Are American children and adolescents of low socioeconomic status at increased risk of obesity? Changes in the association between overweight and family income between 1971 and 2002\(^1\)\(^,\)\(^2\)\(^,\)\(^3\)

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ABSTRACT

Background: A good understanding of the association between obesity and socioeconomic status (SES) has many important public health and policies implications, particularly for the prevention and management of obesity.

Objective: The objective was to examine secular trends in the relations between overweight (body mass index \(\geq 95^{th}\) percentile) and SES.

Design: We examined secular trends in the relation between overweight and SES using nationally representative data collected in the National Health and Nutrition Examination Surveys (NHANES) between 1971 and 2002 for 30 417 US children aged 2–18 y. Poverty income ratio tertiles at each survey were used to indicate low, middle, and high SES.

Results: Considerable race, sex, and age differences were observed in the association between overweight and SES. A reverse association only existed in white girls; African American children with a high SES were at increased risk. Socioeconomic disparities in overweight have changed over time, with an overall trend of weakening. Compared with the medium-SES group, the adjusted odds ratios and 95% CIs were 0.79 (0.47, 1.33), 1.08 (0.73, 1.61), 1.24 (0.73, 2.09), and 1.04 (0.82, 1.33) in NHANES I, II, and III and in the 1999–2002 NHANES for the low-SES group and 0.66 (0.43, 1.00), 0.60 (0.35, 1.03), 0.42 (0.23, 0.76), and 0.99 (0.68, 1.43) for the high-SES group, respectively. Between 1988–1994 and 1999–2002, the ratio in the prevalence of overweight between adolescent boys with a low or high SES decreased from 2.5 to 1.1 and from 3.1 to 1.6 in girls. Consistently across almost all SES groups, the prevalence of overweight was much higher in blacks than in whites.


KEY WORDS Obesity, overweight, body mass index, children, socioeconomic status

INTRODUCTION

There has been a strong interest in studying the relation between socioeconomic status (SES) and obesity. Previous studies have shown that the association between SES and obesity may vary by population, sex, and age (1–7). In general, the literature suggests that, in industrialized countries, low-SES groups are more likely to be obese than are their high-SES counterparts, whereas high-SES groups are at increased risk in developing countries (3, 6, 7). In the United States, several studies have shown that low-SES and minority groups have a higher prevalence of obesity (6–10). However, a person’s body weight status may also affect their education and occupational opportunities, which subsequently affect their SES. A good understanding of the association between obesity and SES has many important public health and policy implications, particularly for the prevention and management of obesity. To fight the growing obesity epidemic, it has been argued that the prevention of childhood obesity is a priority, and more efforts should target low-SES and minority population groups (11). It is widely accepted that low-SES groups in the United States are at greater risk than are their higher-SES counterparts. However, this perception was recently challenged (12, 13). Our recent study, which was based on nationally representative data collected in the National Health and Nutrition Examination Surveys (NHANES) from American adults since the 1970s, indicated an overall trend of a weakening association between SES and obesity, with the patterns differing across ethnic groups (13), but little is known about the trend in children and adolescents. Using the 1996 data collected in the Add Health Study, a national representative study in American adolescents (grades 7 through 12), Gordon-Larsen et al (12) reported considerable ethnic disparity in the prevalence of overweight by SES, but only in girls was there a clear inverse association between SES and obesity. Some researchers have speculated that differences in SES factors (eg, education and income) are the primary causes of the ethnic disparity in the prevalence of obesity in American young people (9, 11). On the other hand, other studies suggest that differences in other factors, such as culture, body image, dietary habits, and sexual maturity, may have contributed to the disparity (12–18).

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Overall, these studies suggest a complex relation between SES and obesity, which might change over time. In adults the causality between SES and obesity may operate in either direction (1–4). In contrast, the effect of body weight status on SES is likely to be trivial in children because children’s SES is determined by their parents’ characteristics, such as parental education and income. Thus, research findings based on national surveys for children can provide better hints regarding the effect of SES factors on a person’s body weight status. A good understanding of the relation between SES and obesity and the trends of that relation will provide useful insights for developing effective obesity-prevention and -management programs and policies.

In the present study, which is based on nationally representative data collected in the NHANES between 1971 and 2002, our main objectives were to 1) examine the secular changes in the relation between obesity and SES in American children and adolescents, and 2) to test the differences in the trends across different population groups. Our findings help provide a basis for predicting future socioeconomic disparity in obesity in addition to other public health implications.

