

Prevalence of Overweight and Obesity in the United States, 1999-2004

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OBESITY CONTINUES TO BE A leading public health concern in the United States.^{1,2} Between 1980 and 2002, obesity prevalence doubled in adults aged 20 years or older and overweight prevalence tripled in children and adolescents aged 6 to 19 years.³⁻⁵ This article provides the most recent prevalence estimates of overweight and obesity based on national measurements of weight and height in 2003-2004 and compares these estimates with estimates from 1999-2000 and 2001-2002 to determine if the trend is continuing.

METHODS

Prevalence estimates of overweight and obesity were calculated using data from the National Health and Nutrition Examination Survey (NHANES), a complex, multistage probability sample of the US civilian, noninstitutionalized population.⁶ Race/ethnicity was reported by survey participants. During a physical examination in a mobile examination center, height and weight were measured using standardized protocols and calibrated equipment. Body mass index (BMI) was calculated as weight in kilograms divided by the

See also pp 1539 and 1577.

Context The prevalence of overweight in children and adolescents and obesity in adults in the United States has increased over several decades.

Objective To provide current estimates of the prevalence and trends of overweight in children and adolescents and obesity in adults.

Design, Setting, and Participants Analysis of height and weight measurements from 3958 children and adolescents aged 2 to 19 years and 4431 adults aged 20 years or older obtained in 2003-2004 as part of the National Health and Nutrition Examination Survey (NHANES), a nationally representative sample of the US population. Data from the NHANES obtained in 1999-2000 and in 2001-2002 were compared with data from 2003-2004.

Main Outcome Measures Estimates of the prevalence of overweight in children and adolescents and obesity in adults. Overweight among children and adolescents was defined as at or above the 95th percentile of the sex-specific body mass index (BMI) for age growth charts. Obesity among adults was defined as a BMI of 30 or higher; extreme obesity was defined as a BMI of 40 or higher.

Results In 2003-2004, 17.1% of US children and adolescents were overweight and 32.2% of adults were obese. Tests for trend were significant for male and female children and adolescents, indicating an increase in the prevalence of overweight in female children and adolescents from 13.8% in 1999-2000 to 16.0% in 2003-2004 and an increase in the prevalence of overweight in male children and adolescents from 14.0% to 18.2%. Among men, the prevalence of obesity increased significantly between 1999-2000 (27.5%) and 2003-2004 (31.1%). Among women, no significant increase in obesity was observed between 1999-2000 (33.4%) and 2003-2004 (33.2%). The prevalence of extreme obesity (body mass index ≥ 40) in 2003-2004 was 2.8% in men and 6.9% in women. In 2003-2004, significant differences in obesity prevalence remained by race/ethnicity and by age. Approximately 30% of non-Hispanic white adults were obese as were 45.0% of non-Hispanic black adults and 36.8% of Mexican Americans. Among adults aged 20 to 39 years, 28.5% were obese while 36.8% of adults aged 40 to 59 years and 31.0% of those aged 60 years or older were obese in 2003-2004.

Conclusions The prevalence of overweight among children and adolescents and obesity among men increased significantly during the 6-year period from 1999 to 2004; among women, no overall increases in the prevalence of obesity were observed. These estimates were based on a 6-year period and suggest that the increases in body weight are continuing in men and in children and adolescents while they may be leveling off in women.

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square of height in meters and was rounded to the nearest tenth.

The NHANES 2003-2004 overall response rate (of those originally selected for participation) was 68.6% (4742/6916) for adults aged 20 years or older and 83.2% (4105/4932) for

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Table 1. Sample Size of US Adults, Children, and Adolescents by Sex, Age, and Racial/Ethnic Group, 2003-2004

| | All (N = 8389)* | Non-Hispanic White (n = 3448) | Non-Hispanic Black (n = 2246) | Mexican American (n = 2055) |
|---------------|--------------------|----------------------------------|----------------------------------|--------------------------------|
| Male | | | | |
| All ages, y | 4240 | 1727 | 1141 | 1048 |
| 2-5 | 402 | 119 | 125 | 111 |
| 6-11 | 463 | 120 | 159 | 140 |
| 12-19 | 1138 | 305 | 425 | 339 |
| 20-39 | 756 | 336 | 175 | 165 |
| 40-59 | 649 | 340 | 146 | 118 |
| ≥60 | 832 | 507 | 111 | 175 |
| Female | | | | |
| All ages, y | 4149 | 1721 | 1105 | 1007 |
| 2-5 | 416 | 121 | 133 | 117 |
| 6-11 | 518 | 136 | 183 | 159 |
| 12-19 | 1021 | 290 | 345 | 316 |
| 20-39 | 661 | 327 | 153 | 130 |
| 40-59 | 662 | 333 | 160 | 110 |
| ≥60 | 871 | 514 | 131 | 175 |

*Includes racial/ethnic groups not shown separately.

children and adolescents aged 2 to 19 years. Less than 3% of examined children and adolescents and 7% of adults had missing data for BMI. Data for analyses were available for 3958 children and adolescents and 4431 adults in 2003-2004 (TABLE 1), in addition to previously published data for 1999-2000 and 2001-2002.³⁻⁵

Among children and adolescents aged 2 to 19 years, overweight and at risk for overweight were defined based on the sex-specific BMI for age growth charts from the Centers for Disease Control and Prevention.⁷ The CDC growth charts were created from national data in the United States collected from 1963 through 1994. Data for the BMI for age charts were collected between 1971 and 1994 for children 2 to 6 years of age and between 1963 and 1980 for children 6 through 19 years of age. The "at risk for overweight" category was defined as a BMI for age at or above the sex-specific 85th percentile but less than the 95th percentile.⁸ Overweight was defined as a BMI for age at or above the sex-specific 95th percentile. For adults aged 20 years or older, overweight was defined as a BMI of 25.0 to 29.9; obesity, 30.0 or higher; and extreme obesity, 40.0 or higher.⁹

