TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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8. BODY-WEIGHT STUDIES

8.1. INTRODUCTION

There are several physiological factors needed to calculate potential exposures. These include skin surface area (see Chapter 7), inhalation rate (see Chapter 6) life expectancy (see Chapter 18), and body weight. The average daily dose (ADD) is a dose that is typically normalized to the average body weight of the exposed population. If exposure occurs only during childhood years, the average child body weight during the exposure period should be used to estimate risk (U.S. EPA, 1989). Conversely, if adult exposures are being evaluated, an adult body-weight value should be used.

The purpose of this chapter is to describe published studies on body weight in the general U.S. population. The recommendations for body weight are provided in the next section, along with a summary of the confidence ratings for these recommendations. The recommended values are based on one key study identified by U.S. Environmental Protection Agency (EPA) for this factor. Following the recommendations, the key study on body weight is summarized. Relevant data on body weight are also provided. These relevant data are included because they may be useful for trend analysis. Since obesity is a growing concern and may increase the risk of chronic diseases during adulthood, information on body mass index (BMI) and height is also provided.

8.2. RECOMMENDATIONS

The key study described in this section was used in selecting recommended values for body weight. The recommendations for body weight are summarized in Table 8-1 and are based on data derived from the National Health and Nutrition Examination Survey (NHANES) 1999−2006. The recommended values represent mean body weights in kilograms for the age groups for children recommended by U.S. EPA in *Guidance for Monitoring and Assessing Childhood Exposures to Environmental Contaminants* (U.S. EPA, 2005) and for adults. Table 8-2 presents the confidence ratings for the body-weight recommendations.

Table 8-1 shows the mean body weight for all adults (male and female, all age groups) combined is 80 kg. Section 8.3 presents percentile data.

The mean recommended value for adults (80 kg) is different from the 70 kg commonly assumed in U.S. EPA risk assessments. Assessors are encouraged to use values that most accurately reflect the exposed population. When using values other than 70 kg, however, the assessors should consider if the dose estimate will be used to estimate risk by combining it with a dose-response relationship that was derived assuming a body weight of 70 kg. If such an inconsistency exists, the assessor may need to adjust the dose-response relationship as described in the appendix to Chapter 1.

Use of upper percentile body-weight values are not routinely recommended for calculating ADDs because inclusion of an upper percentile value in the denominator of the ADD equation would be a non-conservative approach. However, Section 8.3 provides distributions of body-weight data. These distributions may be useful if probabilistic methods are used to assess exposure. Also, if sex-specific data are needed, or if data for finer age bins are needed, the reader should refer to the tables in Section 8.3.

Table 8-1. Recommended Values for Body Weight

Age Group	Mean (kg)	Multiple Percentiles	Source
Birth to <1 month	4.8	Table 8-3 through Table 8-5	U.S. EPA analysis of NHANES, 1999−2006 data
1 to <3 months	5.9		
3 to <6 months	7.4		
6 to <11 months	9.2		
1 to <2 years	11.4		
2 to <3 years	13.8		
3 to <6 years	18.6		
6 to <11 years	31.8		
11 to <16 years	56.8		
16 to <21 years	71.6		
Adults	80.0		

Table 8-2. Confidence in Recommendations for Body Weight

General Assessment Factors	Rationale	Rating
Soundness		High
Adequacy of Approach	The survey methodology and the secondary data analysis were adequate. NHANES consisted of a large sample size; sample size varied with age. Direct measurements were taken during a physical examination.	
Minimal (or Defined) Bias	No significant biases were apparent.	
Applicability and Utility		High
Exposure Factor of Interest	The key study is directly relevant to body weight.	
Representativeness	NHANES was a nationally representative sample of the U.S. population; participants are selected using a complex, stratified, multi-stage probability cluster sampling design.	
Currency	The U.S. EPA analysis used the most current NHANES data.	
Data Collection Period	The U.S. EPA analysis was based on four data sets of NHANES data covering 1999−2006.	
Clarity and Completeness		High
Accessibility	NHANES data are available from NCHS.	
Reproducibility	The methods used were well-described; enough information was provided to allow for reproduction of results.	
Quality Assurance	NHANES follows a strict QA/QC procedures; the U.S. EPA analysis has only been reviewed internally.	
Variability and Uncertainty		High
Variability in Population	The full distributions were given in the key study.	
Uncertainty	No significant biases were apparent in the NHANES data, nor in the secondary analyses of the data.	
Evaluation and Review		Medium
Peer Review	NHANES received a high level of peer review. The U.S. EPA analysis was not published in a peer-reviewed journal.	
Number and Agreement of Studies	The number of studies is 1.	
Overall Rating		**High**

8.3. KEY BODY-WEIGHT STUDY

8.3.1. U.S. EPA Analysis of NHANES 1999−2006 Data

The U.S. EPA analyzed data from the 1999−2006 NHANES to generate distributions of body weight for various age ranges of children and adults. NHANES is conducted annually by the Center for Disease Control (CDC), National Center of Health Statistics (NCHS). The survey's target population is the civilian, non-institutionalized U.S. population. The NHANES 1999−2006 survey was conducted on a nationwide probability sample of approximately 40,000 persons for all ages, of which approximately 20,000 were children. The survey is designed to obtain nationally representative information on the health and nutritional status of the population of the United States through interviews and direct physical examinations. A number of anthropometric measurements, including body weight, were taken for each participant in the study. Unit non-response to the household interview was 19%, and an additional 4% did not participate in the physical examinations (including body-weight measurements).

The NHANES 1999−2006 survey includes over-sampling of low-income persons, adolescents 12−19 years, persons 60+ years of age, African Americans and Mexican Americans. Sample data were assigned weights to account both for the disparity in sample sizes for these groups and for other inadequacies in sampling, such as the presence of non-respondents. Because the U.S. EPA utilized four NHANES data sets in its analysis (NHANES 1999−2000, 2001−2002, 2003−2004, and 2005−2006) sample weights were developed for the combined data set in accordance with CDC guidance from the NHANES' website (http://www.cdc.gov/nchs/about/major/nhanes/nhanes2005-2006/faqs05_06.htm#question%2012).

Using the data and the weighting factors from the four NHANES data sets, U.S. EPA calculated body-weight statistics for the standard age categories. The mean value for a given group was calculated using the following formula:

$$\bar{x} = \frac{\sum_i w_i x_i}{\sum_i w_i} \qquad \text{(Eqn. 8-1)}$$

where:

x = sample mean,
x_i = the i^{th} observation, and
w_i = sample weight assigned to observation x_i.

Percentile values were generated by first calculating the sum of the sample weights for all observations in a given group and multiplying this sum by the percentile of interest (e.g., multiplying by 0.25 to determine the 25th percentile). The observations were then ordered from least to greatest, and each observation was assigned a cumulative sample weight, equal to its own sample weight plus all sample weights listed before the observation. The 1st observation listed with a cumulative sample weight greater than the value calculated for the percentile of interest was selected.

Table 8-3 presents the body-weight means and percentiles, by age category, for males and females combined. Table 8-4 and Table 8-5 present the body-weight means and percentiles for males and females, respectively.

The advantage of this study is that it provides body-weight distributions ranging from infancy to adults. A limitation of the study is that combining the data from various years of NHANES beginning in 1999 through 2006 may underestimate current body weights due to an observed upward trend in body weights (Ogden et al., 2004). However, these data are based on the most recent available NHANES data. The NHANES data are nationally representative and remain the principal source of body-weight data collected nationwide from a large number of subjects.

8.4. RELEVANT GENERAL POPULATION BODY-WEIGHT STUDIES

8.4.1. Najjar and Rowland (1987)—Anthropometric Reference Data and Prevalence of Overweight, United States, 1976−1980

Najjar and Rowland (1987) collected anthropometric measurement data for body weight for the U.S. population as part of the 2nd National Health and Nutrition Examination Survey (NHANES II). NHANES II began in February 1976 and was completed in February 1980. The survey was conducted on a nationwide probability sample of 27,801 persons aged six months to 74 years from the civilian, non-institutionalized population of the United States. A total of 20,322 individuals in the sample were interviewed and examined, resulting in a response rate of 73.1%. The sample was selected so that certain subgroups thought to be at high risk of malnutrition (persons with low incomes, preschool

children, and the elderly) were over sampled. The estimates were weighted to reflect national population estimates. The weighting was accomplished by inflating examination results for each subject by the reciprocal of selection probabilities, adjusting to account for those who were not examined, and post-stratifying by race, age, and sex.

NHANES II collected standard body measurements of sample subjects, including height and weight, that were made at various times of the day and in different seasons of the year. This technique was used because an individual's weight may vary between winter and summer and may fluctuate with patterns of food and water intake and other daily activities (Najjar and Rowland, 1987). Najjar and Rowland (1987) provided descriptive statistics of the body-weight data. Table 8-6 and Table 8-7 present means and percentiles, by age category, for males and females, respectively. Although the NHANES data are nationally representative, a limitation of the study is the age of the data used.

8.4.2. Brainard and Burmaster (1992)—Bivariate Distributions for Height and Weight of Men and Women in the United States

Brainard and Burmaster (1992) examined data on the height and weight of adults published by the U.S. Public Health Service and fit bivariate distributions to the tabulated values for men and women, separately. Height and weight of 5,916 men and 6,588 women in the age range of 18 to 74 years were taken from the NHANES II (1976−1980) study and statistically adjusted to represent the U.S. population aged 18 to 74 years with regard to age structure, sex, and race. Estimation techniques were used to fit normal distributions to the cumulative marginal data, and goodness-of-fit tests were used to test the hypothesis that height and lognormal weight follow a normal distribution for each sex. It was found that the marginal distributions of height and lognormal weight for both men and women are Gaussian (normal) in form. This conclusion was reached by visual observation and the high R^2 values for best-fit lines obtained using linear regression. The R^2 values for men's height and lognormal weight were reported to be 0.999. The R^2 values for women's height and lognormal weight were reported as 0.999 and 0.985, respectively.

Brainard and Burmaster (1992) fit bivariate distributions to estimated numbers of men and women aged 18 to 74 years in cells representing one-inch height intervals and 10-pound weight intervals. Adjusted height and lognormal weight data for men were fit to a single bivariate normal distribution with an estimated mean height of 1.75 meters (69.2 inches) and an estimated mean weight of 78.6 kg (173.2 pounds). For women, height and lognormal weight data were fit to a pair of superimposed bivariate normal distributions (Brainard and Burmaster, 1992). The average height and weight for women were estimated from the combined bivariate analyses. Mean height for women was estimated to be 1.62 meters (63.8 inches), and mean weight was estimated to be 65.8 kg (145.0 pounds). For women, a calculation using a single bivariate normal distribution gave poor results (Brainard and Burmaster, 1992).

The advantage of this study is that it provides distributions that are suitable for use in Monte Carlo simulation. However, these distributions are now based on dated information.

8.4.3. Burmaster and Crouch (1997)—Lognormal Distributions for Body Weight as a Function of Age for Males and Females in the United States, 1976−1980

Burmaster and Crouch (1997) performed data analysis to fit normal and lognormal distributions to the body weights of females and males aged 9 months to 70 years. The data used in this analysis were from NHANES II, which was based on a national probability sample of 27,801 persons 6 months to 74 years of age in the United States. (Burmaster and Crouch, 1997). The NHANES II data had been statistically adjusted for non-response and probability of selection, and stratified by age, sex, and race to reflect the entire U.S. population prior to reporting. Burmaster and Crouch (1997) conducted exploratory and quantitative data analyses and fit normal and lognormal distributions to percentiles of body weights as a function of age. Cumulative distribution functions were plotted for female and male body weights on both linear and logarithmic scales.

Burmaster and Crouch (1997) used "maximum likelihood" estimation to fit lognormal distributions to the data. Linear and quadratic regression lines were fitted to the data. A number of goodness-of-fit measures were conducted on the data generated. The investigators found that lognormal distributions gave strong fits to the data for each sex across all age groups. Table 8-8 and Table 8-9 present the statistics for the lognormal probability plots for females and males aged 9 months to 70 years, respectively. As

indicated in Burmaster and Crouch (1997), Φ_2, and σ_2 are the mean and standard deviation of the logarithm of body weight for an age group. The exponential of Φ_2 provides an estimate of the median of body weight, and σ_2 is approximately equal to the coefficient of variation of the body weight. These data can be used for further analyses of body-weight distribution (i.e., application of Monte Carlo analysis).

The advantage of this study is that NHANES data were used for the analysis and the data are representative nationally. It also provides statistics for probability plot regression analyses for females and males from 9 months to 70 years of age. However, the analysis is based on an older set of NHANES data.

8.4.4. U.S. EPA (2000)—Body-Weight Estimates on NHANES III Data

U.S. EPA's Office of Water has estimated body weights by age and sex using data from NHANES III, which was conducted from 1988 to 1994. NHANES III collected body-weight data for approximately 30,000 individuals between the ages of 2 months and 44 years. Table 8-10 presents the body-weight estimates in kilograms by age and sex. Table 8-11 shows the body-weight estimates for infants 2 and 3 months of age.

The limitations of this analysis are that data were not available for infants under 2 months old, and that the data are roughly 15 to 20 years old. With the upward trends in body weight from NHANES II (1976−1980) to NHANES III, which may still be valid, the data in Table 8-10 and Table 8-11 may underestimate current body weights. However, the data are national in scope and represent the general population.

8.4.5. Kuczmarski et al. (2002)—CDC Growth Charts for the United States: Methods and Development

NCHS published growth charts for infants, birth to 36 months of age, and children and adolescents, 2 to 20 years of age (Kuczmarski et al., 2002). Growth charts were developed with data from five national health examination surveys: National Health Examination Survey (NHES) II (1963−1965) for ages 6−11 years, NHES III (1966−1970) for ages 12−17 years, NHANES I (1971−1974) for ages 1−17 years, NHANES II (1976−1980) beginning at 6 months of age, and NHANES III (1988−1994) beginning at 2 months of age. Data from these national surveys were pooled because no single survey had enough observations to develop these charts. For the infant charts, a limited number of additional data points were obtained from other sources where national data were either not available or insufficient. Birth weights <1,500 grams were excluded when generating the charts for weights and lengths. Also, the length-for-age charts exclude data from NHANES III for ages <3.5 months. Supplemental birth certificate data from the U.S. vital statistics were used in the weight-for-age charts and supplemental birth certificate data from Wisconsin and Missouri vital statistics, CDC Pediatric Nutrition Surveillance System data were used for ages 0.5, 1.5, 2.5, 3.5, and 4.5 months for the length-for-age charts. The Missouri and Wisconsin birth certificate data were also used to supplement the surveys for the weight-for-length charts. Table 8-12 presents the percentiles of weight by sex and age. Figure 8-1 and Figure 8-2 present weight by age percentiles for boys and girls, aged birth to 36 months, respectively. Figure 8-3 and Figure 8-4 present weight by length percentiles for boys and girls, respectively. Figure 8-5 and Figure 8-6 provide the BMI for boys and girls aged 2 to 20 years old.

