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## Racial/Ethnic Differences in Obesity Trends Among Young Low-Income Children

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### Abstract

**Introduction**—Racial/ethnic differences in recent obesity trends have not been reported among young low-income children. The purpose of this study is to examine trends in obesity prevalence from 1998 through 2011 by race/ethnicity among low-income children aged 2–4 years.

**Methods**—The study was based on measured weight and height records of 29,040,851 participants of federally funded health and nutrition programs from 30 states and the District of Columbia, which provided data each year from 1998 through 2011. More than 80% of data were collected through the Special Supplemental Nutrition Program for Women, Infants, and Children, and about 50% of eligible children were included. In 2014, joinpoint regression was used to identify the inflection years when significant changes in obesity trends occurred and piecewise logistic regression was used to examine annual changes in obesity prevalence before and after the inflection years controlling for age, sex, and race/ethnicity.

**Results**—The overall obesity prevalence increased from 13.05% in 1998 to 15.21% in 2003, and decreased slightly to 14.74% in 2011. The increasing trends among non-Hispanic white, non-Hispanic black, and Hispanic children began decreasing in 2003. Asian/Pacific Islander was the only racial/ethnic group with a continual decreasing trend in obesity prevalence from 1998 (14.34%) through 2011 (11.66%). Among American Indian/Alaska Native children, obesity prevalence consistently increased from 16.32% in 1998 to 21.11% in 2011, although the annual increases slowed since 2001.

**Conclusions**—The study findings indicate modest recent declines in obesity prevalence for most racial/ethnic groups of low-income children aged 2–4 years. However, obesity prevalence remains high.

### Introduction

Childhood obesity disproportionately affects minority and low-income families and is associated with adult obesity and adverse health consequences.<sup>1–5</sup> Tracking trends in obesity by race/ethnicity among young low-income children can help identify health disparities and prioritize obesity prevention and control programs. Previous research has compared obesity

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prevalence in 1998, 2003, and 2008 by race/ethnicity<sup>6</sup> and examined the overall obesity trend from 1998 through 2010 among low-income children aged 2–4 years.<sup>7</sup> However, racial/ethnic differences in recent obesity trends have not been reported for the same population. In this study, data from CDC's Pediatric Nutrition Surveillance System (PedNSS) were used to examine race/ethnicity-specific trends in obesity prevalence from 1998 through 2011 among low-income children aged 2–4 years.

## Methods

PedNSS is a state-based public health surveillance system that monitors the nutritional status of low-income U.S. children from birth through age 4 years who participate in federally funded maternal and child health and nutrition programs.<sup>8</sup> More than 80% of PedNSS data were collected through the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).<sup>8</sup> About 50% of young children who were eligible for WIC were included in the database.

PedNSS data were available for the same 30 states and the District of Columbia each year from 1998 through 2011, yielding about 30 million low-income children aged 2–4 years. In this study, 371,986 (1.2%) children with missing entries for height or weight; 106,844 (0.4%) whose height or weight was miscoded; and 454,381 (1.5%) whose height, weight, or BMI were biologically implausible were excluded, leaving 29,040,851 children in the analytic sample. Because the distributions of weight, height, and BMI in the study population were skewed, the upper cut off points for biologically implausible z-scores recommended by WHO<sup>9</sup> were expanded to the following: height-for-age <−5.0 or >5.0, weight-for-age <−5.0 or >8.0, and BMI-for-age <−4.0 or >8.0.

Children's weight and height were measured twice a year on average during routine clinic visits, with weight measured to the nearest quarter pound and height to the nearest eighth inch. One randomly selected visit record per child per year was included in the PedNSS database.<sup>8</sup> Obesity was defined as sex-specific BMI-for-age 95th percentile on the 2000 CDC growth charts.<sup>10</sup> The study was exempt from ethics review by the CDC IRB.