Statistical analyses were performed using SAS (version 9, SAS Institute Inc, Cary, NC) and SUDAAN (version 9, Research Triangle Institute, Research Triangle Park, NC) software. All analyses excluded pregnant females. Sample weights were used to account for differential nonresponse, noncoverage, and to adjust for planned oversampling of some groups. Estimates for adults were age-standardized to the projected estimates of the 2000 US Census using the age groups of 20 to 39 years, 40 to 59 years, and 60 years or older. SEs for all survey years were estimated with SUDAAN software using Taylor series linearization.

Trends in prevalence of overweight for children and adolescents and in obesity for adults over 1999-2000, 2001-2002, and 2003-2004 were modeled separately using logistic regression. To test for trends, the NHANES survey years were included as an ordinal variable in logistic regression models that included age group and race/ethnicity. Trends were similarly tested using 6 separate years of data for 1999, 2000, 2001, 2002, 2003, and 2004.

An interaction was found between sex and the NHANES survey years so the models were run separately for

males and females. All 2-way interaction terms were dropped from the sex-specific models because they were not statistically significant. No 3-way interactions were tested. Because no interaction was found between race/ethnicity and the NHANES survey years, tests for differences between racial/ethnic groups were performed in these models with the 3 NHANES survey periods (1999-2000, 2001-2002, 2003-2004). In contrast, overall differences by sex were tested in 2003-2004 using *t* tests at the .05 significance level for adults and for children and adolescents separately.

RESULTS

Overall, among children and adolescents aged 2 to 19 years, 17.1% were overweight in 2003-2004 and 32.2% of adults aged 20 years or older were obese. The prevalence of extreme obesity among adults was 4.8%. Detailed prevalence estimates of overweight in children and adolescents (TABLE 2 and TABLE 3) and obesity in adults (TABLE 4 and TABLE 5) are shown by sex, age group, and race/ethnicity for 2003-2004.

Prevalence estimates of overweight and at risk for overweight in children and adolescents and overweight, obesity, and extreme obesity among adults for 1999-2000 and 2001-2002 also appear in Tables 2, 3, 4, and 5. Tests of trend using logistic regression adjusted for age and race/ethnicity showed a significant increase in the prevalence of overweight in children and adolescents over 1999-2000, 2001-2002, and 2003-2004 ($P = .0396$ for males and $P = .0463$ for females). Among men, the increase in obesity was not significant ($P = .0503$). Tests for trends using 6 single years of data showed significant increases in prevalence of obesity for men ($P = .02$) and overweight for male children and adolescents ($P = .01$), but no significant increase in overweight for female children and adolescents ($P = .10$). Among women, no significant trends were found using either test of trends.

During 1999-2004, significant differences between racial/ethnic groups

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existed among children and adolescents (TABLE 6). After adjusting for age and the NHANES survey years in a multiple logistic regression model using data from 1999-2000, 2001-2002, and 2003-2004, the prevalence of overweight in Mexican American male children and adolescents was significantly greater than in non-Hispanic white male children and adolescents. However, prevalence of overweight among non-Hispanic white male children and adolescents did not differ significantly from non-Hispanic black male chil-

dren and adolescents. Mexican American and non-Hispanic black female children and adolescents were significantly more likely to be overweight compared with non-Hispanic white female children and adolescents. Adolescents were more likely to be overweight compared with children. Among children and adolescents aged 2 to 19 years in 2003-2004, no significant difference in prevalence of overweight was found between the sexes.

Among adult men, no differences were found between racial/ethnic

groups (Table 6). However, Mexican American and non-Hispanic black women were significantly more likely to be obese compared with non-Hispanic white women. Older adults were more likely to be obese than their younger counterparts. The only exception was adults aged 80 years or older who were not significantly different from adults aged 20 to 39 years (for both sexes). In 2003-2004, there was no significant difference in the prevalence of obesity in adults between the sexes.

Table 2. Prevalence of At Risk of Overweight and Overweight in Children and Adolescents by Age and Racial/Ethnic Group for 1999-2000, 2001-2002, and 2003-2004*

