2005, 2007, AND 2009**

	All (K-12) (%, 95% CI)	Elementary (K-5) (%, 95% CI)	Middle school (6-8) (%, 95% CI)	High school (9-12) (%, 95% CI)
<b>Male</b>				
<b>Overweight</b>				
2005	18.6 (16.8-20.4)	18.7 (16.3-21.2)	19.3 (15.3-24.0)	18.1 (15.0-21.7)
2007	17.5 (15.5-19.7)	16.3 (13.9-19.0)	18.5 (13.1-25.5)	19.3 (15.6-23.6)
2009	18.2 (16.5-20.0)	18.0 (15.5-20.8)	17.1 (14.0-20.6)	19.5 (16.3-23.3)
<b>Obesity</b>				
2005	25.2 (23.0-27.4)	24.2 (21.6-27.0)	28.4 (23.9-33.3)	24.4 (19.3-30.3)
2007	24.2 (22.0-26.6)	25.7 (22.3-29.4)	20.1 (16.3-24.5)	24.4 (20.0-29.4)
2009	24.8 (22.5-27.4)	24.2 (20.9-27.7)	27.1 (22.9-31.8)	23.7 (19.0-29.1)
<b>Female</b>				
<b>Overweight</b>				
2005	18.1 (15.7-20.5)	17.5 (14.5-20.9)	19.6 (15.6-24.2)	18.2 (14.4-22.9)
2007	19.7 (17.3-22.3)	20.5 (18.1-23.2)	19.7 (15.5-24.6)	18.1 (12.4-25.5)
2009	18.8 (17.2-20.5)	17.4 (14.8-20.3)	18.9 (15.3-23.1)	20.5 (18.4-22.9)
<b>Obesity</b>				
2005	25.9 (22.6-29.2)	25.9 (21.8-30.6)	29.4 (23.9-35.6)	22.8 (18.7-27.5)
2007	22.9 (20.4-25.5)	24.8 (20.9-29.2)	24.9 (20.9-29.4)	17.1 (13.4-21.6)
2009	23.0 (20.8-25.3)	24.0 (20.2-28.2)	23.7 (20.0-27.8)	21.1 (17.6-25.2)
<b>White male</b>				
<b>Overweight</b>				
2005	17.9 (15.3-20.9)	17.7 (14.1-22.0)	18.3 (13.4-24.5)*	18.2 (16.4-20.2)*
2007	17.5 (14.7-20.6)	17.3 (14.2-20.8)	17.4 (9.9-28.7)*	17.8 (12.0-25.5)*
2009	17.8 (15.4-20.6)	18.1 (13.7-23.6)	15.8 (10.8-22.6)*	19.4 (13.9-26.5)*
<b>Obesity</b>				
2005	23.6 (21.1-26.4)	21.3 (19.0-23.7)	31.5 (29.5-33.5)	22.3 (18.2-26.9)*
2007	23.6 (20.3-27.2)	23.0 (18.7-27.9)	18.9 (12.1-28.3)*	28.8 (21.8-37.0)
2009	22.5 (19.1-26.4)	18.7 (13.3-25.6)	25.4 (18.4-34.0)	25.2 (18.3-33.5)
<b>Nonwhite male</b>				
<b>Overweight</b>				
2005	19.2 (16.8-21.9)	19.6 (17.8-21.6)	19.8 (14.8-25.9)*	18.0 (13.2-24.2)*
2007	17.7 (14.8-20.9)	15.3 (11.1-20.7)	15.6 (10.5-21.3)*	20.5 (15.0-27.3)
2009	18.4 (16.0-21.1)	17.9 (14.1-22.5)	18.2 (13.1-24.7)*	19.7 (15.5-24.6)
<b>Obesity</b>				
2005	26.4 (22.8-30.4)	26.7 (23.3-30.4)	25.8 (18.5-34.9)*	25.8 (11.4-48.5)*
2007	25.0 (21.9-28.5)	28.3 (23.2-34.0)	20.9 (16.2-26.6)*	28.1 (16.1-30.0)
2009	26.6 (23.8-29.6)	27.9 (23.6-32.7)	28.5 (22.7-35.1)	22.4 (17.2-28.5)
<b>White female</b>				
<b>Overweight</b>				
2005	17.6 (14.3-21.6)	18.1 (14.9-21.9)	18.1 (12.4-25.7)*	16.0 (14.7-17.5)*
2007	19.1 (15.7-22.9)	18.3 (15.1-22.1)	22.0 (13.9-33.2)*	17.2 (9.8-28.3)*
2009	17.9 (15.7-20.3)	18.4 (14.5-23.1)	17.6 (12.1-24.7)	17.6 (14.1-21.6)*
<b>Obesity</b>				
2005	22.3 (18.5-26.7)	22.8 (20.1-25.8)	25.5 (20.9-30.8)*	18.0 (13.0-24.4)*
2007	18.4 (14.9-22.6)	20.7 (15.5-27.2)	20.0 (13.2-29.2)*	10.9 (7.7-15.3)*
2009	16.4 (13.8-19.5)	16.8 (12.3-22.4)	17.9 (12.9-24.4)*	14.8 (10.0-21.3)*
<b>Nonwhite female</b>				
<b>Overweight</b>				
2005	18.4 (15.8-21.4)	17.0 (14.8-19.4)	20.4 (18.3-22.6)*	19.7 (17.0-22.7)*
2007	20.1 (17.2-23.4)	22.6 (18.9-26.8)	17.1 (14.4-20.2)*	17.8 (12.4-27.2)*
2009	19.6 (17.6-21.8)	16.8 (13.9-20.2)	20.3 (13.5-29.4)*	23.1 (19.2-27.6)
<b>Obesity</b>				
2005	28.4 (24.1-33.1)	28.0 (22.6-34.2)	32.0 (23.5-41.9)	26.0 (18.7-34.9)
2007	26.4 (23.2-29.8)	28.5 (23.8-33.8)	29.0 (23.4-35.3)	20.5 (14.8-27.7)
2009	28.1 (25.2-31.2)	28.4 (23.2-34.2)	29.5 (22.9-37.1)	26.6 (22.2-31.5)

