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Incidence of Obesity Among Young US Children Living in Low-Income Families, 2008–2011

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Abstract

OBJECTIVE—To examine the incidence and reverse of obesity among young low-income children and variations across population subgroups.

METHODS—We included 1.2 million participants in federally funded child health and nutrition programs who were 0 to 23 months old in 2008 and were followed up 24 to 35 months later in 2010–2011. Weight and height were measured. Obesity at baseline was defined as gender-specific weight-for-length ≥95th percentile on the 2000 Centers for Disease Control and Prevention growth charts. Obesity at follow-up was defined as gender-specific BMI-for-age ≥95th percentile. We used a multivariable log-binomial model to estimate relative risk of obesity adjusting for gender, baseline age, race/ethnicity, duration of follow-up, and baseline weight-for-length percentile.

RESULTS—The incidence of obesity was 11.0% after the follow-up period. The incidence was significantly higher among boys versus girls and higher among children aged 0 to 11 months at baseline versus those older. Compared with non-Hispanic whites, the risk of obesity was 35% higher among Hispanics and 49% higher among American Indians (AIs)/Alaska Natives (ANs), but 8% lower among non-Hispanic African Americans. Among children who were obese at baseline, 36.5% remained obese and 63.5% were nonobese at follow-up. The proportion of reversing of obesity was significantly lower among Hispanics and AIs/ANs than that among other racial/ethnic groups.

CONCLUSIONS—The high incidence underscores the importance of early-life obesity prevention in multiple settings for low-income children and their families. The variations within

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population subgroups suggest that culturally appropriate intervention efforts should be focused on Hispanics and AIs/ANs.

Keywords

childhood obesity; incidence; preschool age; infancy; population-based studies; public health

Childhood obesity is widely recognized as a major health problem, and much attention has been devoted to monitoring childhood obesity. Numerous studies have examined the prevalence of obesity among US children.[1–5] According to NHANES data, in 2009–2010, 12.1% of the US children aged 2 through 5 years were obese.[3] According to the Centers for Disease Control and Prevention (CDC)'s Pediatric Nutrition Surveillance System (PedNSS) data, the prevalence of obesity was 14.4% among children aged 2 through 4 years living in low-income families in 2010.[5] Prevalence indicates the magnitude of obesity at a specific point in time, whereas incidence conveys information about the rate of developing it and identifies those who become obese over a certain period of time. Incidence data are valuable because they elucidate the characteristics of the incident cases during the study period and thus identify population subgroups at high risk for becoming obese to target for prevention efforts. Reducing the population-level prevalence of obesity during early childhood requires interventions to prevent new cases of obesity and help obese children move to healthier weight.

Childhood obesity has been associated with increased prevalence of other cardiovascular risk factors, increased health care costs, and premature death.[6–10] People who are obese during early childhood are also likely to be obese during middle or late childhood[11] and adulthood.[12] Furthermore, obese adults are at increased risk for stroke and many chronic diseases, including coronary heart disease, hypertension, type 2 diabetes, and certain types of cancer.[13] These lifelong health risks associated with obesity during early childhood indicate the importance of not only monitoring the prevalence of obesity but also identifying the characteristics of incident cases and preventing obesity among infants and young children.

Understanding the incidence and reverse of obesity among low-income children is important for augmenting population-based obesity approaches with targeted intervention programs to prevent and reverse childhood obesity among this vulnerable group and to reduce health disparities. However, no recent national studies have provided incidence data among low-income infants and young children. In this study, we used the longitudinal data from PedNSS to examine the incidence and reverse of obesity in 2010–2011 and variations in risk of obesity across gender, baseline age, and racial/ethnic subgroups among US children living in low-income families who were aged 0 to 23 months in 2008.

METHODS

Study Population and Anthropometric Measurements

PedNSS is a state-based public health surveillance system that monitors the nutritional status of low-income US children from birth through age 4 years who participate in federally funded maternal and child health and nutrition programs. More than 80% of the PedNSS data come from the Special Supplemental Nutrition Program for Women, Infant, and Children (WIC). PedNSS includes almost 50% of US children eligible for WIC.[14] Eligibility criteria for WIC include a family income ≤185% of the poverty income threshold based on US Poverty Income Guidelines. A person who participates or has family members who participate in certain other benefit programs, such as the Supplemental Nutrition Assistance Program, Medicaid, and Temporary Assistance for Needy Families, automatically meets the income-eligibility requirement.[15] PedNSS data also come from other child health and nutrition programs, including the Early and Periodic Screening, Diagnosis, and Treatment Program and the Title V Maternal and Child Health Program.[5]