The advantages of this analysis are that it is based on a nationally representative sample of the U.S. population and it provides body weight on a month-by-month basis up to 36 months of age, as well as BMI data for children through age 20 years. A limitation of this analysis is that trends in the weight data cannot be assessed because data from various years were combined. Also, the analysis is based on an older data set.

8.4.6. U.S. EPA (2004)—Estimated Per Capita Water Ingestion and Body Weight in the United States—An Update

U.S. EPA (2004) developed estimates from empirical distributions of body weights based on data from the U.S. Department of Agriculture (USDA's) 1994−1996 and the 1998 Continuing Survey of Food Intake by Individuals (CSFII). The weights recorded in the survey, and, consequently, the estimates reported, are based on self-reported data by the participants.

When viewed across sexes and all age categories, the average self-reported body weight for individuals in the United States during the 1994−1996 and 1998 period is 65 kg, or 143 lb. The estimated median body weight for all individuals is 67 kg (147 lb). Table 8-13 provides the estimated distribution of body weights for all individuals.

For the fine age categories reported in the summary data, the mean and median estimated body weights are the same for children in categories less

than 2 years of age. This suggests that body weights follow an approximately normal distribution. After the age of 2 years, estimated mean body weights are higher than estimated median body weights as age categories increase. This suggests that the distributions of body weights are skewed to the right. When viewed across ages, the estimated median body weight is higher than the estimated mean body weight. This suggests that the body-weight distribution across the entire survey weighted sample is slightly skewed to the left. The limitations of this analysis are that body weights were self-reported and that it is based on an older data set.

8.4.7. Ogden et al. (2004)—Mean Body Weight, Height, and Body Mass Index, United States, 1960−2002

Ogden et al. (2004) analyzed trends in body weight measured by the NHES II and III, NHANES I, II, and III, and NHANES 1999−2002. The surveys covered the period from 1960 to 2002. Table 8-14 presents the measured body weights for various age groups as measured in NHES and NHANES. Table 8-15 and Table 8-16 present the mean height and BMI data for the same population, respectively. The BMI data were calculated as weight (in kilograms) divided by the square of height (in meters). Population means were calculated using sample weights to account for variation in sampling for certain subsets of the U.S. population, non-response, and non-coverage (Ogden et al., 2004). The data indicate that mean body weight has increased over the period analyzed.

There is some uncertainty inherent in such an analysis, however, because of changes in sampling methods during the 42-year time span covered by the studies. This serves to illustrate the importance of the use of timely data when analyzing body weight. Because this study is based on an analysis of NHANES data, its limitations are the same as those for that study. Another limitation is that the data are based on an older NHANES data set and may not be entirely representative of current BMI values.

8.4.8. Freedman et al. (2006)—Racial and Ethnic Differences in Secular Trends for Childhood BMI, Weight, and Height

Freedman et al. (2006) examined sex and race/ethnicity differences in secular trends for childhood BMI, overweight, weight, and height in the United States using data from NHANES I (1971−1974), NHANES II (1976–1980), NHANES III (1988–1994), and NHANES 1999−2002. The analyses includes children 2 to 17 years old. Persons with missing weight or height information were excluded from the analyses (Freedman et al., 2006). The authors categorized the data across the four examinations and presented the data for non-Hispanic White, non-Hispanic Black, or Mexican American. Freedman et al. (2006) excluded other categories of race/ethnicity, such as other Hispanics, because the sample sizes were small. Height and weight data were obtained for each survey, and BMI was calculated as weight in kilograms divided by height in meters square. Sex specific *z*-scores and percentiles of weight-for-age, height-for-age, and BMI-for-age were calculated. Childhood overweight was defined as BMI-for-age $\geq 95^{th}$ percentile, and childhood obesity was defined as children with a BMI-for-age $\geq 99^{th}$ percentile.

In the analyses, sample weights were used to account for differential probabilities, non-selection, non-response, and non-coverage. Table 8-17 presents the sample sizes used in the analyses by age, sex, race, and survey. Table 8-18 provides mean BMI levels for ages 2 to 17. Table 8-19 shows BMI mean levels for adults 20 years and older (Ogden et al., 2004). Table 8-18 shows that in the 1971−1974 survey total population, Mexican American children had the highest mean BMI level (18.6 kg/m^2). However, the greatest increase throughout the survey occurred among Black children, increasing from 17.8 to 20 kg/m^2 (Freedman et al., 2006). Table 8-20 shows the prevalence of overweight and obesity for children 2 to 17 years old. These results show that 2 to 5 year-old White children had slightly larger increases in overweight, but among the older children, the largest increases were among the Black and Mexican American children (Freedman et al., 2006). Overall, in most sex-age groups, Mexican Americans experienced the greater increase in BMI and overweight than what was experienced by Black and White children (Freedman et al., 2006). Black children experienced larger secular increases in BMI, weight, and height than did White children (Freedman et al., 2006). According to Freedman et al. (2006), racial/ethnicity differences were less marked in the children aged two to five years old.

The advantages of the study are that the sample size is large and the analysis was designed to represent the general population of the racial and ethnic groups studied. The disadvantage is that some ethnic population groups were excluded because of small sample sizes and that it is based on older NHANES data sets.

8.4.9. Martin et al. (2007)—Births: Final Data for 2005

Martin et al. (2007) provided statistics on the percentage of live births categorized as having low or very low birth weights in the United States. Low birth weight was defined as <2,500 grams (<5 pounds 8 ounces), and very low birth weight was defined as <1,500 grams (<three pounds four ounces). The data used in the analysis were from birth certificates registered in all states and the District of Columbia for births occurring in 2005. Data were presented for maternal demographic characteristics including race ethnicity: non-Hispanic White, non-Hispanic Black, and Hispanic.

The numbers of live births within various weight ranges, and the percentages of live births with low or very low birth weights are presented in Table 8-21. The percentage of live births with low birth weights was 8.2, and the percentage of very low birth weights was 1.5 in 2005. Non-Hispanic Blacks had the highest percentage of low birth weights (14.0%) and very low birth weights (3.3%). Martin et al. (2007) also provided statistics on the numbers and percentages of pre-term live births in the United States. Of the 4,138,349 live births in the United States in 2005, 522,913 were defined as pre-term (i.e., less than 37 weeks gestation). A total of 43.3% of these pre-term infants had low birth weights, and 11.3% had very low birth weights. The advantage of this data set is that it is nationally representative and provides data for infants. It provides data on prevalence of low birth weight in the population.

8.4.10. Portier et al. (2007)—Body Weight Distributions for Risk Assessment

Portier et al. (2007) provided age-specific distributions of body weight based on NHANES II, III, and IV data. The number of observations in these surveys is 20,322, 33,311, and 9,965, respectively. Portier et al. (2007) computed the means and standard deviations of body weight as back transformations of the weighted means and standard deviations of natural log-transformed body weights. Body-weight distributions were computed by sex and various age brackets (Portier et al., 2007). The estimated mean body weights are shown in Table 8-22, Table 8-23, and Table 8-24 using NHANES II, III, and IV data, respectively. The sample size (*N*) shown in the tables is the observed number of individuals and not the expected population size (sum of the sample weights) in each age category (Portier et al., 2007). Table 8-25 provides estimates for age groups that are often considered in risk assessments (Portier et al., 2007). The authors concluded that the data show changes in the average body weight over time and that the changes are not constant for all ages. The reader is referred to Portier et al. (2007) for equations suggested by the authors to be used when performing risk assessments where shifts and changes in body-weight distributions need factoring in.

The advantages of this study are that it represents the U.S. general population, it provides distribution data, and can be used for trend analysis. In addition, the data are provided for both sexes and for single-year age groups. The study results are also based on a large sample size.

8.4.11. Kahn and Stralka (2009)—Estimated Daily Average Per Capita Water Ingestion by Child and Adult Age Categories Based on USDA's 1994−1996 and 1998 Continuing Survey of Food Intakes

As part of an analysis of water ingestion, Kahn and Stralka (2009) provided body-weight distributions for the U.S. population. The analysis was based on self-reported body weights from the 1994−1996, 1998 CSFII. The average body weight across all individuals was 65 kg. According to Kahn and Stralka (2009), 10 kg, which is often used as the default body weight for babies, is the 95th value of the distribution of body weight for children in the 3 to <6 months category. The median weight is 9 kg for the 6 to 12-month age category and 11 kg for the one-to-two-year old-category (Kahn and Stralka, 2009). Table 8-26 presents the body-weight distributions, and Table 8-27 presents the intervals around the mean and 90th and 95th percentiles.

The advantages of the study are its large sample size and that it is representative of the U.S. population for the age groups presented. A limitation of the study is that the data are based on self-reporting from the participants and that the data are now somewhat dated.

8.5. RELEVANT STUDIES—PREGNANT WOMEN BODY-WEIGHT STUDIES

8.5.1. Carmichael et al. (1997)—The Pattern of Maternal Weight Gain in Women With Good Pregnancy Outcomes

The Institute of Medicine (IOM) publishes recommendations for total gestational weight gain. Carmichael et al. (1997) conducted a study in a cohort of 7,002 who had good pregnancy outcomes to obtain the distribution of maternal weight gain by trimester and to compare these with women who achieved the IOM recommendations. Good outcome

was defined as having a vaginal delivery, 37 weeks or more of gestation, delivery of a live infant of an average size for gestational age, and from mothers with no diabetes or hypertension. The women were selected from records from the Department of Obstetrics, Gynecology and Reproductive Sciences Perinatal Database at the University of California, San Francisco. Distributions were derived for 4,218 women for whom complete data on pattern of gain for all trimesters were obtained. The mean age of the women was 27.7 years with a mean pre-pregnancy weight of 57.6 kg. Twenty-nine percent of the women were underweight, 61% were of normal weight, 5% were overweight, and 4% were obese, based on BMI calculations. Total weight gain was calculated as the difference between the self-reported pre-pregnancy weight and the last measured weight. A linear regression was applied to estimate the rate of gain in the 2nd and 3rd trimesters. Table 8-28 presents the distributions of weight gain in underweight, normal weight, overweight, and obese women during the 1st, 2nd, and 3rd trimesters. The average weight gains for the 1st, 2nd, and 3rd trimesters were 1.98 kg, 6.73 kg, and 6.37 kg, respectively. The weight gain for the 2nd and 3rd trimesters was calculated by taking the gain rate from Table 8-28 and multiplying it by 13 weeks. These data can be used to calculate the average weight of pregnant women for the 1st, 2nd, and 3rd trimesters by adding the average weight gain for the 1st trimester to the average pre-pregnancy weight of 57.6 kg and subsequently adding the average weight gain for the 2nd and 3rd trimesters to the resulting weight from the previous trimester. These calculations result in a total weight of 59.6 kg, 66.3 kg, and 72.7 kg for the 1st, 2nd, and 3rd trimesters, respectively.

The advantages of this study are that it has a large sample size, and it provides distributional data. The sample, however, may not be representative of the United States. The sample also only included pregnancies with good outcomes. The study did not provide estimates of the weight for each trimester. Instead, it provides weight gain for the 1st trimester and the rates of weight gain for the 2nd and 3rd trimesters. The total weight was estimated by the U.S. EPA based on the mean weight gain for each trimester.

8.5.2. U.S. EPA Analysis of 1999−2006 NHANES Data on Body Weight of Pregnant Women

In 2010, U.S. EPA analyzed the combined 1999−2006 NHANES data sets to examine body weight of pregnant women. Data for 1,248 pregnant women with weight measurements were extracted based from the data set based on either a positive lab pregnancy test or self-reporting of pregnancy at the examination. The NHANES data included a few very large and improbable body weights, as extreme as 186 kg from a respondent in the 1st trimester. These outliers were removed from the database (N = 26) using SAS. Table 8-29 presents the body-weight data by trimester, based on the remaining 1,222 respondents. The statistically weighted average body weight of all pregnant women was 75 kg. Due to a few large weight (>90 kg) respondents with very large sample weights (>18,000), the weighted mean body weight of 1st trimester women (76 kg) is larger than that of 2nd trimester women (73 kg).

The advantage of this study is that by combining eight years of the most recent NHANES data, an adequate sample size was achieved to estimate body weight of pregnant women by trimester. A limitation of this analysis is that high-weight respondents with large sample weight may result in uncertainties as described above.

8.6. RELEVANT FETAL WEIGHT STUDIES

8.6.1. Brenner et al. (1976)—A Standard of Fetal Growth for the United States of America

Brenner et al. (1976) determined fetal weights for 430 fetuses aborted at 8 to 20 weeks of gestation and for 30,772 liveborn infants delivered at 21 to 44 weeks of gestation. Gestational age for the aborted fetuses was determined through a combination of the physician's estimate of uterine size and the patient's stated last normal menstrual period. Data were not used when these two estimates differed by more than two weeks. To determine fetal growth, the fetuses were weighed and measured (crown-to-rump and crown-to-heel lengths). All abortions were legally performed at Memorial Hospital, University of North Carolina, at Chapel Hill, from 1972 to 1975. For the liveborn infants, data were analyzed from single birth deliveries with the infant living at the onset of labor, among pregnancies not complicated by pre-eclampsia, diabetes or other disorders. Infants were weighed on a balance scale immediately after delivery. The liveborn infants were delivered at MacDonald House, University Hospitals of Cleveland, OH, from 1962 to 1969.

Table 8-30 shows percentiles for fetal weight, calculated from the data at each week of gestation. The resulting percentile curves were smoothed with two-point weighted means. Variables associated with

significant differences in fetal weight in the latter part of pregnancy (after 34−38 weeks of gestation) included maternal parity and race, and fetal sex.

The advantage of this study is the large sample size. Limitations of the study are that the data were collected more than 30 years ago in only two U.S. states. In addition, a number of variables that may affect fetal weight (i.e., maternal smoking, disease, nutrition, and addictions) were not evaluated in this study.

8.6.2. Doubilet et al. (1997)—Improved Birth Weight Table for Neonates Developed From Gestations Dated by Early Ultrasonography

Doubilet et al. (1997) matched a database of obstetrical ultrasonograms over a period of five years from 1988 to 1993 to birth records for 3,718 infants (1,857 males and 1,861 females). The study population included 1,514 Whites, 770 Blacks, 1,256 Hispanics, and 178 who were either unclassified, or classified as "other." Birth weights were obtained from hospital records, and a gestational age was assigned based on the earliest 1st trimester sonogram. The database was screened for possible outliers, defined as infants with birth weights that exceeded 5,000 grams. Labor and delivery records and mother-infant medical records were retrieved to correct any errors in data entry for infants with birth weights exceeding 5,000 grams. The mean gestational age at initial sonogram was 9.5 ± 2.3 weeks. Regression analysis techniques were used to derive weight tables for neonates at each gestational age for 25 weeks of gestation onward. Weights for each gestational age were found to conform to a natural logarithm distribution. Polynomial equations were derived from the regression analysis to estimate mean weight by gestational age for males, females, and males and females combined. Table 8-31 provides the distribution of neonatal weights by gestational age from 25 weeks of gestation onward. The advantage of this study is that it provides body weights for neonates based on a relatively large sample. A limitation is the age of the data.