In 2014, joinpoint regression (Joinpoint, version 4.0.1) was used to identify the inflection years when significant changes in the slopes of the overall obesity trend and trend for each racial/ethnic group occurred. The location of significant joinpoint is determined with Monte Carlo samples from permuted data sets, with Bonferroni adjustments to control for increases in type 1 errors.<sup>11</sup> To account for annual differences in population distribution, piecewise logistic regression (SAS, version 9.3) was conducted to derive AORs and 95% CIs for annual change in overall obesity prevalence before and after the inflection years controlling for age, sex, and race/ethnicity.<sup>7</sup> Trends by race/ethnicity were adjusted for age and sex.

## Results

The overall prevalence of obesity significantly increased (AOR=1.034, 95% CI=1.033, 1.035) from 13.05% (95% CI=13.00%, 13.09%) in 1998 to 15.21% (95% CI=15.16%, 15.26%) in 2003, and then decreased (AOR=0.992, 95% CI=0.991, 0.992) slightly to 14.74% (95% CI=14.70%, 14.79%) in 2011 (Table 1, Figure 1).

Although Hispanic children had a higher prevalence of obesity than non-Hispanic white and non-Hispanic black children, a similar pattern in obesity trend was observed among the three racial/ethnic groups. For each group, the prevalence increased from 1998 through 2003, and then declined slightly from 2003 through 2011 (Table 1, Figure 1).

Among Asian/Pacific Islander (PI) children, there was a decreasing trend in obesity prevalence (AOR=0.982, 95% CI=0.981, 0.984) from 1998 (14.34%, 95% CI=14.07%, 14.61%) through 2011 (11.66%, 95% CI=11.43%, 11.89%) (Table 1, Figure 1). This made Asian/PI the only racial/ethnic group that had a continual decrease in obesity prevalence throughout the study period.

Among American Indian (AI)/Alaska Native (AN) children, the prevalence of obesity continuously increased from 16.32% (95% CI=15.74%, 16.90%) in 1998 to 21.11% (95% CI=20.50%, 21.72%) in 2011, although the average annual increase was smaller from 2001 through 2011 than that from 1998 through 2001 (Table 1, Figure 1). AI/AN children had the highest prevalence of obesity among all the racial/ethnic groups in 2005 and subsequent years, and the prevalence differences between AI/AN and other racial ethnic groups increased in recent years (Figure 1).

## Discussion

Using PedNSS data through 2010, the authors' previous study reported that the overall obesity prevalence increased from 1998 to 2003 but decreased slightly from 15.21% in 2003 to 14.94% in 2010 among low-income children aged 2–4 years.<sup>7</sup> The present study found that the overall prevalence continued to decline to 14.74% in 2011.

A previous study among low-income preschool-aged children found that obesity increased from 1998 through 2003 across all racial/ethnic groups except Asian/PI children, but remained stable from 2003 through 2008 among all groups except AI/AN children.<sup>6</sup> The current study adds to the literature by revealing the decreasing trends in obesity prevalence from 2003 through 2011 among non-Hispanic white, non-Hispanic black, and Hispanic children. Furthermore, from 1998 through 2011, the prevalence of obesity decreased among Asian/PI children but increased among AI/AN children, although the annual increase slowed in recent years.

The finding that the prevalence of obesity increased among AI/AN children but decreased slightly among other racial/ethnic groups in recent years suggests that health disparities in the obesity epidemic remain. These racial/ethnic disparities may be explained by variations in genetic factors, dietary and physical activity patterns, attitudes and cultural norms toward body weight, and access to healthful foods and safe locations for physical activity.<sup>12–17</sup> For example, in recent decades, AI/AN's diet has shifted from one that was nutritionally inadequate resulting in malnutrition to a diet characterized by excess calories low in nutritional content.<sup>18,19</sup> Some AI/AN communities tend to have limited access to full-service food markets, which is likely to be linked to unhealthful food consumption.<sup>14,16</sup>

The present study has major strengths. The BMI values were calculated based on measured weight and height, and the sample size of about 29 million was sufficient to examine obesity

trends by race/ethnicity. However, the study sample consisted of children from only 30 states and the District of Columbia, which consistently collected PedNSS data over the study period. Tribes that operate their own WIC programs separate from the state health departments were not represented in the study. Therefore, the study findings may not reflect the trends in tribes, territories, or other states. Additionally, changes in characteristics of the participants of federally funded health and nutrition programs over time, which were not adjusted in the present study, may have influenced the observed obesity trends.