Children's anthropometric measurements were taken on average twice per year by trained staff during required routine clinic visits. Standard data collection and recording protocols were used.[5] Children's weight was reported to the nearest quarter pound and their height to the nearest eighth inch. CDC randomly selected 1 record per child per year for inclusion in its annual PedNSS reporting database.[5] Children who were aged 0 to 23 months in 2008 were followed up through 2011 in 39 states and the District of Columbia. To examine the incidence of obesity during this follow-up period and control for the impact of duration of follow-up on incidence estimates, we limited our study subjects to those who were followed for 24 to 35 months after their baseline visit. One randomly selected weight and height record was included in this study if the child had multiple anthropometric measurements recorded at follow-up.

PedNSS included ~4.39 million low-income infants and children aged 0 to 23 months from 39 states and the District of Columbia in 2008. Approximately 1.27 million children had their weights and heights measured in 2008 and were followed up after 24 to 35 months in 2010–2011. Their ages at follow-up ranged from 24 through 59 months. Of these potential study subjects, we excluded 4596 (0.4%) with missing entries for height or weight at follow-up, 1344 (0.1%) whose height or weight was miscoded (fields contain all zeroes, nonnumeric characters, or values coded to the wrong weight or height units) at baseline or follow-up, and 55 888 (4.4%) whose height, weight, or BMI was biologically implausible at baseline or follow-up, leaving 1 204 839 children in our overall analytic sample. Biologically implausible *z* scores were defined according to the World Health Organization recommendations[16]: height-for-age <−5.0 or >3.0, weight-for-age <−5.0 or >5.0, and weight-for-length or BMI-for-age <−4.0 or >5.0. When comparing our analytic sample with those who participated in PedNSS in 2008 but were not included in this study, the analytic sample had a higher proportion of children who were aged 12 to 23 months at baseline (44.8% vs 36.4%), slightly higher proportions of non-Hispanic whites (35.0% vs 33.1%) and African Americans (21.4% vs 19.1%) but a lower proportion of Hispanics (40.1% vs 44.3%). Among those who were included in the final sample, 1 044 829 children aged 0 to 23 months were nonobese in 2008 (Fig 1).

Obesity Definition and Incidence Calculation

We used CDC growth charts to define obesity for infants and children from birth to age 59 months. Although the CDC recommends use of the World Health Organization growth curves for children aged 0 to 23 months,[17] we decided to use the CDC charts in this age range because transitioning from 1 chart to another might create incomparable definitions of obesity. Obesity at follow-up was defined as gender-specific BMI-for-age ≥95th percentile for children aged 24 to 59 months using the recommended definition for obesity for children aged 2 years and older.[18] The term "obesity" is not generally used in infancy, and BMI is not calculated for children under age 2 on the CDC growth charts. Therefore, we define "obesity" at baseline as gender-specific weight-for-length ≥95th percentile for infants and children aged 0 to 23 months.[19] Infants and children whose weight-for-length or BMI-for-age was at the 0 to 94th percentile were considered nonobese. Weight-for-length and BMI are both measures of body weight adjusted for height. Although we found a high correlation (r = 0.99) between BMI-for- age and weight-for-height percentiles among children aged 24 to 59 months who participated in PedNSS in 2010–2011, the identification of new cases of obesity may be affected by the use of the different definitions. To assess the extent to which the incidence we reported was due to the use of the standard definition of obesity at follow-up, we conducted sensitivity analyses by examining the incidence of obesity using the same definitions of obesity at baseline and follow-up (gender-specific weight-for-height ≥95th percentile). This study was deemed exempt by the CDC Institutional Review Board.

We calculated the incidence of obesity in various population subgroups. The populations in denominators were defined as infants and children who were nonobese in 2008. The numerator was defined as the subset of these children who were obese in 2010–2011. Incidence of obesity was then calculated by dividing the numbers of children who developed obesity during the 24- to 35-month follow-up period by the numbers of children who were nonobese at baseline.

Statistical Methods

SAS version 9.3 (SAS Institute, Cary, NC) was used to estimate the incidence and reverse of obesity from 2008 to 2010–2011, both overall and by gender, baseline age (0–11 months or 12–23 months), and race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, American Indian [AI]/Alaska Native [AN], or Asian/Pacific Islander). *t* tests were used to compare the incidence and reverse of obesity across population subgroups, and Bonferroni adjustments were used to maintain the overall type 1 error rate of 5% during multiple comparisons. To simplify, P values <.005 were considered indications of statistically significant differences for all the comparisons. To estimate the adjusted relative risk (ARR) that represents the risk of obesity in 1 group relative to that in another group, we conducted log-binomial regression, a form of generalized linear modeling with binomial errors and log link,[20] adjusting for gender, baseline age, race/ethnicity, duration of follow-up, and baseline weight-for-length percentile. Because of missing data on covariates, the model included 1 010 253 respondents who were at risk for obesity. In addition, we conducted bivariable log-binomial regression by including only 1 variable in the model to estimate the unadjusted relative risk of obesity for that predictor.