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Table 8-3. Mean and Percentile Body Weights (kg) Derived From NHANES (1999−2006) Males and Females Combined

Age Group	*N*	Mean	Percentiles								
			5th	10th	15th	25th	50th	75th	85th	90th	95th
Birth to <1 month	158	4.8	3.6	3.9	4.1	4.2	4.8	5.1	5.5	5.8	6.2
1 to <3 months	284	5.9	4.5	4.7	4.9	5.2	5.9	6.6	6.9	7.1	7.3
3 to <6 months	489	7.4	5.7	6.1	6.3	6.7	7.3	8.0	8.4	8.7	9.1
6 to <12 months	927	9.2	7.1	7.5	7.9	8.3	9.1	10.1	10.5	10.8	11.3
1 to <2 years	1,176	11.4	8.9	9.3	9.7	10.3	11.3	12.4	13.0	13.4	14.0
2 to <3 years	1,144	13.8	10.9	11.5	11.9	12.4	13.6	14.9	15.8	16.3	17.1
3 to <6 years	2,318	18.6	13.5	14.4	14.9	15.8	17.8	20.3	22.0	23.6	26.2
6 to <11 years	3,593	31.8	19.7	21.3	22.3	24.4	29.3	36.8	42.1	45.6	52.5
11 to <16 years	5,297	56.8	34.0	37.2	40.6	45.0	54.2	65.0	73.0	79.3	88.8
16 to <21 years	4,851	71.6	48.2	52.0	54.5	58.4	67.6	80.6	90.8	97.7	108.0
21 to <30 years	3,232	78.4	50.8	54.7	57.9	63.3	75.2	88.2	98.5	106.0	118.0
30 to <40 years	3,176	80.8	53.5	57.4	60.1	66.1	77.9	92.4	101.0	107.0	118.0
40 to <50 years	3,121	83.6	54.3	58.8	62.1	68.3	81.4	95.0	104.0	111.0	122.0
50 to <60 years	2,387	83.4	54.7	59.0	62.8	69.1	80.8	95.5	104.0	110.0	120.0
60 to <70 years	2,782	82.6	55.2	59.8	63.3	69.0	80.5	94.2	103.0	109.0	116.0
70 to <80 years	2,033	76.4	52.0	56.5	59.7	64.4	74.9	86.8	93.8	98.0	106.0
Over 80 years	1,430	68.5	46.9	51.4	53.8	58.2	67.4	77.4	82.6	87.2	93.6

Source: U.S. EPA Analysis of NHANES 1999−2006 data.

Table 8-4. Mean and Percentile Body Weights (kg) for Males Derived From NHANES (1999−2006)

Age Group	*N*	Mean	Percentiles								
			5th	10th	15th	25th	50th	75th	85th	90th	95th
Birth to <1 month	88	4.9	3.6	3.6	4.0	4.4	4.8	5.5	5.8	6.2	6.8
1 to <3 months	153	6.0	4.6	5.0	5.1	5.4	6.1	6.8	7.0	7.2	7.3
3 to <6 months	255	7.6	5.9	6.4	6.6	6.9	7.5	8.2	8.6	8.8	9.1
6 to <12 months	472	9.4	7.3	7.9	8.2	8.5	9.4	10.3	10.6	10.8	11.5
1 to <2 years	632	11.6	9.0	9.7	10.0	10.5	11.5	12.6	13.2	13.5	14.3
2 to <3 years	558	14.1	11.4	12.0	12.2	12.8	14.0	15.2	15.9	16.4	17.0
3 to <6 years	1,158	18.8	13.5	14.4	14.9	15.9	18.1	20.8	22.6	23.8	26.2
6 to <11 years	1,795	31.9	20.0	21.8	22.9	24.8	29.6	36.4	41.2	45.2	51.4
11 to <16 years	2,593	57.6	33.6	36.3	38.9	44.2	55.5	66.5	75.5	81.2	91.8
16 to <21 years	2,462	77.3	54.5	57.6	60.0	63.9	73.1	86.0	96.8	104.0	113.0
21 to <30 years	1,359	84.9	58.7	63.0	66.2	70.7	81.2	94.0	103.0	111.0	123.0
30 to <40 years	1,445	87.0	61.1	65.7	68.7	73.8	84.0	96.5	104.0	110.0	124.0
40 to <50 years	1,545	90.5	64.9	69.5	73.0	77.7	87.4	99.7	109.0	114.0	125.0
50 to <60 years	1,189	89.5	64.1	68.8	71.4	77.0	87.8	99.8	107.0	112.0	123.0
60 to <70 years	1,360	89.1	63.4	67.5	71.6	77.2	86.9	99.4	108.0	113.0	120.0
70 to <80 years	1,079	83.9	60.6	64.6	68.3	73.1	82.1	93.8	98.6	104.0	113.0
Over 80 years	662	76.1	56.7	60.6	63.9	67.2	75.1	84.0	89.4	92.5	100.0

Source: U.S. EPA Analysis of NHANES 1999−2006 data.

Table 8-5. Mean and Percentile Body Weights (kg) for Females Derived From NHANES (1999−2006)

Age Group	*N*	Mean	Percentiles								
			5th	10th	15th	25th	50th	75th	85th	90th	95th
Birth to <1 month	70	4.6	3.6	4.0	4.1	4.2	4.6	4.9	5.0	5.2	5.9
1 to <3 months	131	5.7	4.3	4.6	4.74	5.1	5.5	6.4	6.6	6.9	7.3
3 to <6 months	234	7.2	5.5	5.9	6.2	6.4	7.2	7.9	8.2	8.4	9.0
6 to <12 months	455	9.0	7.1	7.3	7.6	8.0	8.9	9.8	10.3	10.6	11.2
1 to <2 years	544	11.1	8.7	9.1	9.4	10.0	11.1	12.2	12.9	13.2	13.7
2 to <3 years	586	13.5	10.5	11.0	11.5	12.1	13.2	14.6	15.5	16.2	17.1
3 to <6 years	1,160	18.3	13.5	14.3	14.7	15.6	17.5	19.7	21.3	23.2	26.2
6 to <11 years	1,798	31.7	19.3	20.9	22.0	23.9	29.0	37.3	43.1	46.7	53.4
11 to <16 years	2,704	55.9	34.9	38.6	41.6	45.7	53.3	62.8	70.7	76.5	86.3
16 to <21 years	2,389	65.9	46.2	48.6	51.1	54.5	61.5	73.3	83.4	89.9	99.7
21 to <30 years	1,873	71.9	48.0	51.4	53.8	57.8	67.9	81.4	90.2	98.7	109.0
30 to <40 years	1,731	74.8	50.9	54.0	56.2	60.0	70.2	85.0	95.1	104.0	113.0
40 to <50 years	1,576	77.1	51.7	54.7	57.3	61.7	72.7	88.0	97.8	105.0	118.0
50 to <60 years	1,198	77.5	52.2	55.7	57.9	62.8	73.6	87.7	97.7	105.0	117.0
60 to <70 years	1,422	76.8	51.9	56.5	59.2	63.9	73.9	86.6	95.4	102.0	112.0
70 to <80 years	954	70.8	49.6	53.3	55.7	60.3	69.0	79.4	85.6	91.4	98.2
Over 80 years	768	64.1	45.5	48.7	51.3	54.9	62.8	71.8	77.0	80.5	89.1

Source: U.S. EPA Analysis of NHANES 1999−2006 data.

Table 8-6. Weight in Kilograms for Males 2 Months–21 Years of Age—Number Examined, Mean, and Selected Percentiles, by Age Category: United States, 1976–1980[a]

Age Group	Number of Persons Examined	Mean (kg)	Percentiles								
			5th	10th	15th	25th	50th	75th	85th	90th	95th
Birth to <1 month	-	-	-	-	-	-	-	-	-	-	-
1 to <2 months	-	-	-	-	-	-	-	-	-	-	-
2 to <3 months	103	6.6	5.3	5.5	5.7	5.9	6.8	7.2	7.6	7.8	8.4
3 to <6 months	287	7.7	6.3	6.6	6.7	7.0	7.7	8.4	8.9	9.2	9.6
6 to <12 months	589	9.4	7.5	7.9	8.1	8.6	9.4	10.2	10.6	10.9	11.4
1 to <2 years	613	11.7	9.4	9.8	10.1	10.8	11.7	12.6	13.1	13.7	14.5
2 to <3 years	627	13.7	11.4	11.8	12.2	12.6	13.6	14.6	15.2	15.8	16.5
3 to <6 years	1,556	18.0	13.7	14.6	14.9	15.7	17.5	19.7	21.0	22.0	24.0
6 to <11 years	1,373	30.7	19.5	21.1	22.1	24.0	28.5	35.2	40.5	43.5	48.7
11 to <16 years	1,037	55.2	34.0	36.5	38.7	42.8	53.0	63.0	69.4	74.8	84.3
16 to <21 years	890	71.8	54.1	56.6	58.3	61.8	68.7	77.9	84.3	89.7	101.0

[a] Includes clothing weight, estimated as ranging from 0.09 to 0.28 kg.
- No data available for infants less than 2 months old.

Source: Najjar and Rowland (1987).

Table 8-7. Weight in Kilograms for Females 6 Months–21 Years of Age—Number Examined, Mean, and Selected Percentiles, by Age Category: United States, 1976–1980[a]

Age Group	Number of Persons Examined	Mean (kg)	Percentiles								
			5th	10th	15th	25th	50th	75th	85th	90th	95th
Birth to <1 month	-	-	-	-	-	-	-	-	-	-	-
1 to <2 months	-	-	-	-	-	-	-	-	-	-	-
2 to <3 months	131	6.0	4.7	5.1	5.2	5.6	6.0	6.5	7.1	7.3	7.8
3 to <6 months	269	7.1	5.8	5.9	6.1	6.4	7.1	7.7	7.9	8.4	8.7
6 to <12 months	574	8.8	7.2	7.5	7.7	8.0	8.7	9.4	10.1	10.4	10.8
1 to <2 years	617	11.0	9.1	9.4	9.6	9.9	10.9	11.9	12.6	12.9	13.4
2 to <3 years	597	13.4	10.8	11.2	11.6	12.1	13.2	14.6	15.4	15.6	16.3
3 to <6 years	1,658	18.0	13.3	14.0	14.5	15.4	17.2	19.7	21.1	22.6	25.1
6 to <11 years	1,321	30.6	19.0	20.5	21.3	23.4	28.9	35.0	39.6	44.3	50.2
11 to <16 years	1,144	53.2	34.1	37.2	40.4	45.2	51.6	60.0	67.2	70.6	78.2
16 to <21 years	1,001	62.2	46.7	48.2	49.7	52.2	58.9	68.3	74.7	80.8	92.6

[a] Includes clothing weight, estimated as ranging from 0.09 to 0.28 kg.
- No data available for infants less than 2 months old.

Source: Najjar and Rowland (1987).

Table 8-8. Statistics for Probability Plot Regression Analyses: Female Body Weights 6 Months to 70 Years of Age

Age Midpoint (years)	Lognormal Probability Plots Linear Curve	
	μ_2[a]	σ_2[a]
0.75	2.16	0.145
1.5	2.38	0.129
2.5	2.56	0.112
3.5	2.69	0.136
4.5	2.83	0.134
5.5	2.98	0.164
6.5	3.10	0.174
7.5	3.19	0.174
8.5	3.31	0.156
9.5	3.46	0.214
10.5	3.57	0.199
11.5	3.71	0.226
12.5	3.82	0.213
13.5	3.92	0.215
14.5	3.99	0.187
15.5	4.00	0.156
16.5	4.05	0.167
17.5	4.08	0.165
18.5	4.07	0.147
19.5	4.10	0.149
21.5	4.10	0.168
30	4.15	0.204
40	4.19	0.207
50	4.20	0.208
60	4.20	0.205
70	4.18	0.198

[a] Φ_2, σ_2—correspond to the mean and the standard deviation, respectively, of the logarithm of body weight (kg) for an age group.

Source: Burmaster and Crouch (1997).

Table 8-9. Statistics for Probability Plot Regression Analyses: Male Body Weights 6 Months to 70 Years of Age

Age Midpoint (years)	Lognormal Probability Plots Linear Curve	
	μ_2[a]	σ_2[a]
0.75	2.23	0.131
1.5	2.46	0.120
2.5	2.60	0.120
3.5	2.75	0.114
4.5	2.87	0.133
5.5	2.98	0.138
6.5	3.13	0.145
7.5	3.21	0.151
8.5	3.33	0.181
9.5	3.43	0.165
10.5	3.59	0.195
11.5	3.69	0.252
12.5	3.78	0.224
13.5	3.88	0.215
14.5	4.02	0.181
15.5	4.09	0.159
16.5	4.20	0.168
17.5	4.19	0.167
18.5	4.25	0.159
19.5	4.26	0.154
21.5	4.29	0.163
30	4.35	0.163
40	4.38	0.165
50	4.38	0.166
60	4.35	0.157
70	4.29	0.174

[a] Φ_2, σ_2—correspond to the mean and the standard deviation, respectively, of the logarithm of body weight (kg) for an age group.

Source: Burmaster and Crouch (1997).