**METHODS**

**Data**

We used NHANES data collected between 1971 and 2002 for children and adolescents aged 2–18 y old. The NHANES include a series of cross-sectional surveys that provided nationally representative information on the nutrition and health status of the US civilian population. The National Center for Health Statistics conducted the first, second, and third NHANES surveys (NHANES I, II, and III) in 1971–1975, 1976–1980, and 1988–1994, respectively. Since 1999, NHANES has been a continuous survey. The data were recently made available for the first 4 y of that period (1999–2002). All 4 rounds of NHANES surveys used a stratified, multistage probability cluster sampling design. Detailed descriptions of the sample design, interview procedures, and physical examinations conducted were published elsewhere (19–22).

In each survey, standardized protocols were used for all interviews and examinations. Data on weight and height were collected for each individual through direct physical examination in a mobile examination center. In NHANES I and II, race-ethnic group was classified as white, black, and “other” based on observation. In NHANES III and in 1999–2002, the subjects were classified as non-Hispanic white, non-Hispanic black, Mexican American, and other ethnic groups based on self-reported race and ethnicity.

**Measures**

**Definitions of overweight**

Body mass index \[\text{BMI} = \frac{\text{weight (kg)}}{\text{height}^2 (\text{m})} \] was calculated for each individual on the basis of measured weight and height. In the present study, the children’s and adolescents’ body weight status was classified on the basis of the age- and sex-specific BMI percentiles provided in the 2000 growth charts of the Centers for Disease Control and Prevention (23): overweight was defined as a BMI $\geq 95$th percentile, and at risk of overweight was defined as a BMI $\geq 85$th percentile (ie, it included overweight).

**Socioeconomic status**

The commonly used SES variables include education, income, and occupational status. Each of these measures has its own strengths and limitations for studying the relation between SES and health outcomes (6, 13). In the present study we chose to use poverty income ratio as the indicator of children’s SES. The poverty income ratio is the ratio of household income and the poverty line published by Census Bureau for a certain family size in that calendar year. Specifically, we used the poverty income ratio tertiles at each survey to indicate low-, middle-, and high-SES groups. Compared with using parental education, this allowed us to have an even distribution of the 3 SES groups.

**Sociodemographic characteristics**

Subjects were separated into 2 age groups according to the World Health Organization’s recommendation (24): children (2–9 y old) and adolescents (10–18 y old). On the basis of self-reported race and ethnicity, the participants were categorized as white, black, Mexican American, and other groups. Note that in NHANES I and II, the sample sizes for Mexican Americans were small and did not allow for stable estimates of the association between SES and overweight in children and adolescents, respectively.

**Statistical analysis**

First, we examined the differences in the prevalence of overweight and at risk of overweight between the low-, medium-, and high-SES groups by age, sex, and ethnic group as well as over time. Chi-square tests were conducted to test the differences between groups. Next, we conducted logistic regression analysis to examine the association between body weight status and SES. We used 2 dummy variables to code low and high SES and used the medium-SES group as the reference, which facilitated the tests of a nonlinear relation between SES and overweight. Odds ratios (ORs) and 95% CIs were estimated. In general, the results for being at risk of overweight were similar to those for being overweight; thus, they are not presented. Then, using multiple linear regression analysis, we examined the relation between BMI and SES. Finally, to further test the changes in the association between obesity and SES over time, we pooled all the NHANES data and conducted logistic and linear regression analysis including the interaction terms between survey periods and SES in the models. In addition, using ANOVA and the pooled data, we tested the interaction terms (2-, 3-, and 5-factor interaction terms) between income and the other key covariates (ie, age, sex, ethnicity, and waves of survey), and they were significant, which further justified the stratified analysis. All regression analyses were conducted separately for boys and for girls, and we controlled for age. Race-ethnicity was also adjusted for when the analysis was conducted for combined ethnic groups. Statistical tests were conducted at the $P = 0.05$ significance level. Except for the pooled data analysis, all analyses took into account the complex survey design and unequal probabilities of
FIGURE 1. Prevalence trends in the disparity of overweight in American children and adolescents (1971–2002) in the low-, medium-, and high-socioeconomic status (SES) groups. Overweight was defined as a BMI ≥ 95th percentile. The sample size in each National Health and Nutrition Examination Survey (NHANES) was as follows: NHANES I (n = 6555), NHANES II (n = 6741), NHANES III (n = 9731), and NHANES 1999–2002 (n = 7390).