RESULTS

The demographic distribution was similar among all children included in this study and children who were nonobese at baseline (Table 1). Among those who were nonobese in 2008, ~39% were Hispanics and 36% were non-Hispanic whites. Approximately 57% of the children were 0 to 11 months old at baseline, and 42% of the children were 24 to 35 months at follow-up. The mean duration of follow-up was ~30 months. Approximately 42% of the children were within the 0 to 49th weight-for-length percentiles (Table 1).

Figure 2 and Table 2 show the change in weight status of obese children from 2008 to 2010/2011. In 2008, 13.3% of the low-income children aged 0 to 23 months were obese (Table 2). Among these children, 36.5% remained obese and 63.5% became nonobese at follow-up (Fig 2 and Table 2). The proportion of previously obese children who were nonobese at follow-up was significantly lower among Hispanics and AIs/ANs than among those in other racial/ethnic groups and lower among those who were 12 to 23 months old at baseline than those who were younger (Table 2).

Overall, 11.0% (95% confidence interval [CI] 11.0%–11.1%) of nonobese children aged 0 to 23 months in 2008 were obese 24 to 35 months later. As shown in Table 3, the highest incidences were by gender among boys (11.3%; 95% CI 11.3%–11.4%), by baseline age among children who were 0 to 11 months old (11.6%; 95% CI 11.5%–11.7%), and by race/ethnicity among AI/AN (15.4%; 95% CI 14.6%–16.2%) and Hispanic (13.6%; 95% CI 13.5%–13.8%) children. Non-Hispanic African American (8.7%; 95% CI 8.6%–8.8%) and Asian/Pacific Islander (9.0%; 95% CI 8.7%–9.3%) children had the lowest incidences of obesity during the study period. As the duration of follow-up or children's baseline weight-for-length percentile increased, the incidence of obesity increased as well ($P < .0001$ for both linear trend tests when treating predictors as continuous variables; Table 3).

After controlling for duration of follow-up, baseline weight-for-length percentile, and selected demographic characteristics, the risk of obesity varied across gender, racial/ethnic, and baseline age subgroups. The results of multivariable log-binomial regression showed that compared with boys, girls had a 4% reduction in the risk of obesity (ARR 0.96; 95% CI 0.95–0.97). Compared with non-Hispanic whites, the risk of obesity was 35% higher among Hispanic (ARR 1.35; 95% CI 1.34–1.37) and 49% higher among AI/AN (ARR 1.49; 95% CI 1.41–1.57) children, but 8% lower among non-Hispanic African American children (ARR 0.92; 95% CI 0.91–0.94; Table 3). Compared with those who were 0 to 11 months old at baseline, children who were 12 to 23 months old at baseline had a 17% lower risk of obesity during the study period (ARR 0.83; 95% CI 0.82–0.84; Table 3).

Table 4 shows the results of sensitivity analysis using weight-for-height percentiles to define obesity at follow-up. The overall incidence of obesity was 0.4% lower (10.6% vs 11.0%) than that obtained using BMI-for-age percentile to define obesity. The variation in obesity incidence by baseline age was greater than what was found previously. Compared with younger children, those who were 12 to 23 months old at baseline had a 40% lower risk of obesity during the study period (ARR 0.60; 95% CI 0.60–0.61). Children who were followed up longer had slightly lower risk of obesity compared with those who were followed up for 24 to 27 months.

DISCUSSION

The results of our analyses showed that the incidence of obesity after a mean follow-up period of 30 months between 2008 and 2010–2011 was 11.0% among low-income children who were aged 0 to 23 months at baseline. Compared with non-Hispanic white children, the risk of obesity over the study period was slightly lower among non-Hispanic African American children but increased by more than one-third among Hispanic children and by approximately one-half among AI/AN children. The proportions of previous obese children who were nonobese at follow-up were also lower among Hispanics and AIs/ANs than that among non-Hispanic whites. To our knowledge, these were the most recent national study results to show the incidence and reverse of obesity and variations across population subgroups among young US children living in low-income families.