| | Prevalence of Risk of Overweight or Overweight for Both Sexes by Age, % (SE) | | | |
|--------------------------------------|--|------------|------------|------------|
| | All (2-19 y) | 2-5 y | 6-11 y | 12-19 y |
| All† | | | | |
| At risk of overweight or overweight‡ | | | | |
| 1999-2000 | 28.2 (1.5) | 22.0 (1.9) | 29.8 (2.7) | 30.0 (1.4) |
| 2001-2002 | 30.0 (1.2) | 23.5 (2.5) | 32.2 (2.2) | 31.1 (1.4) |
| 2003-2004 | 33.6 (1.8) | 26.2 (2.1) | 37.2 (1.9) | 34.3 (2.6) |
| Overweight§ | | | | |
| 1999-2000 | 13.9 (0.9) | 10.3 (1.7) | 15.1 (1.4) | 14.8 (0.9) |
| 2001-2002 | 15.4 (0.9) | 10.6 (1.8) | 16.3 (1.6) | 16.7 (1.1) |
| 2003-2004 | 17.1 (1.2) | 13.9 (1.6) | 18.8 (1.3) | 17.4 (1.7) |
| Non-Hispanic white | | | | |
| At risk of overweight or overweight‡ | | | | |
| 1999-2000 | 25.1 (2.4) | 21.5 (2.6) | 26.0 (4.1) | 26.2 (2.1) |
| 2001-2002 | 27.6 (2.0) | 20.0 (3.2) | 30.2 (3.3) | 28.8 (2.1) |
| 2003-2004 | 33.5 (2.3) | 25.0 (2.8) | 36.9 (3.0) | 34.7 (3.3) |
| Overweight§ | | | | |
| 1999-2000 | 11.0 (1.3) | 8.7 (2.0) | 11.7 (1.8) | 11.4 (1.1) |
| 2001-2002 | 13.9 (1.5) | 8.7 (2.3) | 14.8 (2.3) | 15.2 (1.8) |
| 2003-2004 | 16.3 (1.8) | 11.5 (2.4) | 17.7 (2.3) | 17.3 (2.2) |
| Non-Hispanic black | | | | |
| At risk of overweight or overweight‡ | | | | |
| 1999-2000 | 34.3 (1.5) | 21.2 (3.3) | 35.8 (2.4) | 39.5 (2.0) |
| 2001-2002 | 31.8 (1.2) | 25.3 (3.1) | 31.9 (2.1) | 34.5 (1.8) |
| 2003-2004 | 35.1 (2.1) | 24.0 (3.1) | 40.0 (4.2) | 36.5 (2.4) |
| Overweight§ | | | | |
| 1999-2000 | 18.8 (1.0) | 8.7 (2.4) | 19.6 (1.5) | 23.1 (2.0) |
| 2001-2002 | 17.5 (1.1) | 8.6 (1.8) | 19.9 (2.3) | 19.3 (1.4) |
| 2003-2004 | 20.0 (1.1) | 13.0 (1.8) | 22.0 (2.0) | 21.8 (1.4) |
| Mexican American | | | | |
| At risk of overweight or overweight‡ | | | | |
| 1999-2000 | 36.6 (1.6) | 23.1 (3.0) | 38.8 (3.4) | 43.3 (3.1) |
| 2001-2002 | 37.0 (1.5) | 30.1 (4.3) | 39.4 (2.5) | 38.5 (1.9) |
| 2003-2004 | 37.0 (2.1) | 32.6 (4.7) | 42.9 (3.3) | 34.3 (1.5) |
| Overweight§ | | | | |
| 1999-2000 | 20.2 (1.4) | 10.9 (2.2) | 23.4 (2.1) | 23.2 (1.8) |
| 2001-2002 | 19.5 (1.3) | 15.9 (3.2) | 20.1 (2.8) | 21.1 (1.8) |
| 2003-2004 | 19.2 (1.8) | 19.2 (4.5) | 22.5 (2.4) | 16.3 (1.2) |

*Body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) was rounded to the nearest tenth. Pregnant females were excluded.

†Includes racial/ethnic groups not shown separately.

‡BMI for age at 85th percentile or higher.

§BMI for age at 95th percentile or higher.

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COMMENT

These estimates from the NHANES conducted in 2003-2004 provide the most recent prevalence estimates of overweight and obesity in the United States. Among children and adolescents aged 2 to 19 years, 17.1% were overweight and 32.2% of adults aged 20 years or older were obese. The prevalence of overweight among children and adolescents and obesity among men in-

creased significantly between 1999 and 2004. No increase in overall obesity prevalence among women was observed over the 6-year period.

Multivariable model results indicate that the only statistically significant trends were those noted overall for men and for children and adolescents. Trends did not differ significantly by age or racial/ethnic group. Although differences in point esti-

mates may appear large in some subgroups, the differences are not statistically significant. Subgroup estimates by sex, age, and race/ethnicity are less precise than the overall estimates. This is due to smaller sample sizes and fewer degrees of freedom than for the overall estimates. Future data from NHANES 2005-2006 should provide more information about changes in subgroups.

Table 3. Prevalence of At Risk of Overweight and Overweight in Children and Adolescents by Sex, Age, and Racial/Ethnic Group for 1999-2000, 2001-2002, and 2003-2004*