*Significant between-group differences, P < 0.05 (chi-square tests).
FIGURE 2 Continues
sample selection in NHANES. All analyses were conducted by using the “svy” commands in STATA (version 7; Stata Press, College Station, TX).

RESULTS
Sociodemographic characteristics and anthropometric measures
As indicated in Table 1, ≈50% of the participants in each wave of the NHANES were girls; the proportion of white children decreased from 80.8% in NHANES I (1971–1975) to 60.8% in 1999–2002, whereas the proportion of minority children increased. Approximately 20% of the participants were below the poverty line. The prevalence of at risk of overweight or overweight (BMI ≥ 85th percentile) has almost doubled from the 1970s to 2002, increasing from 15.5% to 29.2%. During this period, the prevalence of overweight (BMI ≥ 95th percentile) has tripled, increasing from 5.0% to 14.9%. Consistent with the rising prevalence of overweight, the mean BMI of American children and adolescents has also increased steadily during this period, from 18.1 to 19.5. Interestingly, the largest increase occurred in adolescent boys, whose BMI increased by 2.1 points (from 19.7 to 21.8), followed by adolescent girls (from 20.2 to 22.2).

Secular trends in the disparity of overweight across SES groups—differences in prevalence

Overall trends
The differences in the prevalence of overweight by SES across sex and age groups are shown in Figure 1. Overall, the prevalence in all groups has increased since the 1970s. However, the trends in SES-related disparity patterns varied across age, sex, and ethnic groups. In boys aged 2–9 y, a significant reverse association between family income and overweight appeared in 1999–2002 (Figure 1). In girls aged 2–9 y, none of the associations were significant. A strong reverse association was observed in adolescent boys aged 10–18 y in NHANES III (1988–1994), but it became statistically nonsignificant by 1999–2002. In adolescent girls, the reverse association between family income and overweight remained significant between 1976 and 1980 and between 1999 and 2002, but the ratio in the prevalence of overweight in the low-SES group compared with the high-SES group decreased from 3.1 in NHANES III (1988–1994) to 1.6 in 1999–2002.

Ethnic differences in the trends
Ethnic differences in the changing trends in economic disparities (ie, the association) are shown in Figure 2. Considerable differences in the association between SES and overweight...
Boys and girls group was treated as the reference group. Age, sex, and ethnicity were adjusted for in the models when appropriate. Girls showed a reverse association with family income in 1999–2002, but not in other sex-ethnicity groups or other NHANES waves. A positive association was found in black boys in NHANES II (1976–1980) and in white girls in NHANES III (1988–1994). In adolescents, there was a statistically significant reverse association between family income and overweight (data not shown). In adolescents, there was a statistically significant reverse association between family income and overweight (data not shown). In adolescents, there was a statistically significant reverse association between family income and overweight (data not shown). In adolescents, there was a statistically significant reverse association between family income and overweight (data not shown). In adolescents, there was a statistically significant reverse association between family income and overweight (data not shown).

Table 2: Logistic regression models: odds ratios (ORs) and 95% CIs for the association between socioeconomic status (SES) and overweight (BMI ≥ 95th percentile) by sex and ethnicity in adolescents aged 10–18 y across the 4 waves of the National Health and Nutrition Examination Survey (NHANES) 1971–2002