We are aware of 1 previous study[21] that examined the incidence of obesity during early childhood nationally. Mei and colleagues[21] examined changes in weight status among children who participated in PedNSS during 1985–1990. They found that the 3-year incidence of obesity within the study period was 7.7% among infants and 6.6% among children who were aged 12 to 23 months at baseline, respectively. The proportion of previously obese children who remained obese 3 years later was 25.1% among infants and 34.5% among children whose baseline ages were 12 to 23 months, respectively. On the basis of findings from this previous 36-month study and our study results during a mean study period of 30 months, the incidence of obesity has increased among young children living in low-income families over the past 20 years. The proportions of previously obese children who reversed to nonobese in the current study were also lower than those found in the previous study.

One previous study[4] that examined trends in the prevalence of obesity and extreme obesity based on PedNSS data found that the prevalence slightly decreased during 2003–2010 among low-income, preschool-age children. These results indicate moderate progress of obesity prevention among young US children living in low-income families. However, our study and the previous studies[4,22] show that the incidence and prevalence of obesity among these children remains high. Obesity prevention initiatives within WIC programs and state- and local-level population-based strategies in community and the early care and education settings to prevent nonobese children from developing obesity are important for further reducing the prevalence of obesity during early childhood.

The risk of obesity over the study period varied across population subgroups. For example, compared with other racial/ethnic groups, the risk of developing obesity among nonobese children was substantially higher but the proportion of reverse of obesity was lower among Hispanics and AIs/ANs. The underlying reasons for these differences are unclear. Behavioral, cultural, and environmental factors, including dietary and physical activity patterns, cultural norms regarding body weight, and access to healthful foods and safe locations for physical activity may have contributed to these racial/ethnic disparities.[23–26]

For example, Brewis[27] reported in 2003 that Mexican American parents perceive their child's heaviness as a sign of health rather than a weight problem, and many parents use food to express love, which may lead to an increased risk of obesity. Styne[28] found that AI communities tend to have limited full-service food markets; long travel is often required to obtain fruits and vegetables.[28] In addition, fast-food outlets are often located near AI communities.[28] Given the disparities in the incidence and reverse of obesity across race/ethnicity, public health officials may want to ensure that Hispanic and AI/AN low-income children and families can benefit from the obesity prevention efforts through the partnerships with other public and private sectors.

Our study has 3 major strengths. First, the study was based on longitudinal data of low-income children. Second, measured weight and height of study subjects were used to assess the incidence of obesity. Third, the sample size was large enough to produce stable estimates of the incidence of obesity in population subgroups of young children living in low-income families.

Our study, however, is subject to at least 3 limitations. First, only low-income children are monitored by PedNSS, and our study sample included only children from 39 states and the District of Columbia whose weight and height were measured at baseline and follow-up. Second, this follow-up study included only ~30% of the children aged 0 to 23 months who participated in PedNSS in 2008. Compared with children who were not followed up, the study sample included slightly higher proportions of older children and non-Hispanic whites and African Americans, but a lower proportion of Hispanics. The population differences may have led to underestimation of obesity incidence in the study sample. Third, we defined obesity according to weight-for-length percentiles at baseline and BMI-for-age percentiles at follow-up. Compared with the results using weight-for height percentile to define obesity at follow-up, the incidence of obesity in current study was 0.4 percentage points higher overall and 2.2 percentage points higher among children who were aged 12 to 23 months at baseline but 1.1 percentage points lower among those younger.

CONCLUSIONS

We found that the incidence of obesity after the 24- to 35-month follow-up period between 2008 and 2010/2011 was 11.0% among children aged 0 to 23 months at baseline living in low-income families. The risk of becoming obese was higher but the proportion of reverse of obesity was lower among Hispanic and AI/AN children than among children in other racial/ethnic groups. The needs of Hispanic and AI/AN young children should be considered when designing population-based strategies to support environmental and system change in communities and culturally appropriate interventions.

Acknowledgments

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ABBREVIATIONS

AI	American Indian
AN	Alaska Native
ARR	adjusted relative risk
CDC	Centers for Disease Control and Prevention
CI	confidence interval
WIC	Special Supplemental Nutrition Program for Women, Infant, and Children

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WHAT'S KNOWN ON THIS SUBJECT

One study examined the incidence of obesity among low-income children aged <5 years who participated in federally funded child health and nutrition programs during 1985–1990. The study examined the variations by baseline age but not by gender or race/ethnicity.

WHAT THIS STUDY ADDS

This study provides most recent data on incidence and reversing of obesity and variations across gender, baseline age, and racial/ethnic subgroups among young low-income children. We conducted multivariable analyses to examine the relative risk of obesity in population subgroups.