Table 8-10. Body-Weight Estimates (kg) by Age and Sex, U.S. Population Derived From NHANES III (1988−1994)

Age Group	Sample Size	Population	Males and Females		Males		Females	
			Median	Mean	Median	Mean	Median	Mean
2 to 6 months	1,020	1,732,702	7.4	7.4	7.6	7.7	7.0	7.0
7 to 12 months	1,072	1,925,573	9.4	9.4	9.7	9.7	9.1	9.1
1 year	1,258	3,935,114	11.3	11.4	11.7	11.7	10.9	11.0
2 years	1,513	4,459,167	13.2	12.9	13.5	13.1	13.0	12.5
3 years	1,309	4,317,234	15.3	15.1	15.5	15.2	15.1	14.9
4 years	1,284	4,008,079	17.2	17.1	17.2	17.0	17.3	17.2
5 years	1,234	4,298,097	19.6	19.4	19.7	19.3	19.6	19.4
6 years	750	3,942,457	21.3	21.7	21.5	22.1	20.9	21.3
7 years	736	4,064,397	25.0	25.5	25.4	25.5	24.1	25.6
8 years	711	3,863,515	27.4	28.1	27.2	28.4	27.9	27.9
9 years	770	4,385,199	31.8	32.7	32.0	32.3	31.1	33.0
10 years	751	3,991,345	35.2	35.6	35.9	36.0	34.3	35.2
11 years	754	4,270,211	40.6	41.5	38.8	40.0	43.4	42.8
12 years	431	3,497,661	47.2	46.9	48.1	49.1	45.7	48.6
13 years	428	3,567,181	53.0	55.1	52.6	54.5	53.7	55.9
14 years	415	4,054,117	56.9	61.1	61.3	64.5	53.7	57.9
15 years	378	3,269,777	59.6	62.8	62.6	66.9	57.1	59.2
16 years	427	3,652,041	63.2	65.8	66.6	69.4	56.3	61.6
17 years	410	3,719,690	65.1	67.5	70.0	72.4	60.7	62.2
≥1 years	31,311	251,097,002	66.5	64.5	73.9	89.0	80.8	80.3
1 to 3 years	4,080	12,711,515	13.2	13.1	13.4	13.4	13.0	12.9
1 to 14 years	12,344	56,653,796	24.9	29.9	25.1	30.0	24.7	29.7
15 to 44 years	10,393	118,430,653	70.8	73.5	77.5	80.2	63.2	67.3

Source: U.S. EPA (2000).

Table 8-11. Body-Weight Estimates (in kg) by Age, U.S. Population Derived From NHANES III (1988−1994)

Age Group (months)	Sample Size	Population	Males and Females		
			Median	Mean	95% CI
2	243	408,837	6.3	6.3	6.1−6.4
3	190	332,823	7.0	6.9	6.7−7.1
3 and younger	433	741,660	6.6	6.6	6.4−6.7

CI = Confidence Interval.

Source: U.S. EPA (2000).

Table 8-12. Observed Mean, Standard Deviation, and Selected Percentiles for Weight (kg) by Sex and Age: Birth to 36 Months

Age Group (mo)	Mean	SD	Percentile					
			10th	25th	50th	75th	90th	95th
Boys								
Birth	3.4	0.6	2.7	3.1	3.4	3.8	4.1	4.3
0 to <1	-	-	-	-	-	-	-	-
1 to <2	-	-	-	-	-	-	-	-
2 to <3	6.5	0.8	5.6	5.8	6.7	6.9	7.4	7.5
3 to <4	7.0	0.9	5.9	6.5	7.0	7.5	8.2	8.5
4 to <5	7.2	0.8	6.3	6.7	7.2	7.7	8.0	8.4
5 to <6	7.9	0.9	6.7	7.5	7.8	8.6	9.4	9.6
6 to <7	8.4	1.1	7.3	7.6	8.4	9.0	10.2	10.7
7 to <8	8.6	1.1	7.1	7.8	8.6	9.5	10.1	10.4
8 to <9	9.3	1.1	7.9	8.6	9.2	10.1	10.5	11.0
9 to <10	9.3	0.9	8.2	8.6	9.3	10.0	10.8	10.9
10 to <11	9.5	1.1	8.3	8.7	9.3	10.1	11.3	11.5
11 to <12	10.0	1.0	8.7	9.5	10.0	10.6	11.1	11.6
12 to <15	10.6	1.2	9.2	9.8	10.6	11.3	12.1	12.4
15 to < 8	11.4	1.9	9.9	10.5	11.3	12.0	12.8	13.5
18 to <21	12.1	1.5	10.4	11.0	11.9	12.7	13.9	15.5
21 to <24	12.4	1.3	10.9	11.6	12.4	13.1	14.4	14.7
24 to <30	13.1	1.7	11.3	12.1	12.9	14.1	15.1	15.9
30 to <36	14.0	1.5	12.0	13.0	13.8	14.7	16.0	16.6
Girls								
Birth	3.3	0.5	2.6	3.0	3.3	3.6	3.9	4.1
0 to <1	-	-	-	-	-	-	-	-
1 to <2	-	-	-	-	-	-	-	-
2 to <3	5.4	0.5	4.8	5.0	5.6	5.9	6.0	-
3 to <4	6.3	0.7	5.6	5.8	6.3	6.8	7.4	7.8
4 to <5	6.7	0.9	5.8	6.1	6.6	7.4	8.0	8.3
5 to <6	7.3	0.9	6.3	6.7	7.1	7.7	8.5	8.8
6 to <7	7.7	0.8	6.6	7.1	7.6	8.1	8.9	9.0
7 to <8	8.0	1.4	6.7	7.4	7.8	8.6	9.4	9.8
8 to <9	8.3	0.9	7.3	7.8	8.3	8.9	9.4	9.8
9 to <10	8.9	0.9	7.8	8.1	8.7	9.4	10.1	10.5
10 to <11	9.0	1.1	7.8	8.4	9.0	9.5	10.4	10.9
11 to <12	9.3	1.0	7.9	8.6	9.2	10.1	10.6	10.9
12 to <15	9.8	1.1	8.5	9.1	9.8	10.4	11.3	11.6
15 to <18	10.4	1.1	9.1	9.7	10.3	11.2	11.8	12.0
18 to <21	11.1	1.4	9.6	10.2	11.0	11.9	12.8	13.5
21 to <24	11.8	1.3	10.1	10.9	11.8	12.8	13.5	13.9
24 to <30	12.5	1.5	10.8	11.5	12.4	13.3	14.5	15.1
30 to <36	13.6	1.7	11.8	12.5	13.4	14.52	15.7	16.4

- No data available.

Source: Kuczmarski et al. (2002).

Table 8-13. Estimated Distribution of Body Weight by Fine Age Categories All Individuals, Males and Females Combined (kg)

Ages (years)	Sample Size	Population	Mean	Percentiles					
				10th	25th	50th	75th	90th	95th
<0.5	744	1,890,461	6	3	4	6	7	8	9
0.5 to 0.9	678	1,770,700	9	7	8	9	10	11	12
1 to 3	3,645	11,746,146	14	10	11	13	16	18	19
4 to 6	2,988	11,570,747	21	16	17	20	22	26	28
7 to 10	1,028	14,541,011	32	22	26	29	36	43	48
11 to 14	790	15,183,156	51	35	42	50	58	68	79
15 to 19	816	17,825,164	67	50	56	63	73	85	99
20 to 24	676	18,402,877	72	53	59	68	81	94	104
25 to 54	4,830	111,382,877	77	54	63	75	86	100	109
55 to 64	1,516	20,691,260	77	57	65	75	87	99	105
65+	2,139	30,578,210	72	54	62	71	81	93	100
			Summary Data						
20 +	9,161	181,055,224	76	54	63	73	86	98	107
<2	2,424	7,695,535	10	5	7	10	11	13	14
2 to 15	7,449	49,006,686	33	15	19	28	43	56	63
15+	9,977	198,880,388	75	54	61	72	84	97	106
<6	7,530	23,160,174	15	8	11	14	18	21	23
6 to 15	2,343	33,542,047	40	22	27	36	50	59	68
All ages	**19,850**	**255,582,609**	**65**	**22**	**52**	**67**	**81**	**95**	**104**

Note: 757 individuals did not report body weight. They represent 6,314,627 individuals in the population.

Source: U.S. EPA (2004) (based on 1994−1996, 1998 USDA CSFII).

Table 8-14. Mean Body Weight (kg) by Age and Sex Across Multiple Surveys

Sex and Age (years)	NHES II, 1963−1965			NHES III, 1966−1970			NHANES II, 1976−1980			NHANES III, 1988−1994			NHANES, 1999−2002		
	N	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE
Male															
2	-	-	-	-	-	-	370	13.4	0.1	644	13.6	0.1	262	13.7	0.1
3	-	-	-	-	-	-	421	15.5	0.1	516	15.8	0.2	216	15.9	0.2
4	-	-	-	-	-	-	405	17.6	0.1	549	17.6	0.2	179	18.5	0.2
5	-	-	-	-	-	-	393	19.7	0.1	497	20.1	0.2	147	21.3	0.5
6	575	22.0	0.1	-	-	-	146	22.8	0.4	283	23.2	0.6	182	23.5	0.4
7	632	24.7	0.2	-	-	-	150	24.9	0.4	269	26.3	0.4	185	27.2	0.4
8	618	27.8	0.2	-	-	-	145	28.0	0.6	266	30.2	0.8	214	32.7	1.0
9	603	31.2	0.4	-	-	-	141	30.7	0.6	281	34.4	1.0	174	36.0	0.7
10	576	33.7	0.3	-	-	-	165	36.2	0.7	297	37.3	0.9	187	38.6	0.8
11	595	38.2	0.3	-	-	-	153	39.7	0.9	281	42.5	0.9	182	43.7	1.1
12	-	-	-	643	42.9	0.4	147	44.1	1.0	203	49.1	1.1	299	50.4	1.3
13	-	-	-	626	50.0	0.5	165	49.5	1.2	187	54.0	1.0	298	53.9	1.9
14	-	-	-	618	56.7	0.6	188	56.4	0.9	188	64.1	3.6	266	63.9	1.6
15	-	-	-	613	61.6	0.4	180	61.2	1.0	187	66.9	1.9	283	68.3	1.1
16	-	-	-	556	64.8	0.6	180	66.5	1.2	194	68.7	1.6	306	74.4	1.4
17	-	-	-	458	68.1	0.4	183	66.7	0.8	196	72.9	1.3	313	75.6	1.4
18	-	-	-	-	-	-	156	71.1	1.2	176	71.3	1.7	284	75.6	1.1
19	-	-	-	-	-	-	150	71.8	0.8	168	73.0	2.2	270	78.2	1.3
20 to 29	-	-	-	-	-	-	1,261	76.3	0.5	1,638	78.4	0.6	712	83.4	0.7
30 to 39	-	-	-	-	-	-	871	79.8	0.4	1,468	82.9	0.9	704	86.0	0.9
40 to 49	-	-	-	-	-	-	695	81.7	0.5	1,220	85.1	0.8	776	89.1	0.7
50 to 59	-	-	-	-	-	-	691	80.0	0.6	851	86.0	0.5	598	88.8	0.9
60 to 74	-	-	-	-	-	-	2,086	76.1	0.5	1,683	82.2	0.5	1,001	87.1	0.6
75+	-	-	-	-	-	-	-	-	-	895	75.4	0.7	523	78.5	0.6

Table 8-14. Mean Body Weight (kg) by Age and Sex Across Multiple Surveys (continued)

Sex and Age (years)	NHES II, 1963−1965			NHES III, 1966−1970			NHANES II, 1976−1980			NHANES III, 1988−1994			NHANES, 1999−2002		
	N	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE
Female															
2	-	-	-	-	-	-	330	12.8	0.1	624	13.2	0.1	248	13.3	0.1
3	-	-	-	-	-	-	367	14.8	0.1	587	15.4	0.1	178	15.2	0.2
4	-	-	-	-	-	-	388	16.8	0.2	537	17.9	0.3	191	17.9	0.3
5	-	-	-	-	-	-	369	19.4	0.3	554	20.2	0.2	186	20.6	0.6
6	536	21.5	0.2	-	-	-	150	21.9	0.4	272	22.6	0.6	171	22.4	0.5
7	609	24.2	0.2	-	-	-	154	24.6	0.5	274	26.4	0.8	196	25.9	0.5
8	613	27.5	0.2	-	-	-	125	27.5	0.4	248	29.9	0.6	184	31.9	1.2
9	581	31.4	0.4	-	-	-	154	31.7	0.7	280	34.4	1.2	183	35.4	0.7
10	584	35.2	0.4	-	-	-	128	35.7	0.6	258	37.9	1.2	164	40.0	1.0
11	525	39.8	0.4	-	-	-	143	41.4	0.9	275	44.1	1.1	194	47.9	1.3
12	-	-	-	547	46.6	0.4	146	46.1	0.9	236	49.0	1.2	316	52.0	1.1
13	-	-	-	582	50.5	0.5	155	50.9	1.2	220	55.8	1.6	321	57.7	1.4
14	-	-	-	586	54.2	0.4	181	54.3	1.0	218	58.5	1.4	324	59.9	1.0
15	-	-	-	503	56.5	0.5	144	55.0	0.8	191	58.1	1.1	266	61.1	1.7
16	-	-	-	536	58.1	0.7	167	57.7	0.9	208	61.3	1.4	273	63.0	1.2
17	-	-	-	442	57.6	0.6	134	59.6	1.0	201	62.4	1.2	256	61.7	1.2
18	-	-	-	-	-	-	156	59.0	1.0	175	61.2	1.9	243	65.2	1.5
19	-	-	-	-	-	-	158	59.8	1.0	177	63.2	1.9	225	67.9	1.2
20 to 29	-	-	-	-	-	-	1,290	61.7	0.5	1,663	64.4	0.6	656	71.1	0.9
30 to 39	-	-	-	-	-	-	964	66.1	0.6	1,773	70.2	0.8	699	74.1	0.9
40 to 49	-	-	-	-	-	-	765	67.6	0.6	1,355	71.6	0.8	787	76.5	1.1
50 to 59	-	-	-	-	-	-	793	68.4	0.6	996	74.3	0.8	593	76.9	1.1
60 to 74	-	-	-	-	-	-	2,349	66.8	0.4	1,674	70.1	0.5	1,010	74.9	0.6
75+	-	-	-	-	-	-	-	-	-	1,022	63.4	0.6	554	66.6	0.9

\- = Data not available.
N = Number of individuals.
SE = Standard error.

Source: Ogden et al. (2004).