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<td>(n = 2871)</td>
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<td>(n = 3189)</td>
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<td>Boys</td>
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<td>Low-SES</td>
<td>0.79 (0.47, 1.33)</td>
<td>1.08 (0.73, 1.61)</td>
<td>1.24 (0.73, 2.09)</td>
<td>1.04 (0.82, 1.33)</td>
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<tr>
<td>High-SES</td>
<td>0.66 (0.43, 1.00)</td>
<td>0.60 (0.35, 1.03)</td>
<td>0.42 (0.23, 0.76)</td>
<td>0.99 (0.68, 1.43)</td>
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<td>Girls</td>
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<tr>
<td>Low-SES</td>
<td>0.55 (0.25, 1.20)</td>
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<td>1.49 (0.72, 3.07)</td>
<td>0.80 (0.56, 1.15)</td>
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<td>High-SES</td>
<td>0.77 (0.42, 1.44)</td>
<td>0.59 (0.28, 1.26)</td>
<td>0.55 (0.25, 1.21)</td>
<td>0.93 (0.58, 1.51)</td>
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<tr>
<td>Low-SES</td>
<td>0.62 (0.28, 1.40)</td>
<td>0.70 (0.35, 1.43)</td>
<td>1.99 (0.62, 6.42)</td>
<td>0.99 (0.54, 1.80)</td>
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<td>High-SES</td>
<td>0.83 (0.44, 1.59)</td>
<td>0.39 (0.17, 0.92)</td>
<td>0.61 (0.22, 1.66)</td>
<td>0.98 (0.51, 1.85)</td>
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<td>Black</td>
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<tr>
<td>Low-SES</td>
<td>0.66 (0.11, 3.99)</td>
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<td>0.83 (0.45, 1.54)</td>
<td>0.96 (0.57, 1.61)</td>
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<td>High-SES</td>
<td>1.80 (0.23, 14.2)</td>
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<td>0.38 (0.13, 1.17)</td>
<td>1.16 (0.68, 1.97)</td>
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<td>Mexican American boys</td>
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<tr>
<td>Low-SES</td>
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<td>1.12 (0.80, 1.59)</td>
<td>0.70 (0.46, 1.06)</td>
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<td>High-SES</td>
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<td>2.1 (1.19, 3.72)</td>
<td>0.59 (0.30, 1.19)</td>
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<td>Girls</td>
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<tr>
<td>Low-SES</td>
<td>1.00 (0.48, 2.06)</td>
<td>1.54 (0.86, 2.78)</td>
<td>0.98 (0.58, 1.64)</td>
<td>1.36 (0.87, 2.14)</td>
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<td>High-SES</td>
<td>0.52 (0.28, 0.98)</td>
<td>0.60 (0.30, 1.24)</td>
<td>0.29 (0.15, 0.57)</td>
<td>1.04 (0.66, 1.65)</td>
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<td>White</td>
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<tr>
<td>Low-SES</td>
<td>1.18 (0.55, 2.51)</td>
<td>1.40 (0.68, 2.88)</td>
<td>1.31 (0.57, 3.03)</td>
<td>1.85 (0.75, 4.58)</td>
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<td>High-SES</td>
<td>0.60 (0.31, 1.18)</td>
<td>0.58 (0.28, 1.21)</td>
<td>0.17 (0.06, 0.49)</td>
<td>1.00 (0.49, 2.01)</td>
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<td>Black</td>
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<tr>
<td>Low-SES</td>
<td>0.49 (0.13, 1.83)</td>
<td>1.76 (0.45, 6.94)</td>
<td>0.85 (0.47, 1.55)</td>
<td>1.22 (0.80, 1.86)</td>
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<tr>
<td>High-SES</td>
<td>0.11 (0.01, 1.06)</td>
<td>0.70 (0.06, 7.66)</td>
<td>1.82 (0.79, 4.22)</td>
<td>2.33 (1.68, 3.23)</td>
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<td>Mexican American girls</td>
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<tr>
<td>Low-SES</td>
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<td>—</td>
<td>0.81 (0.52, 1.27)</td>
<td>1.52 (0.98, 2.36)</td>
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<td>High-SES</td>
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<td>0.87 (0.42, 1.79)</td>
<td>1.08 (0.52, 2.24)</td>
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1 The stratified analysis was conducted for all participants in each survey and then separate models were fit for each sex-ethnicity group. The medium-SES group was treated as the reference group. Age, sex, and ethnicity were adjusted for in the models when appropriate.
2 P < 0.01.
3 P < 0.05.
4 There were no overweight subjects in the reference group.
5 The sample size was too small.
6 P < 0.001.

Across ethnic groups, there was a significant reverse association in NHANES III (1988–1994). In contrast, black girls with a high SES had a higher prevalence than did their low- and medium-SES counterparts in 1988–1994 and 1999–2002. For Mexican Americans, the study sample was only large enough with NHANES III (1988–1994) to allow us to examine the trends. There were no consistent patterns.