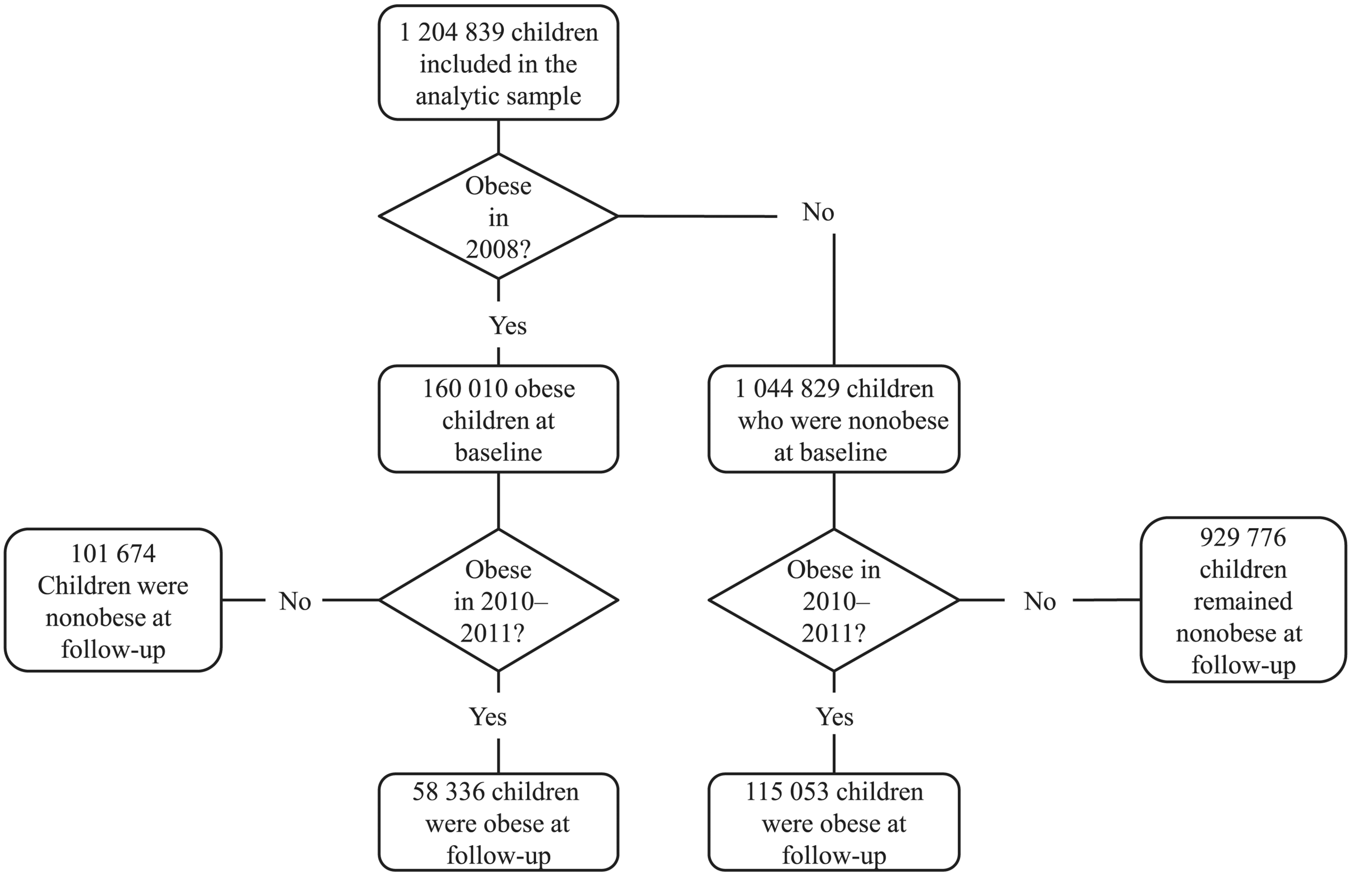

FIGURE 1.
Change in weight status of the study population flow diagram.