| | Prevalence of Risk of Overweight or Overweight by Age, % (SE) | | | | | | | |
|--------------------------------------|---|------------|------------|------------|--------------|------------|------------|------------|
| | Male | | | | Female | | | |
| | All (2-19 y) | 2-5 y | 6-11 y | 12-19 y | All (2-19 y) | 2-5 y | 6-11 y | 12-19 y |
| All† | | | | | | | | |
| At risk of overweight or overweight‡ | | | | | | | | |
| 1999-2000 | 28.9 (2.7) | 21.9 (3.6) | 31.9 (4.1) | 30.0 (2.2) | 27.4 (1.1) | 22.2 (2.6) | 27.4 (2.4) | 30.0 (2.3) |
| 2001-2002 | 30.6 (1.2) | 24.2 (3.0) | 32.6 (2.5) | 31.5 (2.1) | 29.4 (1.6) | 22.8 (2.7) | 31.6 (3.3) | 30.6 (1.6) |
| 2003-2004 | 34.8 (2.2) | 27.3 (2.8) | 36.5 (3.1) | 36.8 (2.9) | 32.4 (2.0) | 25.2 (2.8) | 38.0 (2.5) | 31.7 (3.0) |
| Overweight§ | | | | | | | | |
| 1999-2000 | 14.0 (1.2) | 9.5 (2.3) | 15.7 (1.8) | 14.8 (1.3) | 13.8 (1.1) | 11.2 (2.5) | 14.3 (2.1) | 14.8 (1.0) |
| 2001-2002 | 16.4 (1.0) | 10.7 (2.4) | 17.5 (1.9) | 17.6 (1.3) | 14.4 (1.3) | 10.5 (1.8) | 14.9 (2.4) | 15.7 (1.9) |
| 2003-2004 | 18.2 (1.5) | 15.1 (1.7) | 19.9 (2.0) | 18.3 (1.9) | 16.0 (1.4) | 12.6 (2.4) | 17.6 (1.3) | 16.4 (2.3) |
| Non-Hispanic white | | | | | | | | |
| At risk of overweight or overweight‡ | | | | | | | | |
| 1999-2000 | 26.6 (4.3) | 21.7 (4.7) | 28.5 (6.9) | 27.4 (3.4) | 23.5 (1.6) | 21.3 (3.4) | 23.2 (3.6) | 24.8 (3.4) |
| 2001-2002 | 28.4 (2.2) | 21.4 (4.4) | 29.3 (3.7) | 30.2 (3.1) | 26.9 (2.2) | 18.9 (3.0) | 31.1 (4.4) | 27.3 (2.3) |
| 2003-2004 | 35.4 (2.7) | 26.6 (4.0) | 35.6 (5.2) | 38.7 (3.6) | 31.5 (2.6) | 23.5 (3.8) | 38.2 (4.0) | 30.4 (3.9) |
| Overweight§ | | | | | | | | |
| 1999-2000 | 10.8 (1.5) | 6.9 (2.5) | 11.9 (2.0) | 11.8 (1.7) | 11.1 (1.8) | 10.5 (3.6) | 11.6 (2.9) | 11.0 (1.8) |
| 2001-2002 | 15.0 (1.5) | 9.6 (3.0) | 15.5 (2.2) | 16.6 (2.0) | 12.7 (1.9) | 7.9 (2.1) | 14.1 (3.5) | 13.7 (2.8) |
| 2003-2004 | 17.8 (2.2) | 13.0 (3.3) | 18.5 (3.9) | 19.1 (2.7) | 14.8 (1.9) | 10.0 (3.1) | 16.9 (1.9) | 15.4 (2.9) |
| Non-Hispanic black | | | | | | | | |
| At risk of overweight or overweight‡ | | | | | | | | |
| 1999-2000 | 31.0 (1.9) | 15.2 (3.4) | 35.0 (3.6) | 35.6 (2.5) | 37.9 (2.1) | 27.9 (4.8) | 36.7 (3.4) | 43.7 (2.9) |
| 2001-2002 | 27.0 (1.4) | 26.6 (3.8) | 25.3 (2.6) | 28.7 (3.2) | 36.8 (1.7) | 24.0 (3.9) | 38.9 (4.4) | 40.6 (2.0) |
| 2003-2004 | 30.4 (2.7) | 21.0 (3.8) | 34.5 (5.3) | 31.4 (3.0) | 40.0 (1.9) | 27.0 (3.3) | 45.6 (4.0) | 42.1 (2.3) |
| Overweight§ | | | | | | | | |
| 1999-2000 | 16.3 (1.2) | NA | 17.1 (2.5) | 21.0 (2.5) | 21.4 (1.4) | 11.7 (2.6) | 22.4 (2.3) | 25.2 (2.7) |
| 2001-2002 | 15.5 (1.3) | 9.7 (2.2) | 16.9 (1.8) | 16.7 (2.5) | 19.7 (1.4) | 7.5 (2.3) | 23.1 (4.2) | 22.0 (2.4) |
| 2003-2004 | 16.4 (1.5) | 9.7 (2.7) | 17.5 (3.0) | 18.5 (1.6) | 23.8 (1.4) | 16.3 (3.7) | 26.5 (2.8) | 25.4 (2.0) |
| Mexican American | | | | | | | | |
| At risk of overweight or overweight‡ | | | | | | | | |
| 1999-2000 | 39.0 (2.1) | 26.8 (3.4) | 42.3 (4.3) | 43.6 (2.5) | 34.2 (2.2) | 19.3 (3.9) | 35.0 (4.0) | 42.9 (4.5) |
| 2001-2002 | 39.9 (2.0) | 28.3 (5.4) | 46.0 (3.7) | 40.2 (2.9) | 33.9 (2.2) | 31.8 (6.6) | 32.2 (3.3) | 36.7 (2.8) |
| 2003-2004 | 41.4 (1.9) | 38.3 (5.9) | 47.9 (3.1) | 37.3 (2.2) | 32.2 (2.5) | 26.7 (4.1) | 37.4 (5.0) | 31.1 (2.8) |
| Overweight§ | | | | | | | | |
| 1999-2000 | 23.5 (1.5) | 13.1 (2.3) | 26.7 (2.9) | 27.2 (3.1) | 16.8 (1.9) | 8.7 (3.4) | 19.8 (2.4) | 19.3 (2.7) |
| 2001-2002 | 22.0 (1.3) | 15.4 (3.6) | 26.0 (2.9) | 21.8 (2.4) | 17.0 (1.9) | 16.3 (5.9) | 13.6 (3.2) | 20.3 (2.8) |
| 2003-2004 | 22.0 (1.6) | 23.2 (5.1) | 25.3 (2.2) | 18.3 (1.7) | 16.2 (2.3) | 15.1 (5.0) | 19.4 (3.9) | 14.1 (2.0) |

Abbreviation: NA, data not available.

*Body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) was rounded to the nearest tenth. Pregnant females were excluded.