Secular trends in the association between overweight and SES

Controlling for covariates, we conducted logistic regression analysis to examine the association between SES and overweight. Then we conducted an analysis stratified by age groups. In children aged 2–9 y, none of the associations were significant (data not shown). In adolescents, there was a statistically significant reverse association between family income and overweight in white boys in NHANES II (1976–1980) and in white girls in NHANES III (1988–1994) and a positive association in black girls in 1999–2002, but not in other sex-ethnicity groups or other rounds of surveys (Table 2). Overall, the results suggest considerable ethnic, sex, and time differences in the relation between SES and obesity and an overall weak association in American adolescents because only 5 of the ORs were statistically significant at P = 0.05. Furthermore, it seems that the association was weakened over time because the ORs changed toward 1, and none was statistically significant by 1999–2002, except for black girls, for whom a strong positive association emerged in 1999–2002. Blacks with a high SES were twice as likely to be overweight than were their counterparts with a medium SES (OR: 2.33; 95% CI: 1.68, 3.23).

Secular trends in the relation between BMI and SES

In general, the findings of our multiple linear and logistic regression analyses were consistent. No significant association was found in children aged 2–9 y (P > 0.05; data not shown). The results for adolescents are presented in Table 3. Only 4 of the β coefficients presented in Table 3 were statistically significant. In general, except for black girls and Mexican American adolescents, all the β coefficients became smaller and all the significant

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assessments were conducted for each sex and ethnicity group. Overall, the partial $R^2$ was small in each group (Figure 3). The partial $R^2$ increased between NHANES II (1976–1980) and III (1988–1994) and then decreased between 1988 and 1994 and between 1999 and 2002. However, to our knowledge, statistical tests cannot be conducted to test significance of the changes in $R^2$. In 1999–2002, only a very small proportion (1–2% in girls and <1% in boys) of the variation in BMI could be explained by SES.

Pooled analysis

Moreover, we pooled the 4 waves of NHANES data and conducted logistic and linear regression analysis including “SES*survey” interaction terms in the models. Overweight and BMI were the outcome variables, respectively. We conducted the analysis for different population groups. If some of the interaction terms were statistically significant, it would suggest a significant change in the association between the outcome variables and SES between survey periods. However, a limitation was that the sample weights could not be used in the analysis, and some epidemiologists do not support this approach of testing effect modification.

Overall, our findings were consistent with those presented above. When the analysis was conducted for the whole pooled
sample, none of the interaction terms were statistically significant \((P > 0.05)\), except for “low-income*NHANES 1999–2002” when BMI was used as the outcome variable. However, when a stratified analysis was performed for each race-sex group, some of interaction terms became significant. For example, in white boys, the interaction term “low-SES*NHANES III (1988–94)” was significant in linear \((\beta = 1.3, SE = 0.6, P = 0.021)\) and logistic \((OR: 3.8; 95\% CI: 1.4, 10.5; P = 0.010)\) regression models; in white girls, “low-SES*NHANES 1999–2002” and “high-SES*NHANES III (1988–94)” were significant in the linear models \((\beta = 1.1, SE = 0.5, P = 0.047; \beta = -1.8, SE = 0.5, P = 0.001, \text{ respectively})\); and “low-SES*NHANES III (1988–94)” was significant in the logistic model \((OR: 0.2, 95\% CI: 0.0–0.7; P = 0.018)\). These results indicate significant changes in the association in NHANES III (1988–1994) and 1999–2002 among white boys and girls.

**DISCUSSION**

Using nationally representative data collected in the NHANES over the past 3 decades, we studied the trends in the association between SES and overweight (ie, disparity patterns) in children and adolescents and the difference across different demographic groups in the United States. Our results indicate complex patterns that vary across ethnic groups and over time. Our findings suggest several characteristics in the association and the time trends, as follows.

First, on the basis of the most recent nationally representative survey data, not all low-SES groups were at increased risk of overweight. Considerable racial, sex, and age differences existed. Previously, it was a widely accepted perception that high-SES groups in the United States and other industrialized countries are less likely to become overweight than are their low-SES counterparts (1–7). In general, our findings indicate that a reverse association only existed in white children, not in black children and adolescents. In whites, such a reverse association existed only in girls (not in boys). In blacks, a strong positive association existed in girls. The observed association was stronger in older white adolescents than in white children. In black children and adolescents, no significant systematic socioeconomic disparity was observed. Black adolescent girls with a high SES were more likely to be overweight than were their medium-SES counterparts in NHANES III and 1999–2002 \((P < 0.05)\). In Mexican American children and adolescents, no consistent association between SES and overweight was observed.