Table 8-15. Mean Height (cm) by Age and Sex Across Multiple Surveys

Sex and Age (years)	NHES II, 1963−1965			NHES III, 1966−1970			NHANES II, 1976−1980			NHANES III, 1988−1994			NHANES, 1999−2002		
	N	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE
Male															
2	-	-	-	-	-	-	350	91.1	0.2	589	90.9	0.2	254	91.2	0.3
3	-	-	-	-	-	-	421	98.7	0.3	513	98.8	0.3	222	98.6	0.3
4	-	-	-	-	-	-	405	105.5	0.4	551	105.2	0.4	183	106.5	0.4
5	-	-	-	-	-	-	393	112.3	0.3	497	112.3	0.3	156	113.0	0.5
6	575	118.9	0.2	-	-	-	146	119.1	0.5	283	118.9	0.7	188	119.2	0.5
7	632	124.5	0.3	-	-	-	150	124.5	0.5	270	125.9	0.6	187	126.2	0.6
8	618	130.0	0.3	-	-	-	145	129.6	0.7	269	131.3	0.6	217	132.5	0.7
9	603	135.5	0.4	-	-	-	141	135.0	0.6	280	137.7	0.7	177	138.1	0.4
10	576	140.2	0.3	-	-	-	165	141.3	0.6	297	142.0	1.1	188	141.4	0.6
11	595	145.5	0.3	-	-	-	153	145.5	0.6	285	147.4	0.7	187	148.7	0.9
12	-	-	-	643	152.3	0.4	147	152.5	0.7	207	155.5	1.1	301	154.8	0.7
13	-	-	-	626	159.8	0.4	165	158.3	0.8	190	161.6	0.8	298	160.1	0.8
14	-	-	-	618	166.7	0.5	188	166.8	0.6	191	169.0	0.9	267	168.5	0.9
15	-	-	-	613	171.4	0.3	180	171.2	0.7	188	172.8	1.0	287	173.8	0.6
16	-	-	-	556	174.3	0.4	180	173.4	0.5	197	175.0	0.9	310	175.3	0.6
17	-	-	-	458	175.6	0.4	183	174.8	0.5	196	176.5	0.9	317	175.3	0.6
18	-	-	-	-	-	-	156	177.3	0.6	176	177.3	1.0	289	176.4	0.7
19	-	-	-	-	-	-	150	176.1	0.5	169	175.5	0.6	275	176.7	0.6
20 to 29	-	-	-	-	-	-	1,261	177.1	0.3	1,639	176.1	0.3	724	176.7	0.3
30 to 39	-	-	-	-	-	-	871	176.3	0.3	1,468	176.6	0.3	717	176.4	0.3
40 to 49	-	-	-	-	-	-	695	175.9	0.3	1,220	176.3	0.3	784	177.2	0.3
50 to 59	-	-	-	-	-	-	691	174.7	0.3	851	175.8	0.3	601	175.8	0.3
60 to 74	-	-	-	-	-	-	2,086	172.1	0.2	1,684	173.6	0.2	1,010	174.4	0.3
75+	-	-	-	-	-	-	-	-	-	895	170.7	0.3	505	171.3	0.4

Table 8-15. Mean Height (cm) by Age and Sex Across Multiple Surveys (continued)

Sex and Age (years)	NHES II, 1963−1965			NHES III, 1966−1970			NHANES II, 1976−1980			NHANES III, 1988−1994			NHANES, 1999−2002		
	N	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE
Female															
2	-	-	-	-	-	-	314	89.4	0.3	564	89.7	0.2	233	90.1	0.4
3	-	-	-	-	-	-	367	97.1	0.2	590	98.2	0.2	187	97.6	0.5
4	-	-	-	-	-	-	388	104.2	0.4	535	105.1	0.3	195	105.9	0.5
5	-	-	-	-	-	-	369	111.2	0.4	557	112.2	0.5	190	112.4	0.7
6	536	117.8	0.3	-	-	-	150	117.9	0.6	274	117.9	0.6	172	117.1	0.7
7	609	123.5	0.2	-	-	-	154	123.4	0.7	275	124.3	0.7	200	124.4	0.5
8	613	129.4	0.3	-	-	-	125	129.5	0.5	247	131.1	0.6	184	130.9	0.6
9	581	135.5	0.3	-	-	-	154	134.1	0.5	282	136.6	0.7	189	136.9	0.7
10	584	140.9	0.3	-	-	-	128	141.7	0.6	262	142.7	0.6	164	143.3	0.9
11	525	147.3	0.3	-	-	-	143	147.4	0.7	275	150.2	0.7	194	151.4	0.7
12	-	-	-	547	46.6	0.3	146	143.8	0.6	239	155.5	0.7	318	156.0	0.7
13	-	-	-	582	50.5	0.3	155	158.7	0.5	225	159.9	0.9	324	159.1	0.6
14	-	-	-	586	54.2	0.3	181	160.7	0.7	224	161.2	0.7	326	161.8	0.6
15	-	-	-	503	56.5	0.5	144	163.3	0.5	195	162.8	0.6	271	162.0	0.6
16	-	-	-	536	58.1	0.3	167	162.8	0.5	214	163.0	0.7	275	161.9	0.5
17	-	-	-	442	57.6	0.3	134	163.5	0.6	201	163.6	0.6	258	163.2	0.6
18	-	-	-	-	-	-	156	162.8	0.5	175	163.2	0.9	249	163.0	0.5
19	-	-	-	-	-	-	158	163.2	0.4	178	163.4	0.7	231	163.1	0.7
20 to 29	-	-	-	-	-	-	1,290	163.3	0.2	1,665	162.8	0.2	663	162.8	0.3
30 to 39	-	-	-	-	-	-	964	163.1	0.2	1,776	163.4	0.3	708	163.0	0.3
40 to 49	-	-	-	-	-	-	765	162.3	0.3	1,354	162.8	0.3	794	163.4	0.2
50 to 59	-	-	-	-	-	-	793	160.5	0.3	998	161.8	0.3	601	162.3	0.3
60 to 74	-	-	-	-	-	-	2,349	158.8	0.2	1,680	159.8	0.2	1,004	160.0	0.2
75+	-	-	-	-	-	-	-	-	-	1,025	156.2	0.4	538	157.4	0.3

- = Data not available.
N = Number of individuals.
SE = Standard error.

Source: Ogden et al. (2004).

Table 8-16. Mean Body Mass Index (kg/m^2) by Age and Sex Across Multiple Surveys

Sex and Age (years)	NHES II, 1963−1965			NHES III, 1966−1970			NHANES I, 1971−1974			NHANES II, 1976−1980			NHANES III, 1988−1994			NHANES, 1999−2002		
	N	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE
Male																		
2	-	-	-	-	-	-	298	16.3	0.1	350	16.2	0.1	588	16.5	0.1	225	16.6	0.1
3	-	-	-	-	-	-	308	16.0	0.1	421	15.9	0.1	512	16.1	0.2	209	16.2	0.1
4	-	-	-	-	-	-	304	15.7	0.1	405	15.8	0.1	547	15.9	0.1	178	16.3	0.2
5	-	-	-	-	-	-	273	15.6	0.1	393	15.6	0.1	495	15.9	0.1	147	16.5	0.3
6	575	15.6	0.1	-	-	-	179	15.7	0.2	146	16.0	0.2	282	16.3	0.3	182	16.4	0.2
7	632	15.9	0.1	-	-	-	164	15.8	0.2	150	16.0	0.2	269	16.5	0.2	185	17.0	0.2
8	618	16.3	0.1	-	-	-	152	15.8	0.2	145	16.5	0.2	266	17.3	0.4	214	18.4	0.4
9	603	16.9	0.2	-	-	-	169	17.1	0.3	141	16.8	0.2	279	18.0	0.7	174	18.7	0.3
10	576	17.1	0.1	-	-	-	184	17.3	0.2	165	18.0	0.3	297	18.4	0.3	187	19.1	0.3
11	595	17.9	0.1	-	-	-	178	18.0	0.3	153	18.6	0.3	280	19.4	0.3	182	19.6	0.4
12	-	-	-	643	18.4	0.1	200	18.7	0.2	147	18.8	0.3	203	20.1	0.3	299	20.7	0.4
13	-	-	-	626	19.4	0.1	174	19.6	0.3	165	19.5	0.4	187	20.5	0.3	298	20.7	0.5
14	-	-	-	618	20.2	0.2	174	20.2	0.3	188	20.2	0.2	188	22.3	1.1	266	22.3	0.4
15	-	-	-	613	20.9	0.1	171	20.5	0.3	180	20.8	0.3	187	22.3	0.5	283	22.5	0.3
16	-	-	-	556	21.3	0.1	169	21.8	0.3	180	22.0	0.3	194	22.3	0.5	306	24.1	0.4
17	-	-	-	458	22.1	0.1	176	21.9	0.3	183	21.8	0.2	196	23.4	0.4	313	24.5	0.4
18	-	-	-	-	-	-	124	23.7	0.3	156	22.6	0.4	176	22.6	0.5	284	24.2	0.3
19	-	-	-	-	-	-	136	23.3	0.5	150	23.1	0.3	168	23.7	0.6	269	24.9	0.4
20 to 29	-	-	-	-	-	-	986	24.5	0.1	1,261	24.3	0.1	1,638	25.2	0.2	712	26.6	0.2
30 to 39	-	-	-	-	-	-	654	26.1	0.2	871	25.6	0.1	1,468	26.5	0.2	704	27.5	0.3
40 to 49	-	-	-	-	-	-	715	26.2	0.2	695	26.4	0.2	1,220	27.3	0.2	774	28.4	0.3
50 to 59	-	-	-	-	-	-	717	26.0	0.2	691	26.2	0.2	851	27.8	0.2	594	28.7	0.3
60 to 74	-	-	-	-	-	-	1,920	25.4	0.1	2,086	25.7	0.1	1,683	27.2	0.2	991	28.6	0.2
75+	-	--	-	--	-	-	-	-	-	-	-	-	895	25.9	0.2	487	26.8	0.2

Table 8-16. Mean Body Mass Index (kg/m^2) by Age and Sex Across Multiple Surveys (continued)

Sex and Age (years)	NHES II, 1963−1965			NHES III, 1966−1970			NHANES I, 1971−1974			NHANES II, 1976−1980			NHANES III, 1988−1994			NHANES, 1999−2002		
	N	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE	*N*	Mean	SE
Female																		
2	-	-	-	-	-	-	272	15.9	0.1	314	16.1	0.1	562	16.5	0.1	214	16.4	0.1
3	-	-	-	-	-	-	292	15.7	0.1	367	15.6	0.1	582	15.9	0.1	173	16.0	0.1
4	-	-	-	-	-	-	281	15.5	0.1	388	15.5	0.1	533	16.0	0.2	190	15.9	0.2
5	-	-	-	-	-	-	314	15.5	0.1	369	15.6	0.1	554	15.9	0.1	186	16.1	0.3
6	536	115.4	0.1	-	-	-	176	15.4	0.1	150	15.6	0.2	272	16.1	0.3	170	16.2	0.2
7	609	15.8	0.1	-	-	-	169	15.6	0.2	154	16.1	0.2	274	16.9	0.3	196	16.6	0.2
8	613	16.4	0.1	-	-	-	152	16.4	0.2	125	16.3	0.2	247	17.3	0.3	184	18.3	0.5
9	581	17.0	0.1	-	-	-	171	17.2	0.2	154	17.5	0.3	280	18.2	0.5	183	18.7	0.3
10	584	17.6	0.2	-	-	-	197	17.1	0.2	128	17.7	0.3	258	18.4	0.4	163	19.3	0.3
11	525	18.2	0.2	-	-	-	166	18.6	0.3	143	18.9	0.3	275	19.4	0.4	194	20.7	0.4
12	-	-	-	547	19.2	0.1	177	19.5	0.4	146	19.3	0.3	236	20.2	0.5	315	21.2	0.4
13	-	-	-	582	19.9	0.1	198	20.4	0.3	155	20.1	0.4	220	21.8	0.6	321	22.6	0.4
14	-	-	-	586	20.8	0.1	184	21.1	0.3	181	21.0	0.3	218	22.4	0.5	324	22.9	0.4
15	-	-	-	503	21.4	0.2	167	21.1	0.3	144	20.6	0.3	191	21.9	0.4	266	23.2	0.5
16	-	-	-	536	21.9	0.2	171	21.7	0.3	167	21.8	0.3	208	23.0	0.5	273	24.0	0.4
17	-	-	-	442	21.7	0.2	150	22.6	0.5	134	22.3	0.4	201	23.3	0.5	255	23.1	0.4
18	-	-	-	-	-	-	141	21.5	0.3	156	22.3	0.4	175	22.9	0.6	243	24.4	0.5
19	-	-	-	-	-	-	130	22.5	0.6	158	22.4	0.3	177	23.7	0.8	225	25.5	0.4
20 to 29	-	-	-	-	-	-	2,122	23.0	0.1	1,290	23.1	0.2	1,663	24.3	0.2	654	26.8	0.3
30 to 39	-	-	-	-	-	-	1,654	24.7	0.2	964	24.9	0.2	1,773	26.3	0.3	698	27.9	0.3
40 to 49	-	-	-	-	-	-	1,232	25.7	0.2	765	25.7	0.2	1,354	27.1	0.3	783	28.6	0.4
50 to 59	-	-	-	-	-	-	780	26.2	0.2	793	26.5	0.2	996	28.4	0.3	591	29.2	0.4
60 to 74	-	-	-	-	-	-	2,131	26.5	0.2	2,349	26.5	0.1	1,673	27.4	0.2	993	29.2	0.2
75+	-	-	-	-	-	-	-	-	-	-	-	-	1,021	25.9	0.2	524	26.8	0.4

- = Data not available.
N = Number of individuals.
SE = Standard error.

Source: Ogden et al. (2004).

Table 8-17. Sample Sizes by Age, Sex, Race, and Examination

Age Group (years)	Sex	Race[a]	NHANES Examination		
			II (1976−1980)	III (1988−1994)	1999−2002
Overall (2 to 17)			6,395 (10.6)[b]	9,610 (9.9)	6,710 (10.1)
2 to 5	Boys	White	1,082 (4.1)	605 (4.0)	226 (3.9)
		Black	273 (4.1)	693 (3.9)	234 (4.0)
		Mexican American	105 (4.2)	732 (4.0)	231 (3.9)
	Girls	White	1,028 (4.0)	639 (4.0)	235 (4.1)
		Black	234 (4.0)	684 (3.9)	222 (4.0)
		Mexican American	102 (4.2)	800 (3.9)	238 (4.1
6 to 11	Boys	White	667 (9.0)	446 (8.9)	298 (8.9)
		Black	137 (9.0)	584 (9.0)	371 (9.0)
		Mexican American	60 (9.2)	565 (9.0)	384 (9.0)
	Girls	White	631 (9.1)	428 (9.1)	293 (8.9)
		Black	155 (9.0)	538 (9.0)	363 (9.1)
		Mexican American	40 (9.3)	581 (8.9)	361 (9.0)
12 to 17	Boys	White	786 (15.1)	282 (14.9)	449 (14.9)
		Black	155 (15.1)	412 (15.0)	543 (14.9)
		Mexican American	49 (15.0)	406 (15.0)	648 (15.0)
	Girls	White	695 (15.1)	344 (15.0)	456 (14.9)
		Black	159 (15.0)	450 (14.9)	528 (14.8)
		Mexican American	37 (15.2)	421 (14.8)	631 (14.9)
20 to 39	Male	White	-	-	607
		Black	-	-	279
		Mexican American	-	-	399
	Female	White	-	-	569
		Black	-	-	298
		Mexican American	-	-	358
40 to 59	Male	White	-	-	676
		Black	-	-	289
		Mexican American	-	-	310
	Female	White	-	-	632
		Black	-	-	297
		Mexican American	-	-	332
60 and over[c]	Male	White	-	-	866
		Black	-	-	256
		Mexican American	-	-	318
	Female	White	-	-	862
		Black	-	-	275
		Mexican American	-	-	329

[a] Race was recorded in the 1st two examinations (using data concerning ancestry/national origin) to create comparable categories in all surveys.