\* Sample size is less than 50. The estimates may not be reliable.

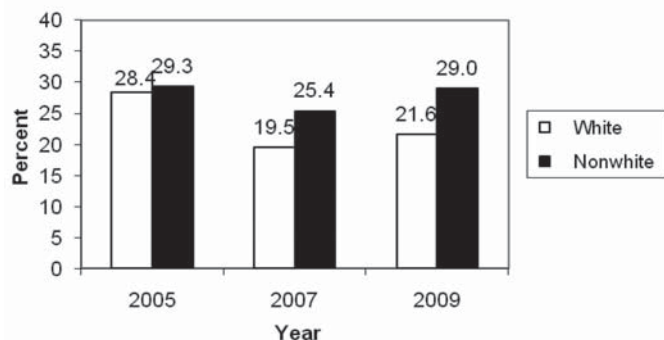
high school. Specifically, at the elementary level, 17.8% of White students were obese and 18.3% were overweight. For Nonwhite students, 28.1% were obese and 17.4% were overweight. At the elementary level difference in the prevalence of obesity between White and Nonwhite students was statistically significant (p = 0.006; Figure 1).

**FIGURE 1: OBESITY PREVALENCE BY RACE AMONG MISSISSIPPI ELEMENTARY SCHOOL STUDENTS**



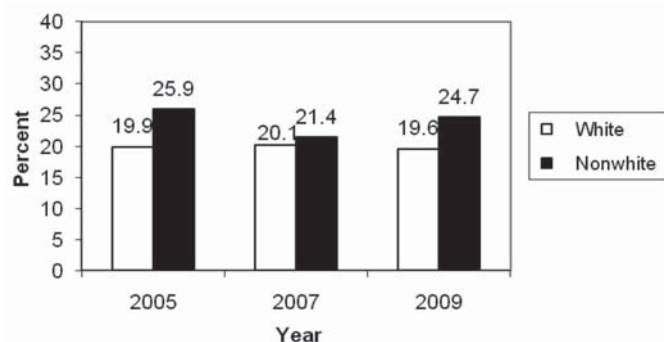
Among middle school students, 21.6% of White students were obese and 16.7% were overweight. For Nonwhite students, 29.0% were obese and 19.2% were overweight. The difference in the prevalence of obesity between white and nonwhite students was not statistically significant (p = 0.069; Figure 2). At the high school level, 19.6% of White students were obese, with 18.4% overweight. For Nonwhite

**FIGURE 2: OBESITY PREVALENCE BY RACE AMONG MISSISSIPPI MIDDLE SCHOOL STUDENTS**



students, 24.7% were obese and 21.6% were overweight. The difference in the prevalence of obesity between white and nonwhite students was not statistically significant ( $p = 0.071$ ; Figure 3).

**FIGURE 3: OBESITY PREVALENCE BY RACE AMONG MISSISSIPPI HIGH SCHOOL STUDENTS**



### **Gender, Race, and Grade Level**

When race and gender were combined at the elementary level, 16.8% of White females were obese and 18.4% were overweight. Among Nonwhite females, 28.4% were obese and 16.8% were overweight. At the elementary level, these differences between rates of obesity between White and Nonwhite females were statistically significant. Among males, 18.7% of White males were obese, with 18.1% overweight. Among the Nonwhite males, 27.9% were obese and 17.9% were overweight.

At the middle school level, 17.9% of White females were obese and 17.6% were overweight. Among Nonwhite females, 29.5% were obese and 20.3% were overweight. Among males, 25.4% of White males were obese, with 15.8% overweight. Among the Nonwhite males, 28.5% were obese and 18.2% were overweight.