On the basis of the current study findings, the obesity prevention and control initiatives may have resulted in modest progress for most racial/ethnic groups of young low-income children during the past decade. However, health disparities remain and the prevalence of obesity is still high overall and in all racial/ethnic groups. Considering the impact of acculturation and social norms on the obesity epidemic, culturally appropriate intervention programs may further reduce childhood obesity and related health inequities.<sup>16,20</sup> Public health officials may want to ensure that low-income AI/AN children and families can benefit from these obesity prevention and control programs.

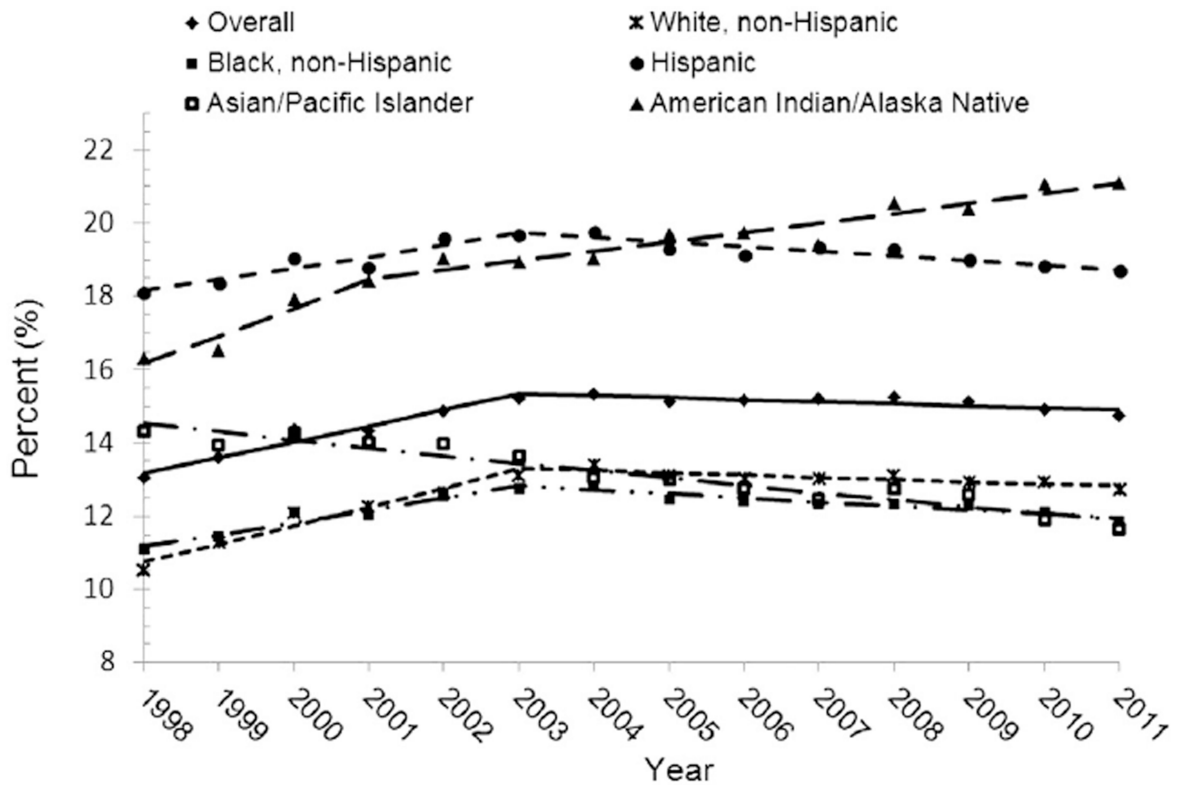
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<sup>a</sup> Defined as sex-specific body mass index-for-age  $\geq$  the 95th percentile on the 2000 CDC growth charts.

<sup>b</sup> Regression lines and inflection years when significant changes in the slope of trends occurred were identified by Joinpoint regression. The inflection year was 2001 for trend among American Indian/Alaska Native and 2003 for overall trend and trends among non-Hispanic white, non-Hispanic black, and Hispanic. No inflection year was identified for trend among Asian/Pacific Islander.