[b] Mean ages are shown in parentheses. There are no mean ages available for the older age group data (ages 20 and above).

[c] Data from Ogden et al. (2004).

\- No data available.

Sources: Freedman et al. (2006); Ogden et al. (2004).

Table 8-18. Mean BMI (kg/m^2) Levels and Change in the Mean *Z*-Scores by Race-Ethnicity and Sex (ages 2 to 17)

		Examination Year[a]				Increase in Mean *z*-score from 1971−1974 to 1999−2002		
	Race	1971−1974	1976−1980	1988−1994	1999−2002	BMI	Weight	Height
Overall	White	18.0[b]	18.0	18.8	19.0	+0.33	+0.36	+0.20
	Black	17.8	18.2	19.1	20.0	+0.61	+0.63	+0.31
	Mexican American	18.6	18.8	19.5	20.1	+0.32	+0.52	+0.39
Sex								
Boys	White	17.9	18.0	18.8	19.0	+0.37	+0.42	+0.25
	Black	17.7	17.8	18.8	19.6	+0.53	+0.58	+0.32
	Mexican American	18.6	18.9	19.4	20.3	+0.38	+0.67	+0.57
Girls	White	18.0	18.0	18.7	19.0	+0.30	+0.32	+0.16
	Black	17.9	18.6	19.5	20.4	+0.71	+0.69	+0.30
	Mexican American	18.5	18.6	19.6	19.9	+0.25	+0.35	+0.21
Age (years)								
2 to 5	White	15.8	15.7	16.0	16.2	+0.21	+0.22	+0.13
	Black	15.8	15.7	15.9	16.2	+0.34	+0.32	+0.18
	Mexican American	16.5	16.2	16.5	16.5	-0.02	+0.29	+0.43
6 to 11	White	16.7	16.9	17.6	17.9	+0.42	+0.47	+0.30
	Black	16.5	17.1	17.9	18.7	+0.67	+0.69	+0.36
	Mexican American	16.9	17.7	18.5	18.8	+0.50	+0.65	+0.41
12 to 17	White	20.7	20.6	21.8	22.0	+0.32	+0.35	+0.15
	Black	20.4	20.9	22.4	23.7	+0.72	+9,77	+0.33
	Mexican American	21.6	21.5	22.6	24.0	+0.37	+0.55	+0.34

[a] Secular trends for BMI, BMI-for-age, weight-for-age, and height-for-age were each statistically significant at the 0.001 level. Trends in BMI, BMI-for-age, and weight also differed ($p < 0.001$) by race.

[b] Mean BMI levels have been adjusted for differences in age and sex across exams.

Source: Freedman et al. (2006).

Table 8-19. Mean Body Mass Index (kg/m^2) by Survey, Sex, Race/Ethnicity, and Age Group; Adults: United States

Sex, Race/Ethnicity, and Age (years)	HHANES, 1982−1984			NHANES III, 1988−1994			NHANES, 1999−2002		
	Sample Size	Mean	Standard Error of the Mean	Sample Size	Mean	Standard Error of the Mean	Sample Size	Mean	Standard Error of the Mean
Males									
Non-Hispanic White:[a]									
20 and over	-	-	-	3,152	26.8	0.1	2,116	27.9	0.2
20 to 39	-	-	-	846	25.9	0.2	607	27.1	0.2
40 to 59	-	-	-	842	27.6	0.2	673	28.7	0.3
60 and over	-	-	-	1,464	27.0	0.1	836	28.3	0.1
Non-Hispanic Black:									
20 and over[a]	-	-	-	2,091	26.6	0.1	820	27.5	0.2
20 to 39 yr[a]	-	-	-	985	26.3	0.2	279	27.1	0.3
40 to 59	-	-	-	583	27.1	0.2	289	27.7	0.4
60 and over[a]	-	-	-	523	26.4	0.3	252	28.0	0.3
Mexican American:[a]									
20 and over	-	-	-	2,229	27.3	0.1	1,018	28.0	0.2
20 to 74	2,273	26.2	0.2	2,127	27.3	0.1	959	28.1	0.2
20 to 39	1,133	25.6	0.3	1,143	26.1	0.2	399	27.1	0.3
40 to 59	856	26.9	0.1	558	28.6	0.2	309	28.9	0.3
60 to 74	284	26.3	0.2	426	27.4	0.3	251	28.6	0.3
60 and over	-	-	-	528	27.1	0.3	310	28.1	0.3
Females									
Non-Hispanic white:[a]									
20 and over	-	-	-	3,554	26.1	0.2	2,026	27.6	0.2
20 to 39	-	-	-	1,030	24.7	0.2	567	26.7	0.3
40 to 59	-	-	-	950	27.2	0.3	629	28.3	0.4
60 and over	-	-	-	1,574	26.7	0.2	830	28.2	0.2
Non-Hispanic Black:[a]									
20 and over	-	-	-	2,451	29.1	0.2	863	31.1	0.3
20 to 39	-	-	-	1,191	27.6	0.3	298	30.2	0.5
40 to 59	-	-	-	721	30.4	0.3	294	32.1	0.5
60 and over	-	-	-	539	29.4	0.4	271	31.1	0.6
Mexican American:									
20 and over	-	-	-	2,106	28.4	0.2	1,012	29.0	0.3
20 to 74[a]	3,039	27.1	0.1	2,013	28.5	0.2	960	29.1	0.3
20 to 39[a]	1,482	25.6	0.2	1,063	27.2	0.2	358	27.8	0.4
40–to 59[a]	1,159	28.2	0.2	557	29.7	0.3	332	30.4	0.5
60 to 74[a]	398	28.1	0.3	393	29.2	0.4	270	29.5	0.3
60 and over	-	-	-	486	28.7	0.4	322	28.9	0.4

[a] Statistically significant trend or difference $p < 0.05$ for all years available.

\- Data not available.

Notes: BMI is calculated as weight in kilograms divided by square of height in meters. HHANES: Hispanic Health and Nutrition Examination Survey.

Source: Ogden et al. (2004).

Table 8-20. Prevalence of Overweight and Obesity[a] Among Children

			Examination Year				Increase in Prevalence from 1971−1974 to 1999−2002	
		Race	1971−1974	1976−1980	1988−1994	1999−2002	Overweight	Obesity
Overall		White	5% (1)[b]	5% (1)	9% (2)	12% (3)	+8	+2
		Black	6% (1)	7% (2)	12% (3)	18% (5)	+12	+4
		Mexican American	8% (1)	10% (1)	14% (4)	21% (5)	+12	+4
Sex								
	Boys	White	5% (1)	5% (1)	10% (2)	13% (4)	+8	+3
		Black	6% (2)	5% (1)	11% (3)	16% (5)	+10	+3
		Mexican American	8% (1)	12% (1)	15% (4)	24% (4)	+16	+6
	Girls	White	5% (1)	5% (1)	9% (2)	12% (2)	+7	+1
		Black	6% (1)	9% (2)	14% (3)	21% (6)	+14	+5
		Mexican American	8% (2)	7% (0)	14% (3)	17% (4)	+9	+2
Age (yr)								
	2 to 5	White	4% (1)	3% (1)	5% (1)	9% (3)	+5	+2
		Black	7% (3)	4% (0)	8% (3)	9% (4)	+2	+1
		Mexican American	10% (5)	11% (3)	12% (5)	13% (5)	+3	0
	6 to 11	White	4% (0)	6% (1)	11% (3)	13% (4)	+10	+3
		Black	4% (0)	9% (3)	15% (3)	20% (5)	+15	+4
		Mexican American	6% (0)	11% (0)	17% (4)	22% (5)	+16	+5
	12 to 17	White	6% (1)	4% (0)	11% (2)	13% (2)	+7	+1
		Black	8% (1)	8% (1)	13% (3)	22% (6)	+14	+5
		Mexican American	9% (0)	8% (1)	14% (2)	25% (5)	+15	+5

[a] Overweight is defined as a BMI $\geq$95th percentile or $\geq$30 kg/m^2; obesity is defined as a BMI $\geq$99th percentile or $\geq$40 kg/m^2.

[b] Values are percentage of overweight children (percentage of obese children).

Source: Freedman et al. (2006).

Table 8-21. Numbers of Live Births by Weight and Percentages of Live Births With Low and Very Low Birth Weights, by Race, and Hispanic Origin of Mother: United States, 2005

	All Races[a]	Non-Hispanic White[b]	Non-Hispanic Black[b]	Hispanic[c]
Total Births	4,138,349	2,279,768	583,759	985,505
Weight (g)		Number of Live Births		
<500	6,599	2,497	2,477	1,212
500−999	23,864	10,015	8,014	4,586
1,000−1,499	31,325	14,967	8,573	5,988
1,500−1,999	66,453	33,687	15,764	12,710
2,000−2,499	210,324	104,935	46,846	43,300
2,500−2,999	748,042	364,726	144,803	176,438
3,000−3,499	1,596,944	857,136	221,819	399,295
3,500−3,999	1,114,887	672,270	108,698	266,338
4,000−4,499	289,098	167,269	22,149	64,704
4,500−4,999	42,119	27,541	3,203	9,167
>5,000	4,715	2,840	405	1,174
Not stated	3,979	1,885	1,008	593
		% of Total		
Low Birth Weight[d]	8.2	7.3	14.0	6.9
Very Low Birth Weight[e]	1.5	1.2	3.3	1.2

[a] All Races includes White, Black, and races other than White and Black and origin not stated.
[b] Race categories are consistent with the 1977 Office of Management and Budget standards.
[c] Hispanic includes all persons of Hispanic origin of any race.
[d] Low birth weight is birth weight less than 2,500 g (5 lb 8 oz).
[e] Very low birth weight is birth weight less than 1,500 g (3 lb 4 oz).

Source: Martin et al. (2007).

Table 8-22. Estimated Mean Body Weights of Males and Females by Single-Year Age Groups Using NHANES II Data

Age Group[a] (years)	Males (kg)			Females (kg)			Overall (kg)		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
0 to 1	9.4	1.3	179	8.8	1.3	177	9.1	1.2	356
1 to 2	11.8	1.6	370	10.8	1.4	336	11.3	1.5	706
2 to 3	13.6	1.8	375	13.0	1.5	336	13.3	1.6	711
3 to 4	15.6	1.9	418	14.9	2.1	366	15.2	1.8	784
4 to 5	17.8	2.4	404	17.0	2.3	396	17.4	2.4	800
5 to 6	19.8	2.8	397	19.6	3.2	364	19.7	2.8	761
6 to 7	23.0	3.7	133	22.1	3.9	135	22.5	3.6	268
7 to 8	25.1	3.8	148	24.7	4.6	157	24.8	3.8	305
8 to 9	28.2	5.6	147	27.8	4.8	123	28.1	5.6	270
9 to 10	31.1	5.8	145	31.8	7.3	149	31.4	5.9	294
10 to 11	36.4	7.2	157	36.1	7.7	136	36.2	7.1	293
11 to 12	40.2	9.8	155	41.8	10.1	140	41.0	9.9	295
12 to 13	44.2	9.8	145	46.4	10.1	147	45.4	10.0	292
13 to 14	49.8	11.4	173	50.9	11.2	162	50.4	11.5	335
14 to 15	57.1	10.7	186	54.7	10.7	178	55.9	10.5	364
15 to 16	61.0	10.4	184	55.1	9.0	145	58.0	9.9	329
16 to 17	67.1	11.7	178	58.1	9.6	170	62.4	10.9	348
17 to 18	66.7	11.3	173	59.6	10.4	134	63.3	10.7	307
18 to 19	71.0	12.0	164	59.0	10.2	170	64.6	10.9	334
19 to 20	71.7	11.3	148	60.1	10.1	158	65.3	10.3	306
20 to 21	71.6	12.0	114	60.5	10.7	162	65.2	10.9	276
21 to 22	74.76	12.73	150	60.39	11.14	170	66.71	11.35	320
22 to 23	76.10	12.88	135	60.51	10.11	150	67.30	11.39	285
23 to 24	75.93	11.76	148	61.21	11.48	133	68.43	10.60	281
24 to 25	75.18	11.65	129	62.71	13.44	123	68.43	10.60	252
25 to 26	76.34	11.52	118	62.64	12.46	120	68.80	10.38	238
26 to 27	79.49	14.18	127	61.74	11.77	118	70.57	12.59	245
27 to 28	76.17	12.34	112	62.83	12.18	130	68.24	11.06	242
28 to 29	79.80	14.15	104	63.79	14.34	138	69.79	12.38	242
29 to 30	77.64	11.63	124	63.33	12.92	122	69.97	10.48	246
30 to 31	78.63	13.63	103	64.90	13.71	139	70.44	12.21	242
31 to 32	78.19	14.19	108	67.71	14.45	116	72.33	13.13	224
32 to 33	79.15	12.99	102	68.94	17.51	104	73.43	12.05	206
33 to 34	80.73	12.67	86	63.43	11.77	92	71.82	11.27	178
34 to 35	81.24	14.83	83	63.03	14.43	91	70.91	12.94	174
35 to 36	79.04	12.81	91	67.30	15.62	113	72.24	11.71	204
36 to 37	80.41	14.10	79	65.41	11.27	84	72.03	12.63	163
37 to 38	79.06	12.41	83	66.81	13.08	97	71.82	11.27	180
38 to 39	83.01	15.40	65	66.56	15.72	71	74.14	13.76	136
39 to 40	79.85	13.02	71	67.21	13.85	79	73.19	11.94	150
40 to 41	84.20	13.22	76	70.56	17.70	77	76.49	12.01	153
41 to 42	81.20	15.07	73	65.25	12.91	70	73.47	13.63	143
42 to 43	79.67	11.86	74	65.81	12.14	98	71.23	10.60	172
43 to 44	81.50	14.04	68	68.45	14.89	84	73.38	12.64	152
44 to 45	82.76	13.41	65	66.96	15.19	71	73.70	11.94	136
45 to 46	80.91	13.77	62	65.18	14.78	65	72.33	12.31	127
46 to 47	82.83	15.28	68	70.45	15.91	82	75.24	13.89	150
47 to 48	82.29	11.83	55	68.02	13.67	73	73.42	10.55	128
48 to 49	81.52	12.63	77	67.39	15.71	67	74.28	11.51	144
49 to 50	80.60	13.31	77	66.83	14.54	79	73.07	12.06	156
50 to 51	81.14	14.23	79	70.81	14.67	98	75.12	13.17	177
51 to 52	81.25	11.27	69	67.20	11.99	67	73.81	10.23	136
52 to 53	82.38	15.03	73	66.07	14.58	88	72.70	13.27	161
53 to 54	79.37	12.94	69	68.83	14.83	73	73.71	12.02	142