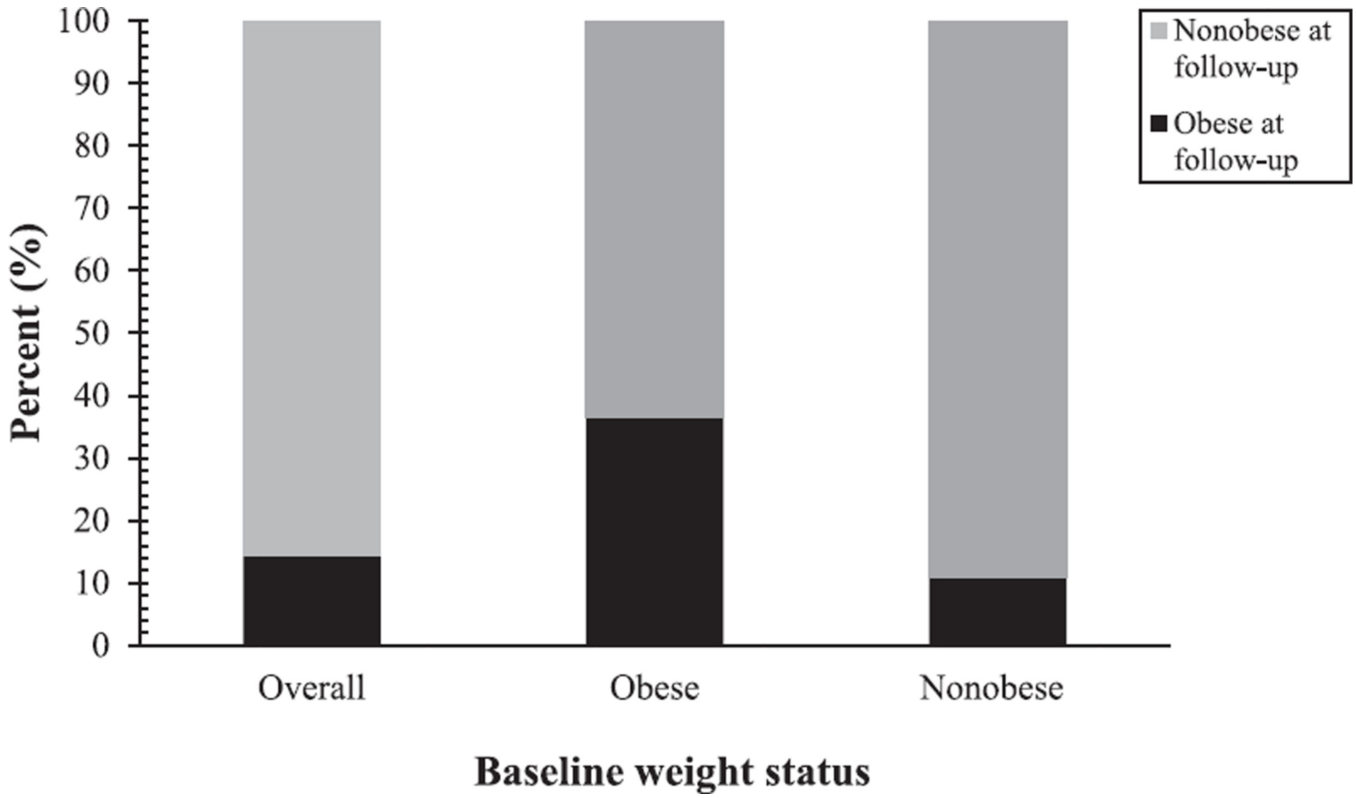

FIGURE 2.

Obesity status of young low-income children at follow-up by baseline weight status.

TABLE 1

Characteristics of the Study Population of Young Low-Income Children

Characteristic	All Children		Children Who Were Nonobese at Baseline	
	N[a]	% (SE)	N[a]	% (SE)
Total	1 204 839		1 044 829	
Gender				
Boys	606 654	50.4 (0.05)	521 402	49.9 (0.05)
Girls	598 185	49.6 (0.05)	523 427	50.1 (0.05)
Race/ethnicity				
Non-Hispanic white	407 600	35.0 (0.04)	360 867	35.7 (0.05)
Non-Hispanic AA	248 688	21.4 (0.04)	216 922	21.5 (0.04)
Hispanic	466 852	40.1 (0.05)	395 329	39.1 (0.05)
AI/AN	9743	0.8 (0.01)	7994	0.8 (0.01)
Asian/Pacific Islander	32 184	2.8 (0.02)	29 141	2.9 (0.02)
Baseline Age (mo)[b]				
0–11	665 052	55.2 (0.05)	592 562	56.7 (0.05)
12–23	539 787	44.8 (0.05)	452 267	43.3 (0.05)
Age at follow-up (mo)[c]				
24–35	479 665	39.8 (0.04)	436 050	41.7 (0.05)
36–47	521 352	43.3 (0.05)	437 835	41.9 (0.05)
48–59	203 822	16.9 (0.03)	170 944	16.4 (0.04)
Duration of follow-up (mo)				
24–27	423 372	35.1 (0.04)	367 712	35.2 (0.05)
28–31	465 008	38.6 (0.04)	403 287	38.6 (0.05)
32–35	316 559	26.3 (0.04)	273 830	26.2 (0.04)
Baseline WFL percentile				
0–9th	94 497	7.8 (0.02)	94 497	9.0 (0.03)
10–24th	121 510	10.1 (0.03)	121 510	11.6 (0.03)
25–49th	220 911	18.3 (0.04)	220 911	21.1 (0.04)
50–74th	282 133	23.4 (0.04)	282 133	27.0 (0.04)
75–89th	225 088	18.7 (0.04)	225 088	21.5 (0.04)
90–94th	100 690	8.4 (0.03)	100 690	9.6 (0.03)
≥95th	160 010	13.3 (0.03)		