†Includes racial/ethnic groups not shown separately.

‡BMI for age at 85th percentile or higher.

§BMI for age at 95th percentile or higher.

||Does not meet standard of statistical reliability and precision. Relative SE was greater than 30% but less than 40%.

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Table 4. Prevalence of Overweight, Obesity, and Extreme Obesity in Adults by Age and Racial/Ethnic Group for 1999-2000, 2001-2002, and 2003-2004*

| | Prevalence of Overweight, Obesity, or Extreme Obesity for Both Sexes by Age, % (SE) | | | |
|---------------------------|---|------------|------------|------------|
| | All (≥20 y) | 20-39 y | 40-59 y | ≥60 y |
| All† | | | | |
| Overweight or obesity‡ | | | | |
| 1999-2000 | 64.5 (1.6) | 57.6 (1.8) | 68.0 (2.7) | 70.8 (1.4) |
| 2001-2002 | 65.7 (0.6) | 57.2 (1.6) | 71.1 (1.2) | 71.5 (1.9) |
| 2003-2004 | 66.3 (1.1) | 57.1 (1.6) | 73.1 (1.8) | 71.0 (1.5) |
| Obesity§ | | | | |
| 1999-2000 | 30.5 (1.5) | 26.0 (1.3) | 33.5 (3.0) | 33.5 (1.7) |
| 2001-2002 | 30.6 (1.1) | 26.1 (1.4) | 33.9 (1.5) | 33.1 (1.5) |
| 2003-2004 | 32.2 (1.2) | 28.5 (1.5) | 36.8 (1.8) | 31.0 (1.3) |
| Extreme obesity | | | | |
| 1999-2000 | 4.7 (0.6) | 4.5 (0.6) | 5.8 (1.2) | 3.4 (0.6) |
| 2001-2002 | 5.1 (0.5) | 4.8 (0.5) | 5.8 (0.8) | 4.7 (0.6) |
| 2003-2004 | 4.8 (0.6) | 5.4 (0.8) | 5.4 (0.8) | 3.0 (0.6) |
| Non-Hispanic white | | | | |
| Overweight or obesity‡ | | | | |
| 1999-2000 | 62.3 (2.3) | 55.2 (3.2) | 65.4 (3.7) | 69.7 (1.6) |
| 2001-2002 | 64.1 (0.9) | 54.0 (2.2) | 70.1 (1.6) | 71.8 (2.5) |
| 2003-2004 | 64.2 (1.6) | 52.5 (2.1) | 72.5 (2.6) | 71.1 (1.7) |
| Obesity§ | | | | |
| 1999-2000 | 28.7 (1.8) | 23.2 (1.7) | 31.4 (3.8) | 33.8 (1.8) |
| 2001-2002 | 30.2 (1.2) | 24.5 (1.8) | 34.3 (1.5) | 33.6 (1.8) |
| 2003-2004 | 30.6 (1.3) | 25.5 (1.7) | 36.7 (2.1) | 29.7 (1.3) |
| Extreme obesity | | | | |
| 1999-2000 | 4.0 (0.7) | 3.5 (0.8) | 5.0 (1.4) | 3.1 (0.9) |
| 2001-2002 | 4.9 (0.5) | 4.1 (0.6) | 6.0 (0.8) | 4.6 (0.7) |
| 2003-2004 | 4.3 (0.7) | 4.8 (0.8) | 4.6 (1.1) | 2.8 (0.7) |
| Non-Hispanic black | | | | |
| Overweight or obesity‡ | | | | |
| 1999-2000 | 69.7 (1.0) | 62.2 (2.7) | 73.7 (1.9) | 76.3 (2.5) |
| 2001-2002 | 71.7 (1.6) | 64.5 (2.7) | 74.3 (3.2) | 80.0 (2.4) |
| 2003-2004 | 76.1 (1.5) | 69.7 (2.5) | 81.2 (2.2) | 78.8 (1.7) |
| Obesity§ | | | | |
| 1999-2000 | 39.8 (1.6) | 36.8 (2.8) | 42.8 (2.8) | 40.2 (3.2) |
| 2001-2002 | 39.0 (1.8) | 35.8 (3.0) | 39.4 (1.9) | 44.0 (3.9) |
| 2003-2004 | 45.0 (2.2) | 41.9 (3.7) | 48.4 (2.9) | 44.9 (4.3) |
| Extreme obesity | | | | |
| 1999-2000 | 9.8 (1.0) | 8.7 (1.5) | 11.0 (1.7) | 9.7 (1.9) |
| 2001-2002 | 8.1 (1.2) | 7.7 (2.3) | 8.1 (2.1) | 8.8 (2.5) |
| 2003-2004 | 10.5 (0.8) | 11.7 (1.7) | 11.8 (1.1) | 6.6 (1.4) |
| Mexican American | | | | |
| Overweight or obesity‡ | | | | |
| 1999-2000 | 73.4 (1.9) | 64.9 (2.9) | 79.2 (3.4) | 78.5 (3.6) |
| 2001-2002 | 71.4 (2.1) | 62.2 (3.1) | 81.9 (1.9) | 70.4 (3.7) |
| 2003-2004 | 75.8 (2.6) | 71.2 (4.0) | 79.4 (3.9) | 78.1 (2.6) |
| Obesity§ | | | | |
| 1999-2000 | 34.4 (2.4) | 30.5 (3.2) | 38.0 (4.0) | 35.6 (3.7) |
| 2001-2002 | 31.0 (2.1) | 23.6 (2.2) | 40.6 (3.5) | 28.4 (2.7) |
| 2003-2004 | 36.8 (1.8) | 34.0 (3.5) | 39.8 (3.5) | 36.9 (1.8) |
| Extreme obesity | | | | |
| 1999-2000 | 3.9 (0.6) | 3.4 (0.9) | 4.7 (1.8)¶ | 3.5 (0.5) |
| 2001-2002 | 4.5 (1.1) | 3.6 (1.2)¶ | 6.3 (1.9) | 3.3 (0.7) |
| 2003-2004 | 4.5 (0.7) | 4.7 (1.1) | 4.7 (1.4) | 3.9 (1.1) |