Table 8-22. Estimated Mean Body Weights of Males and Females by Single-Year Age Groups Using NHANES II Data (continued)

Age Group[a] (years)	Males (kg)			Females (kg)			Overall (kg)		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
54 to 55	76.63	13.36	61	67.62	14.64	71	71.52	12.47	132
55 to 56	81.92	15.12	62	71.93	16.17	90	75.32	13.90	152
56 to 57	77.36	11.28	69	70.82	15.40	67	73.59	10.73	136
57 to 58	79.85	13.02	64	66.87	14.41	99	71.60	11.68	163
58 to 59	79.23	12.52	73	68.73	13.60	70	73.28	11.58	143
59 to 60	80.00	12.47	72	64.43	12.88	70	71.45	11.14	142
60 to 61	79.76	12.92	183	67.28	12.83	218	72.75	11.79	401
61 to 62	78.42	11.75	169	68.12	13.83	176	72.68	10.89	345
62 to 63	77.06	12.33	188	66.09	13.69	184	71.00	11.36	372
63 to 64	77.07	11.31	162	66.41	14.03	178	70.72	10.38	340
64 to 65	77.27	13.63	185	67.45	13.77	177	72.26	12.74	362
65 to 66	77.36	13.25	158	68.48	14.68	185	71.84	12.30	343
66 to 67	75.35	13.21	138	67.36	13.95	182	70.40	12.34	320
67 to 68	73.98	12.82	143	65.98	13.47	149	69.19	11.99	292
68 to 69	74.14	14.60	124	68.87	13.63	161	71.02	13.98	285
69 to 70	74.40	13.20	129	65.59	13.39	119	69.37	12.30	248
70 to 71	75.17	13.03	128	65.04	12.47	136	69.32	12.01	264
71 to 72	74.45	12.60	115	65.62	13.53	139	69.00	11.67	254
72 to 73	73.47	12.36	100	64.89	11.58	135	68.17	11.46	235
73 to 74	72.80	12.17	82	65.59	12.71	108	68.36	11.43	190
74+	75.89	13.38	82	67.20	14.48	102	70.55	12.44	184

[a] Data were converted from ages in months to ages in years. For instance, age 1–2 yr represents ages from 12 to 23 mo.
SD = Standard deviation.
N = Number of individuals.

Source: Portier et al. (2007).

Table 8-23. Estimated Mean Body Weights of Males and Females by Single-Year Age Groups Using NHANES III Data

Age Group[a] (years)	Males (kg)			Females (kg)			Overall (kg)		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
0 to 1	8.5	1.5	902	7.8	1.6	910	8.17	1.7	1,812
1 to 2	11.6	1.5	660	10.9	1.4	647	11.2	1.5	1,307
2 to 3	13.6	1.5	644	13.2	1.8	624	13.4	1.8	1,268
3 to 4	15.8	2.3	516	15.4	2.2	587	15.6	2.2	1,103
4 to 5	17.6	2.4	549	17.9	3.2	537	17.8	3.2	1,086
5 to 6	20.1	3.0	497	20.2	3.5	554	20.2	3.5	1,051
6 to 7	23.2	5.0	283	22.6	4.7	272	22.9	4.8	555
7 to 8	26.3	5.0	269	26.3	6.2	274	26.4	6.2	543
8 to 9	30.1	6.9	266	29.8	6.7	248	30.0	6.7	514
9 to 10	34.4	7.9	281	34.3	9.0	280	34.4	9.0	561
10 to 11	37.3	8.6	297	37.9	9.5	258	37.7	9.4	555
11 to 12	42.5	10.5	281	44.2	10.5	275	43.4	10.3	556
12 to 13	49.1	11.1	203	49.1	11.6	236	49.1	11.7	439
13 to 14	54.0	12.9	187	55.7	13.2	220	54.8	13.0	407
14 to 15	63.7	17.1	188	58.3	11.8	220	60.6	12.2	408
15 to 16	66.8	14.9	187	58.3	10.1	197	61.7	10.7	384
16 to 17	68.6	14.9	194	61.5	12.8	215	65.2	13.6	409
17 to 18	72.7	13.3	196	62.4	11.9	217	67.6	12.9	413
18 to 19	71.2	14.3	176	61.5	14.2	193	66.4	15.3	369
19 to 20	73.0	12.8	168	63.6	14.5	193	68.3	15.6	361
20 to 21	72.5	13.4	149	61.7	12.9	180	66.1	13.8	329
21 to 22	72.92	12.86	161	65.01	16.03	188	69.24	17.08	349
22 to 23	76.34	14.72	160	64.07	13.61	193	69.48	14.75	353
23 to 24	77.85	14.37	172	66.99	16.24	205	72.72	17.63	377
24 to 25	78.56	15.38	187	62.79	12.62	200	70.16	14.10	387
25 to 26	80.33	17.89	171	66.19	16.05	157	74.11	17.97	328
26 to 27	75.88	12.84	143	64.89	15.19	184	69.73	16.33	327
27 to 28	81.17	14.90	176	65.10	14.43	184	73.33	16.25	360
28 to 29	81.10	18.23	154	66.97	15.26	190	73.28	16.70	344
29 to 30	81.93	16.89	156	65.89	13.65	177	73.33	15.19	333
30 to 31	83.56	16.71	163	67.76	16.85	202	75.11	18.68	365
31 to 32	79.48	13.12	155	72.48	19.32	204	77.04	20.54	359
32 to 33	81.65	15.82	159	67.53	17.22	179	74.33	18.95	338
33 to 34	84.03	16.63	153	68.49	16.03	176	75.09	17.58	329
34 to 35	82.95	15.56	162	67.55	14.27	186	76.47	16.16	348
35 to 36	81.24	16.16	143	71.45	17.47	188	76.02	18.59	331
36 to 37	87.67	21.26	163	66.02	14.29	180	77.32	16.74	343
37 to 38	83.33	17.61	123	72.04	17.69	202	76.42	18.77	325
38 to 39	82.53	14.47	136	71.58	17.43	183	76.85	18.71	319
39 to 40	82.62	12.46	122	74.57	19.41	157	79.34	20.65	279
40 to 41	85.84	15.23	152	68.70	15.80	198	75.55	17.37	350
41 to 42	86.19	18.93	148	70.11	13.80	183	78.34	15.42	331
42 to 43	85.12	16.76	161	72.72	19.46	171	79.25	21.21	332
43 to 44	86.37	17.71	139	68.94	15.35	123	77.80	17.33	262
44 to 45	90.62	20.37	120	72.61	17.15	152	79.13	18.69	272
45 to 46	83.58	13.46	108	71.78	15.76	125	78.22	17.18	233
46 to 47	80.70	13.00	102	72.07	15.53	113	76.30	16.44	215
47 to 48	85.54	17.28	116	72.09	15.98	102	79.28	17.57	218
48 to 49	82.29	14.93	93	75.80	16.09	95	79.21	16.82	188
49 to 50	82.25	16.11	85	73.41	18.26	106	77.95	19.39	191
50 to 51	81.69	13.24	77	74.05	18.03	118	77.31	18.82	195
51 to 52	85.78	15.39	84	79.48	19.60	85	83.81	20.67	169
52 to 53	87.02	13.66	93	72.00	16.86	100	79.97	18.72	193
53 to 54	89.44	14.86	86	73.92	17.08	97	81.86	18.91	183

Table 8-23. Estimated Mean Body Weights of Males and Females by Single-Year Age Groups Using NHANES III Data (continued)

Age Group[a] (years)	Males(kg)			Females (kg)			Overall (kg)		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
54 to 55	86.02	16.76	86	74.63	19.97	113	79.88	21.38	199
55 to 56	83.10	14.99	82	72.56	14.06	102	76.59	14.84	184
56 to 57	87.16	15.10	96	77.69	16.74	105	83.15	17.91	201
57 to 58	86.31	15.04	89	75.65	17.87	97	82.12	19.40	186
58 to 59	83.54	15.67	81	72.26	16.47	100	76.89	17.52	181
59 to 60	87.93	16.14	74	74.00	15.33	82	80.48	16.67	156
60 to 61	83.54	14.22	130	68.73	13.60	104	75.88	15.02	234
61 to 62	81.91	15.03	119	72.26	15.42	141	76.50	16.32	260
62 to 63	81.98	15.47	116	72.97	17.54	114	77.18	18.55	230
63 to 64	84.15	14.50	118	71.32	14.48	111	76.88	15.61	229
64 to 65	84.28	15.73	116	74.34	17.40	126	78.86	18.46	242
65 to 66	85.10	14.75	127	67.47	16.08	118	76.14	18.14	245
66 to 67	81.43	15.03	102	71.82	14.58	118	76.49	15.53	220
67 to 68	84.35	15.22	117	68.98	15.22	95	76.08	16.78	212
68 to 69	80.60	11.75	98	70.72	16.56	110	76.07	17.81	208
69 to 70	84.81	18.18	113	66.57	11.74	97	74.84	13.20	210
70 to 71	80.18	14.14	92	68.36	15.72	124	72.95	16.78	216
71 to 72	79.34	14.64	126	70.74	17.89	98	75.64	19.13	224
72 to 73	78.97	13.36	119	66.70	13.89	101	72.76	15.15	220
73 to 74	82.07	17.26	109	68.24	14.14	115	74.37	15.41	224
74 to 75	79.32	15.37	84	69.08	13.67	97	73.57	14.56	181
75 to 76	77.18	10.47	75	68.58	13.50	85	72.89	14.35	160
76 to 77	79.30	14.88	64	65.68	13.88	94	70.38	14.87	158
77 to 78	80.70	13.98	64	67.33	14.16	86	72.43	15.23	150
78 to 79	75.21	11.34	50	63.67	14.31	63	67.94	15.27	113
79 to 80	78.75	11.32	45	60.21	14.41	61	67.28	16.10	106
80 to 81	76.94	15.15	108	63.55	13.10	101	68.77	14.18	209
81 to 82	73.70	13.30	96	63.17	12.70	112	66.94	13.45	208
82 to 83	73.25	12.32	81	61.96	12.01	69	67.05	12.99	150
83 to 84	72.10	15.31	63	62.78	12.23	63	65.80	12.82	126
84 to 85	72.09	10.73	62	63.68	11.43	57	66.74	11.97	119
85+	70.08	11.64	189	59.67	11.69	240	63.11	12.36	429

[a] Data were converted from ages in months to ages in years. For instance, age 1–2 yr represents ages from 12 to 23 mo.
SD = Standard deviation.
N = Number of individuals.

Source: Portier et al. (2007).

Table 8-24. Estimated Mean Body Weights of Males and Females by Single-Year Age Groups Using NHANES IV Data

Age Group[a] (years)	Males (kg)			Females (kg)			Overall (kg)		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
0 to 1	9.3	1.8	116	9.3	1.5	101	9.3	1.5	217
1 to 2	11.3	1.4	144	11.5	1.9	98	11.4	1.8	242
2 to 3	13.7	2.0	130	13.3	1.9	113	13.5	2.0	243
3 to 4	16.4	2.3	105	15.2	2.1	77	15.9	2.2	182
4 to 5	18.8	2.6	95	18.1	3.2	87	18.5	3.3	182
5 to 6	20.2	3.3	65	20.7	4.9	92	20.6	4.9	157
6 to 7	22.9	4.3	94	22.0	4.5	74	22.5	4.6	168
7to 8	28.1	5.6	100	26.0	6.2	82	27.4	6.5	182
8 to 9	31.9	8.6	100	30.8	7.2	89	31.3	7.3	189
9 to 10	36.1	7.5	76	36.0	8.4	84	36.2	8.5	160
10 to 11	39.5	9.0	92	39.4	10.2	84	39.5	10.2	176
11 to 12	42.0	10.2	84	47.2	12.2	97	44.6	11.6	181
12 to 13	49.4	12.7	158	51.6	12.3	160	50.3	11.9	318
13 to 14	54.9	16.2	161	59.8	15.3	156	56.9	14.6	317
14 to 15	65.1	19.9	137	59.9	13.3	158	61.5	13.7	295
15 to 16	68.2	15.7	142	63.4	13.9	126	65.9	14.4	268
16 to 17	72.5	18.6	153	63.4	16.0	142	68.0	17.1	295
17 to 18	75.4	17.9	146	59.9	11.9	128	66.6	13.2	274
18 to 19	74.8	15.9	131	65.0	15.2	139	70.2	16.4	270
19 to 20	80.1	17.2	129	68.7	17.4	132	74.6	19.0	261
20 to 21	80.0	15.5	37	66.3	15.5	44	74.3	17.4	81
21 to 22	73.84	12.87	33	65.89	15.49	47	69.40	16.32	80
22 to 23	89.62	23.98	37	67.27	15.47	49	75.85	17.44	86
23 to 24	83.39	18.31	36	73.58	23.21	53	80.27	25.32	89
24 to 25	80.26	19.38	20	71.81	21.27	54	75.04	22.23	74
25 to 26	87.47	14.89	27	71.64	20.31	44	80.45	22.80	71
26 to 27	72.11	14.64	33	78.09	20.98	47	75.63	20.32	80
27 to 28	85.78	22.69	30	72.48	18.10	49	78.75	19.67	79
28 to 29	88.04	26.64	36	76.18	16.18	34	81.29	17.26	70
29 to 30	84.02	15.16	35	71.88	16.60	50	78.10	18.04	85
30 to 31	80.10	22.28	29	74.00	22.71	48	77.01	23.63	77
31 to 32	84.65	18.59	33	79.12	22.51	49	82.51	23.48	82
32 to 33	90.99	15.77	35	77.53	18.15	55	83.82	19.62	90
33 to 34	90.90	18.74	37	76.60	22.28	29	85.94	25.00	66
34 to 35	79.09	19.50	33	73.26	16.92	49	75.72	17.49	82
35 to 36	91.15	25.45	33	79.91	22.74	37	84.60	24.07	70
36 to 37	88.96	17.15	29	72.10	20.29	38	80.17	22.55	67
37 to 38	84.62	17.62	47	70.75	15.39	35	79.21	17.23	82
38 to 39	80.52	17.26	29	80.86	22.32	40	81.18	22.41	69
39 to 40	84.77	14.26	37	78.08	19.34	43	81.92	20.29	80
40 to 41	92.21	26.63	40	73.87	18.14	47	82.13	20.17	87
41 to 42	83.11	14.06	37	75.91	17.38	37	79.56	18.21	74
42 to 43	91.94	15.56	46	82.03	21.78	41	88.15	23.41	87
43 to 44	89.48	16.15	40	71.59	17.81	27	83.18	20.69	67
44 to 45	87.00	14.63	34	74.86	18.15	42	80.04	19.41	76
45 to 46	84.61	17.53	33	81.15	23.52	50	83.21	24.12	83
46 to 47	93.27	20.48	28	74.94	16.84	34	82.90	18.63	62
47 to 48	80.87	11.38	29	68.24	16.97	38	74.29	18.48	67
48 to 49	85.58	17.91	21	82.10	29.55	34	84.51	30.42	55
49 to 50	88.84	24.90	28	75.55	21.74	24	82.17	23.64	52
50 to 51	90.09	14.51	26	83.22	27.42	27	88.10	29.03	53
51 to 52	90.63	18.22	35	76.89	16.09	36	83.63	17.50	71
52 to 53	90.62	19.52	24	80.89	19.78	42	85.03	20.79	66
53 to 54	92.42	21.93	28	76.12	16.64	32	82.96	18.13	60