**Figure 1.**

Trends in the prevalence of obesity<sup>a</sup>, by race/ethnicity, 1998–2011.<sup>b</sup>

Table 1

Trends in the Prevalence of Obesity<sup>a</sup>, by Race/Ethnicity, 1998–2011

Characteristic	1998			2003			2011			Trend 1 (from 1998 to inflection year)			Trend 2 (from inflection year to 2011)		
	n <sup>b</sup>	Prevalence, % (SE) <sup>c</sup>	n <sup>b</sup>	Prevalence, % (SE) <sup>d</sup>	n <sup>b</sup>	Prevalence, % (SE) <sup>e</sup>	n <sup>b</sup>	Prevalence, % (SE) <sup>f</sup>	Years	AOR <sup>g</sup> (95% CI) Per year change	Years	AOR <sup>g</sup> (95% CI) Per year change			
Overall	1,945,115	13.05 (0.02)	1,958,480	15.21 (0.03)	2,332,334	14.74 (0.02)	1998–2003	1.034 (1.033, 1.035)	2003–2011	0.992 (0.991, 0.992)					
Race/ethnicity															
Non-Hispanic white	830,776	10.52 (0.03)	800,126	13.13 (0.04)	837,755	12.75 (0.04)	1998–2003	1.050 (1.049, 1.052)	2003–2011	0.995 (0.994, 0.995)					
Non-Hispanic black	446,634	11.10 (0.05)	407,768	12.77 (0.05)	472,783	11.85 (0.05)	1998–2003	1.033 (1.031, 1.035)	2003–2011	0.990 (0.989, 0.991)					
Hispanic	544,588	18.13 (0.05)	598,879	19.68 (0.05)	811,158	18.70 (0.04)	1998–2003	1.023 (1.021, 1.024)	2003–2011	0.992 (0.991, 0.993)					
Asian/Pacific Islander <sup>g</sup>	64,191	14.34 (0.14)	71,430	13.63 (0.13)	75,370	11.66 (0.12)	1998–2011	0.982 (0.981, 0.984)							
American Indian/Alaska Native	15,429	16.32 (0.30)	14,370	18.95 (0.33)	17,065	21.11 (0.31)	1998–2001	1.057 (1.041, 1.073)	2001–2011	1.016 (1.012, 1.021)					

Note: BMI, calculated as weight in kilograms divided by height in meters squared.

<sup>a</sup> Defined as sex-specific BMI-for-age the 95th percentile on the 2000 CDC growth charts, excluding missing, miscoded, or biologically implausible height, weight, and BMI. Because the distribution of weight, height, and BMI in the study population was skewed, we expanded the upper cut off points for biologically implausible z scores recommended by WHO to the following: height for age, <-5.0 or >5.0; weight for age, <-5.0 or >8.0; and BMI for age, <-4.0 or >8.0.

<sup>b</sup> The sample sizes by race/ethnicity do not add up to the total because we did not include the multiple racial/ethnic group and children with unknown race/ethnicity.

<sup>c</sup> Results of all subgroup comparisons across racial/ethnic groups are all statistically significant at  $p < 0.005$  according to  $t$  tests with Bonferroni adjustments.

<sup>d</sup> Results of all subgroup comparisons across racial/ethnic groups are statistically significant at  $p < 0.005$  according to  $t$  tests with Bonferroni adjustments, except the prevalence difference between Hispanic and American Indian/Alaska Native children.

<sup>e</sup> Results of all subgroup comparisons across racial/ethnic groups are statistically significant at  $p < 0.005$  according to  $t$  tests with Bonferroni adjustments, except the prevalence difference between non-Hispanic black and Asian/Pacific Islander children.

<sup>f</sup> Adjusted odds of being obese for 1 year's increase in time, calculated from piecewise logistic regression controlling for age, sex, and race/ethnicity for overall trend and adjusting for age and sex for trends by race/ethnicity.

<sup>g</sup> One obesity trend was reported since no inflection year was identified by Joinpoint.