*Body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) was rounded to the nearest tenth. Pregnant women were excluded. Estimates for ages ≥20 years were age standardized by the direct method to the 2000 US Census population using the age groups of 20 to 39 years, 40 to 59 years, and 60 years or older.

†Includes racial/ethnic groups not shown separately.

‡Defined as BMI of 25 or higher.

§Defined as BMI of 30 or higher.

||Defined as BMI of 40 or higher.

¶Does not meet standard of statistical reliability and precision. Relative SE was greater than 30% but less than 40%.

OVERWEIGHT AND OBESITY AMONG CHILDREN, ADOLESCENTS, AND ADULTS

Table 5. Prevalence of Overweight, Obesity, and Extreme Obesity in Adults by Sex, Age, and Racial/Ethnic Group for 1999-2000, 2001-2002, and 2003-2004*

| | Prevalence of Overweight, Obesity, or Extreme Obesity by Age, % (SE) | | | | | | | |
|------------------------|--|------------|------------|------------|-------------|------------|------------|-------------|
| | Men | | | | Women | | | |
| | All (≥20 y) | 20-39 y | 40-59 y | ≥60 y | All (≥20 y) | 20-39 y | 40-59 y | ≥60 y |
| All† | | | | | | | | |
| Overweight or obesity‡ | | | | | | | | |
| 1999-2000 | 67.2 (1.7) | 60.5 (2.2) | 70.0 (3.1) | 74.1 (1.5) | 61.9 (2.3) | 54.4 (2.5) | 66.1 (3.4) | 68.1 (2.4) |
| 2001-2002 | 70.0 (1.0) | 59.7 (1.8) | 78.2 (1.4) | 74.4 (1.7) | 61.4 (1.1) | 54.7 (2.1) | 63.7 (1.9) | 69.2 (2.5) |
| 2003-2004 | 70.8 (1.4) | 62.2 (2.1) | 78.2 (2.8) | 73.7 (1.4) | 61.8 (1.9) | 51.7 (2.6) | 68.1 (3.1) | 68.9 (2.3) |
| Obesity§ | | | | | | | | |
| 1999-2000 | 27.5 (1.5) | 23.7 (1.6) | 28.8 (2.9) | 31.8 (2.2) | 33.4 (1.7) | 28.3 (2.0) | 37.8 (3.3) | 35.0 (2.2) |
| 2001-2002 | 27.8 (1.0) | 22.3 (1.5) | 32.2 (1.7) | 30.2 (1.9) | 33.3 (1.5) | 29.8 (2.1) | 35.7 (2.1) | 35.2 (2.0) |
| 2003-2004 | 31.1 (1.3) | 28.0 (2.2) | 34.8 (2.5) | 30.4 (1.9) | 33.2 (1.7) | 28.9 (2.3) | 38.8 (2.7) | 31.5 (1.7) |
| Extreme obesity | | | | | | | | |
| 1999-2000 | 3.1 (0.7) | 3.0 (0.8) | 4.0 (1.1) | 1.8 (0.6)¶ | 6.3 (0.7) | 6.0 (0.8) | 7.5 (1.6) | 4.7 (0.8) |
| 2001-2002 | 3.6 (0.6) | 4.5 (1.0) | 3.8 (1.0) | 1.8 (0.6)¶ | 6.5 (0.6) | 5.0 (0.7) | 7.9 (1.3) | 6.8 (1.0) |
| 2003-2004 | 2.8 (0.4) | 3.1 (0.7) | 2.7 (0.7) | 2.5 (0.6) | 6.9 (0.9) | 8.0 (1.5) | 7.9 (1.4) | 3.3 (0.7) |
| Non-Hispanic white | | | | | | | | |
| Overweight or obesity‡ | | | | | | | | |
| 1999-2000 | 67.4 (2.3) | 61.0 (3.9) | 69.9 (3.8) | 74.3 (1.8) | 57.3 (3.3) | 49.0 (4.1) | 61.0 (4.9) | 65.8 (2.8) |
| 2001-2002 | 70.9 (1.2) | 58.8 (2.4) | 80.4 (1.7) | 76.3 (2.2) | 57.3 (1.4) | 49.2 (2.6) | 59.1 (2.6) | 68.2 (3.2) |
| 2003-2004 | 70.6 (1.8) | 59.3 (3.1) | 79.6 (3.0) | 75.4 (1.5) | 58.0 (2.7) | 45.6 (3.5) | 65.3 (4.4) | 67.6 (2.6) |
| Obesity§ | | | | | | | | |
| 1999-2000 | 27.3 (1.8) | 22.0 (2.4) | 28.5 (3.4) | 34.3 (2.8) | 30.1 (2.1) | 24.4 (2.6) | 34.2 (4.6) | 33.3 (2.2) |
| 2001-2002 | 29.1 (1.3) | 23.9 (2.2) | 33.2 (1.9) | 31.5 (1.9) | 31.3 (1.6) | 25.2 (2.3) | 35.4 (2.1) | 35.2 (2.8) |