AA, African American; WFL, weight-for-length.

[a]The sample sizes may not add up to the total because of missing data.

[b]Age of the study subjects in 2008.

[c]Age of the study subjects in 2010 or 2011.

TABLE 2

Shifts in Weight Status[a] After the 24 to 35-Month Follow-Up Period Among Low-Income Children Aged 0 to 23 Months in 2008, by Gender, Race/Ethnicity, and Baseline Age

Characteristic	Prevalence of Obesity[b] at Baseline (SE)[c]	Remained Obese (SE)	From Obese to Nonobese (SE)[d]
Total	13.3 (0.03)	36.5 (0.12)	63.5 (0.12)
Gender			
Boys	14.1 (0.04)	36.9 (0.17)	63.1 (0.16)
Girls	12.5 (0.04)	36.0 (0.18)	64.0 (0.17)
Race/ethnicity			
Non-Hispanic white	11.5 (0.05)	34.7 (0.22)	65.3 (0.21)
Non-Hispanic AA	12.8 (0.07)	30.5 (0.26)	69.5 (0.25)
Hispanic	15.3 (0.05)	40.3 (0.18)	59.7 (0.18)
AI/AN	18.0 (0.39)	44.4 (1.19)	55.6 (1.17)
Asian/Pacific Islander	9.5 (0.16)	33.2 (0.85)	66.8 (0.83)
Baseline age (mo)			
0–11	10.9 (0.04)	27.7 (0.17)	72.3 (0.17)
12–23	16.2 (0.05)	43.7 (0.17)	56.3 (0.16)

AA, African American.

[a] Include all the shifts in wt status from 2008 to 2010 or 2011 except the shift from nonobese to obese (incidence), which is presented in Table 3.

[b] Gender-specific BMI-for-age ≥95th percentile according to 2000 CDC growth charts.

[c] Results of all subgroup comparisons are all statistically significant at $P < .005$.

[d] Results of all subgroup comparisons are all statistically significant at $P < .005$, except the percentage difference between non-Hispanic white and Asian/Pacific Islander children.

TABLE 3

Incidence of Obesity[a] Based on BMI-for-Age Percentiles After the 24- to 35-Month Follow-Up Period Among Low-Income Children Aged 0 to 23 Months in 2008

Characteristic	Incidence (95% CI)[b]	Unadjusted RR[c] (95% CI)	ARR[d] (95% CI)
Total	11.0 (11.0–11.1)		
Gender			
Boys	11.3 (11.3–11.4)	1.00	1.00
Girls	10.7 (10.6–10.8)	0.94 (0.93–0.95)	0.96 (0.95–0.97)
Race/ethnicity			
Non-Hispanic white	9.7 (9.6–9.8)	1.00	1.00
Non-Hispanic AA	8.7 (8.6–8.8)	0.90 (0.88–0.92)	0.92 (0.91–0.94)
Hispanic	13.6 (13.5–13.8)	1.41 (1.40–1.43)	1.35 (1.34–1.37)
AI/AN	15.4 (14.6–16.2)	1.59 (1.51–1.68)	1.49 (1.41–1.57)
Asian/Pacific Islander	9.0 (8.7–9.3)	0.93 (0.90–0.97)	0.98 (0.95–1.02)
Baseline age (mo)			
0–11	11.6 (11.5–11.7)	1.00	1.00
12–23	10.2 (10.1,10.3)	0.88 (0.87–0.89)	0.83 (0.82–0.84)
Follow-up duration (mo)[e]			
24–27	10.1 (10.0–10.2)	1.00	1.00
28–31	11.1 (11.0–11.2)	1.10 (1.08–1.11)	1.09 (1.07–1.10)
32–35	12.1 (12.0–12.2)	1.20 (1.18–1.21)	1.18 (1.16–1.19)
Baseline WFL percentile[f]			
0–9th	6.5 (6.3–6.6)	1.00	1.00
10–24th	6.8 (6.6–6.9)	1.05 (1.01–1.08)	1.04 (1.01–1.08)
25–49th	7.6 (7.5–7.7)	1.17 (1.14–1.21)	1.16 (1.13–1.20)
50–74th	10.1 (10.0–10.2)	1.57 (1.52–1.61)	1.54 (1.50–1.58)
75–89th	14.9 (14.8–15.1)	2.31 (2.25–2.37)	2.26 (2.20–2.32)
90–94th	21.6 (21.3–21.8)	3.33 (3.25–3.43)	3.23 (3.15–3.32)