At the high school level, 14.8% of White females were obese and 17.6% were overweight. Among Nonwhite females, 26.6% were obese and 23.1% were overweight. Among males, 25.2% of White males were obese, with 19.4% overweight. Among the Nonwhite males, 22.4% were obese and 19.7% were overweight (Table 3).

### **Comparison of 2005, 2007 and 2009 CAYPOS**

While no statistically significant differences were found over the three time periods (2005, 2007, 2009) for overall rates or by gen-

der, race, or educational level, the data are described here. In 2009, the prevalence of obesity for all students in grades K - 12 was 23.9%, as compared to 23.5% in 2007 and 25.5% in 2005. The prevalence of overweight was 18.2% in 2009, as compared to 18.6% in 2007 and 18.4% in 2005.

The prevalence of obesity among males in 2009 was 24.8%, compared to 24.2% in 2007 and 25.2% in 2005. Among females, 23.0% were obese in 2009, compared to 22.9% in 2007 and 25.9% in 2005.

As for race, 19.5% of White students were obese in 2009, compared to 21.0% in 2007 and 22.9% in 2005. Among Nonwhite students, 27.4% were obese in 2009, compared to 25.7% in 2007 and 27.4% in 2005.

The prevalence among elementary students in 2009 was 24.1%, compared to 25.3% in 2007 and 25.0% in 2005. Among middle school students, 25.4% were obese in 2009, compared to 22.8% in 2007 and 28.9% in 2005. Among high school students, 22.3% were obese in 2009, compared to 20.8% in 2007 and 23.5% in 2005.

### **DISCUSSION**

Like prevalence rates reported nationally, the prevalence of obesity among children and youth assessed through actual measures of height and weight no longer appears to be increasing. Since 2005, the 2007 and 2009 CAYPOS suggest that the prevalence of obesity has leveled off among children and youth in the public school system.

While the leveling off of obesity is good news, the bad news is what appears to be an increasing disparity between White and Nonwhite students especially for those in elementary and middle schools. The prevalence of obesity is again significantly lower among White students than the Nonwhite students. Further, while the prevalence has remained nearly the same for Nonwhite students over the three time periods (2005, 2007, 2009), it has dropped for the White students in the same period (22.9%, 21.0%, 19.5%, respectively).

As for race, the differences between White and Nonwhite students continue to be statistically significant. Further, for both 2005 and 2007, significant differences between the White and Nonwhite students are found at the elementary level, suggesting the disparity is emerging among the younger children.

Although the differences are not statistically significant, it is worth noting that in 2005 females had higher rates than boys in all three grade levels. In 2007, females had higher rates in only middle school. In 2009, boys had higher rates in all three educational levels.

As in previous years, in 2009 the middle school again had the highest prevalence rates. However, there was no significant difference in grade levels, nor was there a difference in grade levels over time.

While the highest prevalence rates in the study were among Nonwhite females in middle school, these rates were not significantly higher than White females, nor significantly different than in previous years. However, among the elementary level students, significant differences were found between Nonwhite and White students as well as among Nonwhite females and White females. Also, although the differences were not statistically significant, it is worth noting that the prevalence rates dropped for each of the three survey years among the White females in the elementary schools (22.8%, 20.7%, and 16.8%,

respectively). It is encouraging to see signs of changes among females, particularly among young White females. Why is it that we are not seeing similar signs of changes among males and Nonwhite students? What do these findings suggest in light of recent educational initiatives? Given that most of the initiatives have only been fully implemented during the same year (2008-2009) of the CAYPOS, it would be difficult at this time to associate changes, or the lack thereof, in prevalence rates to the recent policies, programs, and activities being implemented across the state. It is clear that continued monitoring of the prevalence rates is critical, especially as educational initiatives continue to be implemented.

While there have been recent pediatric obesity focused initiatives from the American Academy of Pediatrics along with the American Medical Association related to childhood obesity, there have not been any formal statewide medical initiatives instituted in Mississippi.<sup>29-31</sup> However, a recent development provides a new opportunity for the Mississippi Medical Association to lead a statewide initiative to screen school-aged children for obesity. Recent recommendations from the US Preventive Services Task Force issued January 18, 2010 by the American Academy of Pediatrics specifically recommends that clinicians screen children aged 6 years and older for elevated BMI's and offer them or refer them to intensive counseling and behavioral interventions to promote improvements in weight status.<sup>30</sup> These recommendations differ from 2005 Task Force recommendations, as there is now stronger evidence that obese and overweight school aged children, once identified, can improve weight status with moderate to high intensity interventions.

**Acknowledgements:** Funding for this study was through a grant from the Bower Foundation. The authors wish to thank Westat, Inc., for their assistance in the sampling and weighting of the data and to thank the Mississippi Schools and school nurses and personnel who were so instrumental in collecting the data.

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