Second, an unparallel increase in the prevalence of overweight in American adolescents over time was observed in the low- and high-SES groups. This resulted in an increase in socioeconomic disparity during 1976–1994 (NHANES II and III) and then a decrease between 1988–1994 and 1999–2002. As indicated in Figures 1 and 2, an increase in the prevalence of overweight in the low-income group occurred between NHANES II (1976–1980) and III (1988–94), whereas the “jump” in prevalence in the high-income group occurred mostly between NHANES II (1976–1980) and III (1988–94), whereas the “jump” in prevalence in the high-income group occurred mostly between NHANES II and III \((1988–94)\) and NHANES 1999–2002. It is important to understand the fundamental causes for the increase of obesity in the United States and other societies, which involve many complex factors and issues. It is beyond the scope of this report to provide a thorough discussion. In general, it has been argued that increased television viewing time and energy intake accompanied by decreased physical activity over time have contributed to the growing childhood obesity epidemic in the United States (7, 25, 26). We speculated that the following factors might help explain the patterns we observed. During the period of NHANES II (1976–1980) and III (1988–1994), television viewing might have been the primary type of inactivity in poor adolescents. However, during NHANES III (1988–1994) and 1999–2002, computers and computer games became more widely accessible and affordable, especially in high-SES groups, and the energy intake and expenditure patterns of all adolescents, regardless of SES, particularly for white adolescent boys, become more similar. Thus, the economic disparities of overweight tended to become smaller.
Third, economic disparities in obesity have changed over the past 3 decades. The overall trend is a weakening association between SES and overweight, particularly between the late 1980s and 1999–2002, and in adolescent boys and girls. For example, the ratio in prevalence of at risk of overweight between adolescent boys with a low and high SES decreased from 2.5 to 1.1 between NHANES III (1988–94) and 1999–2002; in adolescent girls, it decreased from 3.1 to 1.6. Changes in the associations also varied considerably across race, sex, and age groups. In general, in whites, the change was greater in adolescents than in children. For example, between NHANES III (1988–1994) and 1999–2002, the low- versus high-SES prevalence ratio changed from 6.4 to 1.7 in white adolescent girls compared with from 0.7 to 0.6 in 2–9-y-olds.

It is worth noting that, although the association between SES and overweight has been weakened over time, the gap between ethnic groups became wider, especially in adolescent girls. For example, the prevalence was 7.1%, 6.4%, and 3.8% in low-, medium-, and high-SES white adolescent girls compared with 8.2%, 14.8%, and 1.9% in black adolescent girls in NHANES I (1971–1975); however, in 1999–2002, the values were 17.9%, 10.6%, and 10.6% compared with 24.5%, 18.7%, and 38.0%, respectively. In a recent study based on data collected from 21,911 preschool children who participated in the Hawaii WIC (Women, Infants, and Children) Nutrition Program in 1997–1998, Baruffi et al (27) reported that even in a relatively “homogeneous” low-SES sample of young US children, remarkable ethnic differences remained, and the differences emerged at very young ages. Our findings of inconsistent associations between SES and overweight across ethnic and sex groups are consistent with previous findings, such as those by Gordon-Larsen et al (12), which were based on a 1996 national school-based survey conducted in adolescents. Our study included younger children, used more recent national representative data, and examined the secular trends in the association. Our study suggests considerable changes in the association between 1988–1994 and 1999–2002. Ethnic disparities in obesity are likely due to environmental, contextual, biological, and sociocultural factors in addition to parental education and family income. Further longitudinal studies are needed to fully understand the underlying causes.

Our findings of a weakening association between SES and overweight particularly in white adolescent girls and boys and a widening gap between ethnic groups have many policy implications. Efforts solely targeting a reduction of income disparities probably cannot effectively help reduce the racial disparities in obesity (12, 28). More balanced intervention programs targeting all SES groups are needed. However, we need to develop different strategies to address the obesity problem in different race-ethnicity groups. For example, although white children with a low SES might be at higher risk and need more attention than their high-SES counterparts, the high-SES black groups should be targeted as well to help promote healthy lifestyles. To reduce the ethnic disparity, more efforts and resources are needed in minority groups. It is important to develop broad national policies and programs to fight the obesity epidemic. Meanwhile, it is crucial to tailor prevention and management efforts to each particular ethnic group to ensure efficiency and effectiveness.

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