| 2003-2004 | 31.1 (1.5) | 27.2 (2.9) | 35.6 (3.2) | 30.6 (2.2) | 30.2 (2.1) | 23.8 (3.1) | 37.8 (3.3) | 28.9 (1.5) |
| Extreme obesity | | | | | | | | |
| 1999-2000 | 3.0 (0.7) | 2.4 (0.9)¶ | 4.3 (1.4)¶ | NA | 4.9 (0.8) | 4.8 (1.2) | 5.7 (1.9)¶ | 4.0 (1.1) |
| 2001-2002 | 3.7 (0.8) | 4.6 (1.2) | 4.1 (1.2) | NA | 6.0 (0.6) | 3.5 (0.7) | 8.0 (1.4) | 7.0 (1.3) |
| 2003-2004 | 2.8 (0.6) | 3.2 (1.0) | 2.3 (0.9)¶ | 2.9 (0.8) | 5.8 (1.1) | 6.4 (1.6) | 7.0 (1.8) | 2.7 (0.7) |
| Non-Hispanic black | | | | | | | | |
| Overweight or obesity‡ | | | | | | | | |
| 1999-2000 | 60.7 (1.3) | 52.6 (3.8) | 63.9 (2.8) | 69.1 (3.8) | 77.4 (1.8) | 71.2 (4.0) | 81.5 (2.2) | 81.5 (3.4) |
| 2001-2002 | 64.9 (2.6) | 57.8 (3.9) | 66.3 (5.0) | 74.7 (2.3) | 77.5 (2.1) | 70.1 (3.4) | 81.4 (3.1) | 83.7 (4.3) |
| 2003-2004 | 69.1 (3.0) | 65.0 (4.7) | 73.1 (4.1) | 69.8 (3.2) | 81.6 (1.8) | 73.7 (2.9) | 88.0 (2.9) | 84.8 (2.1) |
| Obesity§ | | | | | | | | |
| 1999-2000 | 28.1 (1.7) | 27.4 (2.7) | 29.9 (3.3) | 26.4 (4.0) | 49.5 (3.0) | 45.6 (3.9) | 53.2 (3.2) | 50.2 (7.1) |
| 2001-2002 | 27.9 (2.0) | 22.2 (2.9) | 30.0 (3.1) | 34.2 (4.4) | 48.2 (2.7) | 47.2 (3.8) | 47.8 (3.1) | 50.8 (6.5) |
| 2003-2004 | 34.0 (3.5) | 32.3 (4.1) | 37.6 (3.0) | 31.1 (6.6) | 53.9 (3.0) | 50.3 (4.6) | 57.5 (4.4) | 54.0 (5.1) |
| Extreme obesity | | | | | | | | |
| 1999-2000 | 3.5 (0.9) | 4.5 (1.6)¶ | 3.7 (1.4)¶ | NA | 15.0 (2.0) | 12.7 (2.1) | 17.0 (3.3) | 15.7 (3.3) |
| 2001-2002 | 3.5 (0.8) | NA | NA | NA | 11.9 (1.5) | 10.8 (3.2) | 13.2 (3.3) | 11.8 (3.9)¶ |
| 2003-2004 | 5.4 (1.1) | 7.1 (1.4) | 6.2 (1.9)¶ | NA | 14.7 (1.3) | 15.7 (2.7) | 16.5 (2.3) | 10.2 (2.0) |
| Mexican American | | | | | | | | |
| Overweight or obesity‡ | | | | | | | | |
| 1999-2000 | 74.7 (2.9) | 67.5 (3.8) | 79.1 (4.9) | 79.6 (2.4) | 71.9 (2.4) | 61.6 (3.5) | 79.3 (3.3) | 77.5 (4.9) |
| 2001-2002 | 71.3 (2.2) | 62.6 (3.9) | 81.5 (2.2) | 70.0 (5.8) | 71.5 (2.8) | 61.8 (5.1) | 82.3 (3.3) | 70.8 (4.6) |
| 2003-2004 | 76.1 (3.2) | 72.6 (5.8) | 79.1 (4.6) | 77.2 (3.5) | 75.4 (2.5) | 69.3 (3.9) | 79.7 (4.0) | 78.9 (2.5) |
| Obesity§ | | | | | | | | |
| 1999-2000 | 28.9 (1.9) | 30.4 (3.1) | 27.0 (3.7) | 29.7 (3.9) | 39.7 (3.8) | 30.6 (5.7) | 48.5 (4.8) | 41.0 (4.2) |
| 2001-2002 | 25.9 (2.0) | 17.4 (3.2) | 34.8 (3.7) | 25.9 (3.2) | 37.0 (3.2) | 31.6 (5.3) | 47.1 (4.2) | 30.2 (4.1) |
| 2003-2004 | 31.6 (2.5) | 32.7 (4.9) | 31.8 (5.3) | 29.5 (3.7) | 42.3 (2.7) | 35.7 (3.6) | 48.3 (4.9) | 43.8 (3.1) |
| Extreme obesity | | | | | | | | |
| 1999-2000 | 2.4 (0.4) | NA | 3.4 (1.1)¶ | NA | 5.5 (0.8) | 5.7 (1.1) | NA | 4.6 (1.1) |
| 2001-2002 | 3.3 (1.3)¶ | NA | 5.4 (2.0)¶ | NA | 5.8 (1.6) | NA | 7.4 (2.8)¶ | 4.7 (1.2) |
| 2003-2004 | 1.7 (0.6)¶ | 1.9 (0.6) | NA | NA | 7.8 (1.2) | 8.6 (2.3) | 7.8 (2.7)¶ | 6.5 (2.2)¶ |

Abbreviation: NA, data not shown, do not meet standard of statistical reliability and precision, relative SE was 40% or greater.