AA, African American; RR, relative risk; WFL, weight-for-length.

[a]Gender-specific BMI-for-age ≥95th percentile according to 2000 CDC growth charts.

[b]Results of all comparisons across age, gender, and race/ethnic subgroups on the incidence of obesity are all statistically significant at $P < .005$, except the incidence difference between non-Hispanic AA and Asian/Pacific Islander children.

[c]Unadjusted RR of obesity, calculated from log-binomial models.

[d]Adjusted RR of obesity, calculated from a log-binomialmodel adjusting for baseline age, gender, race/ethnicity, and baseline WFL percentile.

[e]The incidence of obesity increases with duration of follow-up, $P < .0001$ for linear trend.

[f]The incidence of obesity increases with baseline WFL percentiles, $P < .0001$ for linear trend.

TABLE 4

Incidence of Obesity[a] Based on Weight-for-Height Percentiles After the 24- to 35-Month Follow-Up Period Among Low-Income Children Aged 0 to 23 Months in 2008

Characteristic	Incidence (95% CI)[b]	Unadjusted RR[c] (95% CI)	ARR[d] (95% CI)
Total	10.6 (10.6–10.7)		
Gender			
Boys	11.2 (11.1–11.3)	1.00	1.00
Girls	10.1 (10.0–10.2)	0.90 (0.89–0.91)	0.92 (0.91–0.93)
Race/ethnicity			
Non-Hispanic white	9.3 (9.3–9.4)	1.00	1.00
Non-Hispanic AA	8.5 (8.4–8.7)	0.91 (0.90–0.93)	0.94 (0.92–0.95)
Hispanic	13.1 (13.0–13.2)	1.40 (1.38–1.42)	1.37 (1.35–1.39)
AI/AN	15.3 (14.5–16.1)	1.64 (1.55–1.73)	1.54 (1.46–1.62)
Asian/Paci fic Islander	8.7 (8.4–9.0)	0.93 (0.89–0.96)	0.97 (0.94–1.01)
Baseline age (mo)			
0–11	12.7 (12.6–12.7)	1.00	1.00
12–23	8.0 (8.0–8.1)	0.63 (0.63–0.64)	0.60 (0.60–0.61)
Follow-up duration (mo)			
24–27	10.8 (10.7–10.9)	1.00	1.00
28–31	10.6 (10.5–10.7)	0.98 (0.97–0.99)	0.97 (0.96–0.99)
32–35	10.6 (10.5–10.7)	0.98 (0.97–0.99)	0.96 (0.95–0.98)
Baseline WFL percentile[e]			
0–9th	7.4 (7.2–7.5)	1.00	1.00
10–24th	7.4 (7.3–7.6)	1.01 (0.98–1.04)	1.02 (0.99–1.06)
25–49th	7.9 (7.8–8.0)	1.07 (1.04–1.10)	1.09 (1.06–1.12)
50–74th	9.9 (9.8–10.0)	1.34 (1.31–1.38)	1.37 (1.34–1.41)
75–89th	13.6 (13.5–13.7)	1.84 (1.80–1.89)	1.89 (1.85–1.94)
90–94th	19.2 (19.0–19.5)	2.61 (2.54–2.68)	2.64 (2.58–2.71)

AA, African American; RR, relative risk; WFL, weight-for-length.

[a]Gender-specific weight-for-height ≥95th percentile according to 2000 CDC growth charts.

[b]Results of all comparisons across age, gender, and race/ethnic subgroups on the incidence of obesity are all statistically significant at $P < .005$, except the incidence difference between non-Hispanic AA and Asian/Pacific Islander children.

[c]Unadjusted RR of obesity, calculated from log-binomial models.

[d]Adjusted RR of obesity, calculated from a log-binomial model adjusting for baseline age, gender, race/ethnicity, duration of follow-up, and baseline WFL percentile.

[e]The incidence of obesity increases with baseline WFL percentiles, $P < .0001$ for linear trend.