*Body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) was rounded to the nearest tenth. Pregnant women were excluded. Estimates for ages were standardized by the direct method to the 2000 US Census population using the age groups of 20 to 39 years, 40 to 59 years, and 60 years or older.

†Includes racial/ethnic groups not shown separately.

‡Defined as BMI of 25 or higher.

§Defined as BMI of 30 or higher.

||Defined as BMI of 40 or higher.

¶Does not meet standard of statistical reliability and precision. Relative SE was greater than 30% but less than 40%.

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Table 6. Logistic Regression of Overweight in Children and Adolescents and Obesity in Adults*

| | Odds Ratio (95% Confidence Interval) | |
|---|--------------------------------------|------------------|
| | Male | Female |
| Overweight in Children and Adolescents | | |
| Race/ethnicity | | |
| Non-Hispanic white | 1.00 | 1.00 |
| Mexican American | 1.73 (1.42-2.10) | 1.56 (1.29-1.88) |
| Non-Hispanic black | 1.13 (0.91-1.40) | 1.46 (1.22-1.73) |
| Age, y | | |
| 2-5 | 1.00 | 1.00 |
| 6-11 | 1.63 (1.24-2.14) | 1.53 (1.23-1.90) |
| 12-19 | 1.56 (1.20-2.03) | 1.50 (1.24-1.83) |
| Obesity in Adults | | |
| Race/ethnicity | | |
| Non-Hispanic white | 1.00 | 1.00 |
| Mexican American | 1.02 (0.87-1.20) | 1.31 (1.11-1.55) |
| Non-Hispanic black | 0.99 (0.86-1.15) | 2.01 (1.76-2.29) |
| Age, y | | |
| 20-39 | 1.00 | 1.00 |
| 40-59 | 2.51 (2.17-2.89) | 2.95 (2.55-3.42) |
| 60-79 | 2.65 (2.27-3.08) | 2.95 (2.57-3.39) |
| ≥80 | 0.86 (0.66-1.11) | 1.20 (0.93-1.56) |

*Adjusted for National Health and Nutrition Examination Survey period (1999-2000, 2001-2002, 2003-2004).

Increases in prevalence of overweight and obesity among both adults and children have been observed in many countries throughout the world.^{10,11} For example, the prevalence of obesity among adults in Great Britain almost tripled between 1980 and 2002.¹² Among preschool children in urban areas of China, the prevalence of obesity increased from 1.5% in 1989 to 12.6% in 1997.¹³

Similar to previous analyses,^{4,5} there continues to be differences in overweight and obesity prevalence by racial/ethnic group among women and among children and adolescents. Among women, almost 58% of non-Hispanic black women aged 40 to 59 years were obese in 2003-2004 compared with about 38% of non-Hispanic white women of the same age. Among men, however, the prevalence of obesity did not differ by racial/ethnic group. Among children and adolescents, differences by racial/ethnic group exist for both sexes. These racial/ethnic group differences in

female children and adolescents were observed in 1988-1994 but these differences were not observed among male adolescents in 1988-1994.⁴

The prevalence of overweight and obesity in the United States remains high. The prevalence of obesity has continued to increase in men and the prevalence of overweight has continued to increase in children and adolescents between 1999 and 2004. However, no significant increases were observed among women. There is little indication that the prevalence is decreasing in any subgroup of the population. These prevalence estimates, based on a 6-year period (1999-2004), suggest that the increases in body weight may be leveling off in women.

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Study concept and design: Ogden, Curtin, Tabak, Flegal.
Acquisition of data: McDowell.
Analysis and interpretation of data: Ogden, Carroll, Curtin, Flegal.

Drafting of the manuscript: Ogden, Flegal.
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REFERENCES

1. National Task Force on the Prevention and Treatment of Obesity. Overweight, obesity, and health risk. *Arch Intern Med.* 2000;160:898-904.
2. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess deaths associated with underweight, overweight, and obesity. *JAMA.* 2005;293:1861-1867.
3. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. *JAMA.* 2002;288:1723-1727.
4. Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA.* 2002;288:1728-1732.
5. Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA.* 2004;291:2847-2850.
6. Centers for Disease Control and Prevention. National Health and Nutrition Examination Survey. Available at: <http://www.cdc.gov/nchs/about/major/nhanes/datalink.htm>. Accessibility verified February 27, 2006.
7. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC growth charts for the United States: methods and development. *Vital Health Stat 11.* 2002;(246):1-190.
8. Himes JH, Dietz WH; Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services. Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. *Am J Clin Nutr.* 1994;59:307-316.
9. National Institutes of Health. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report [published correction appears in *Obes Res.* 1998;6:464]. *Obes Res.* 1998;6(suppl 2):51S-209S.
10. Silventoinen K, Sans S, Tolonen H, et al; WHO MONICA Project. Trends in obesity and energy supply in the WHO MONICA Project. *Int J Obes Relat Metab Disord.* 2004;28:710-718.
11. Wang Y, Monteiro C, Popkin BM. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *Am J Clin Nutr.* 2002;75:971-977.
12. Rennie KL, Jebb SA. Prevalence of obesity in Great Britain. *Obes Rev.* 2005;6:11-12.
13. Luo J, Hu FB. Time trends of obesity in preschool children in China from 1989 to 1997. *Int J Obes Relat Metab Disord.* 2002;26:553-558.