Table 8-24. Estimated Mean Body Weights of Males and Females by Single-Year Age Groups Using NHANES IV Data (continued)

Age Group[a] (years)	Males (kg)			Females (kg)			Overall (kg)		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
54 to 55	90.51	21.10	32	75.19	18.07	36	81.46	19.58	68
55 to 56	84.84	18.72	20	79.87	16.71	25	82.39	17.24	45
56 to 57	84.48	18.55	26	80.68	20.24	32	82.72	20.75	58
57 to 58	86.02	20.50	26	73.07	13.79	24	80.20	15.13	50
58 to 59	89.11	21.33	19	71.21	16.01	17	79.97	17.97	36
59 to 60	83.82	16.33	25	76.28	16.36	17	80.76	17.32	42
60 to 61	89.53	17.90	60	75.97	18.66	43	83.70	20.56	103
61 to 62	86.04	15.44	34	77.01	16.67	37	81.12	17.56	71
62 to 63	84.46	16.28	41	75.78	13.13	45	79.50	13.78	86
63 to 64	86.51	20.07	24	77.95	16.96	39	80.73	17.56	63
64 to 65	91.45	16.88	39	76.75	18.29	42	83.98	20.01	81
65 to 66	89.46	18.44	41	72.95	18.37	41	80.38	20.24	82
66 to 67	90.40	20.13	49	79.00	17.67	26	86.09	19.26	75
67 to 68	85.34	19.18	36	77.76	18.21	35	81.18	19.01	71
68 to 69	84.48	12.92	26	73.28	14.12	35	78.20	15.07	61
69 to 70	92.35	16.95	24	69.94	9.20	32	80.53	10.59	56
70 to 71	81.91	16.38	47	70.50	12.94	32	76.06	13.96	79
71 to 72	79.65	21.31	25	66.22	13.04	35	68.99	13.58	60
72 to 73	84.67	17.45	32	76.89	15.30	21	81.08	16.13	53
73 to 74	89.70	15.36	35	72.75	16.80	27	81.69	18.87	62
74 to 75	80.85	17.00	17	69.21	16.35	31	73.34	17.32	48
75 to 76	84.26	11.94	25	68.61	10.42	21	75.14	11.41	46
76 to 77	86.13	15.45	20	67.42	11.34	25	73.62	12.38	45
77 to 78	81.68	14.15	18	78.35	17.45	21	80.09	17.84	39
78 to 79	81.99	16.39	26	72.30	14.16	17	77.77	15.23	43
79 to 80	80.18	10.39	19	67.95	12.54	21	73.39	13.54	40
80 to 81	75.90	12.07	27	60.97	14.46	23	65.39	15.51	50
81 to 82	73.77	7.40	31	68.76	13.75	25	71.28	14.25	56
82 to 83	81.01	13.46	20	62.93	9.81	20	68.51	10.68	40
83 to 84	76.07	10.63	12	66.24	11.68	12	70.90	12.50	24
84 to 85	73.06	12.88	12	66.29	15.04	17	68.79	15.60	29
85+	74.10	12.23	46	59.68	10.04	59	64.45	10.84	105

[a] Data were converted from ages in months to ages in years. For instance, age 1–2 yr represents ages from 12 to 23 mo.

SD = Standard deviation.

N = Number of individuals.

Source: Portier et al. (2007).

Table 8-25. Estimated Body Weights of Typical Age Groups of Interest in U.S. EPA Risk Assessments[a]

Age Group (years)	NHANES	Males (kg)			Females (kg)			Overall (kg)		
		Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
1 to 6	II	17.0	4.6	2,097	16.3	4.7	1,933	16.7	4.5	4,030
	III	16.9	4.7	3,149	16.5	4.9	3,221	16.8	5.0	6,370
	IV	17.1	4.9	633	17.5	5.0	541	17.3	5.0	1,174
7 to 16	II	45.2	17.6	1,618	43.9	15.9	1,507	44.8	17.5	3,125
	III	49.3	20.9	2,549	46.8	18.0	2,640	47.8	18.4	5,189
	IV	47.9	20.1	1,203	47.9	19.2	1,178	47.7	19.1	2,381
18 to 65	II	78.65	13.23	4,711	65.47	13.77	5,187	71.23	11.97	9,898
	III	82.19	16.18	6,250	69.45	16.55	7,182	75.61	18.02	13,462
	IV	85.47	19.03	1,908	74.55	19.32	2,202	79.96	20.73	4,110
65+	II	74.45	13.05	1,041	66.26	13.25	1,231	69.56	12.20	2,272
	III	79.42	14.66	1,857	66.76	14.52	1,986	72.25	15.71	3,843
	IV	83.50	16.35	547	69.59	14.63	535	75.54	15.88	1,082

[a] Estimates were weighted using the sample weights provided with each survey.
SD = Standard deviation.
N = Number of individuals.

Source: Portier et al. (2007).

Table 8-26. Estimated Percentile Distribution of Body Weight by Fine Age Categories Derived From 1994−1996, 1998 CSFII

Age Group	Sample Size	Mean	Weight (kg) Percentile								
			1st	5th	10th	25th	50th	75th	90th	95th	99th
Birth to 1 month	88	4	1[a]	2[a]	3[a]	3	3	4	4[a]	5[a]	5[a]
1 to <3 months	245	5	2[a]	3[a]	4	4	5	6	6	7[a]	8[a]
3 to <6 months	411	7	4[a]	5	5	6	7	8	9	10	12[a]
6 to <12 months	678	9	6[a]	7	7	8	9	10	11	12	13[a]
1 to <2 years	1,002	12	8[a]	9	9	10	11	13	14	15	19[a]
2 to <3 years	994	14	10[a]	10	11	12	14	16	18	19	22[a]
3 to <6 years	4,112	18	11	13	13	16	18	20	23	25	32
6 to <11 years	1,553	30	16[a]	18	20	23	27	35	41	45	57[a]
11 to <16 years	975	54	29[a]	33	36	44	52	61	72	82	95[a]
16 to <18 years	360	67	41[a]	46[a]	50	56	63	73	86	100[a]	114[a]
18 to <21 years	383	69	45[a]	48[a]	51	58	66	77	89	100[a]	117[a]
≥21 years	9,049	76	45	51	54	63	74	86	99	107	126
≥65 years	2,139	72	44	50	54	62	71	81	93	100	113
All ages	19,850	65	8	15	22	52	67	81	95	104	122

[a] Sample size does meet minimum reporting requirements as described in the *3rd Report on Nutrition Monitoring in the United States* (FASEB/LSRO, 1995).

Source: Kahn and Stralka (2009).

Table 8-27. Estimated Percentile Distribution of Body Weight by Fine Age Categories With Confidence Interval

Weight (kg)										
Age Group	Sample Size	Mean			90th Percentile			95th Percentile		
		Estimate	90% CI		Estimate	90% BI		Estimate	90% BI	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound		Lower Bound	Upper Bound
Birth to 1 month	88	4	3	4	4[a]	4[a]	5[a]	5[a]	5[a]	5[a]
1 to <3 months	245	5	5	5	6	6	7	7[a]	7	7
3 to <6 months	411	7	7	7	9	9	9	10	10	10
6 to <12 months	678	9	9	9	11	11	11	12	12	12
1 to <2 years	1,002	12	12	12	14	14	15	15	15	16
2 to <3 years	994	14	14	14	18	17	18	19	18	19
3 to <6 years	4,112	18	18	18	23	23	23	25	25	25
6 to <11 years	1,553	30	29	30	41	41	43	45	44	48
11 to <16 years	975	54	53	55	72	70	75	82	81	84
16 to <18 years	360	67	66	68	86	84	95	100[a]	95[a]	109[a]
18 to <21 years	383	69	68	70	89	88	95	100[a]	95[a]	104[a]
≥21 years	9,049	76	-	-	99	-	-	107	-	-
≥65 years	2,139	72	-	-	93	-	-	100	-	-
All ages	19,850	65	-	-	95	-	-	104	-	-

[a] Sample size does meet minimum reporting requirements as described in the *3rd Report on Nutrition Monitoring in the United States* (Vol. I) (FASEB/LSRO, 1995). Interval estimates may involve aggregation of variance estimation units when data are too sparse to support estimation of variance.
CI = Confidence interval.
BI = Percentile intervals estimated using percentile bootstrap method with 1,000 bootstrap replications.
- = Data unavailable.

Source: Kahn and Stralka (2009).

Table 8-28. Distribution of 1st Trimester Weight Gain and 2nd and 3rd Trimester Rates of Gain in Women With Good Pregnancy Outcomes

Trimester	Percentile of Weight Gain					
	10th	25th	50th	75th	90th	Mean ± SD
1st Trimester, kg						
Underweight	−1.81	−0.14	1.92	3.78	5.77	1.92 ± 3.06
Normal weight	−2.21	−0.09	2.20	4.37	6.59	2.19 ± 3.47
Overweight	−2.91	−0.59	2.38	4.63	7.04	2.16 ± 3.95
Obese	−3.08	−0.86	1.17	3.89	7.22	1.65 ±3. 94
2nd Trimester, kg/wk[a]						
Underweight	0.33	0.44	0.56	0.69	0.82	0.57 ± 0.20
Normal weight	0.31	0.44	0.56	0.71	0.85	0.58 ± 0.22
Overweight	0.21	0.36	0.49	0.65	0.83	0.51 ± 0.24
Obese	0.06	0.24	0.42	0.56	0.78	0.41 ± 0.27
3rd Trimester, kg/wk[a]						
Underweight	0.26	0.36	0.47	0.60	0.71	0.48 ± 0.19
Normal weight	0.26	0.37	0.50	0.64	0.77	0.51 ± 0.21
Overweight	0.21	0.34	0.47	0.63	0.77	0.49 ± 0.22
Obese	0.19	0.31	0.43	0.64	0.80	0.47 ± 0.24

[a] To calculate the distribution of total gain (kg) in the 2nd and 3rd trimesters, multiply the values in the table by 13 wk.

SD = Standard deviation.

Source: Carmichael et al. (1997).

Table 8-29. Estimated Body Weights of Pregnant Women—NHANES (1999−2006)

Weight (kg)												
		Mean		Percentiles								
Trimester	Sample size	Estimate	SD	5th	10th	15th	25th	50th	75th	85th	90th	95th
1	204	76	3	48	50	55	60	74	91	98	106	108
2	430	73	1	50	53	57	61	72	83	93	95	98
3	402	80	1	60	63	65	69	77	88	99	104	108
Ref/Dk[a]	186	69	2	46	52	55	60	65	77	84	87	108
All	1,222	75	1	50	55	59	63	73	85	94	99	107

[a] Refers to pregnant women who either refused to tell which trimester they were in or didn't know or data were missing.
SD = Standard deviation.

Source: U.S. EPA Analysis of NHANES 1999−2006 data.

Table 8-30. Fetal Weight (g) Percentiles Throughout Pregnancy

Gestational Age (wk)	Number of Women	10th	25th	50th	75th	90th
8	6	–[a]	–	6.1[b]	–	–
9	7	–	–	7.3[b]	–	–
10	15	–	–	8.1[b]	–	–
11	13	–	–	11.9[b]	–	–
12	18	–	11	21	34	–
13	43	–	23	35	55	–
14	61	–	3,405	51	77	–
15	63	–	51	77	108	–
16	59	–	80	117	151	–
17	36	–	125	166	212	–
18	58	–	172	220	298	–
19	31	–	217	283	394	–
20	21	–	255	325	460	–
21	43	280	330	410	570	860
22	69	320	410	480	630	920
23	71	370	460	550	690	990
24	74	420	530	640	780	1,080
25	48	490	630	740	890	1,180
26	86	570	730	860	1,020	1,320
27	76	660	840	990	1,160	1,470
28	91	770	980	1,150	1,350	1,660
29	88	890	1,100	1,310	1,530	1,890
30	128	1,030	1,260	1,460	1,710	2,100
31	113	1,180	1,410	1,630	1,880	2,290
32	210	1,310	1,570	1,810	2,090	2,500
33	242	1,480	1,720	2,010	2,280	2,690
34	373	1,670	1,910	2,220	2,510	2,880
35	492	1,870	2,130	2,430	2,730	3,090
36	1,085	2,190	2,470	2,650	2,950	3,290
37	1,798	2,310	2,580	2,870	3,160	3,470
38	3,908	2,510	2,770	3,030	3,320	3,610
39	5,413	2,680	2,910	3,170	3,470	3,750
40	10,586	2,750	3,010	3,280	3,590	3,870
41	3,399	2,800	3,070	3,360	3,680	3,980
42	1,725	2,830	3,110	3,410	3,740	4,060
43	507	2,840	3,110	3,420	3,780	4,100
44	147	2,790	3,050	3,390	3,770	4,110

[a] Data not available.

[b] Median fetal weights may be overestimated. They were derived from only a small proportion of the fetuses delivered at these gestational weeks.

Source: Brenner et al. (1976).

Table 8-31. Neonatal Weight by Gestational Age for Males and Females Combined

Gestational Age (weeks)	Weight (g)						
	5th	10th	25th	50th	75th	90th	95th
25	450	490	564	660	772	889	968
26	523	568	652	760	885	1,016	1,103
27	609	660	754	875	1,015	1,160	1,257
28	707	765	870	1,005	1,162	1,322	1,430
29	820	884	1,003	1,153	1,327	1,504	1,623
30	947	1,020	1,151	1,319	1,511	1,706	1,836
31	1,090	1,171	1,317	1,502	1,713	1,928	2,070
32	1,249	1,338	1,499	1,702	1,933	2,167	2,321
33	1,422	1,519	1,696	1,918	2,169	2,421	2,587
34	1,608	1,714	1,906	2,146	2,416	2,687	2,865
35	1,804	1,919	2,125	2,383	2,671	2,959	3,148
36	2,006	2,129	2,349	2,622	2,927	3,230	3,428
37	2,210	2,340	2,572	2,859	3,177	3,493	3,698
38	2,409	2,544	2,786	3,083	3,412	3,736	3,947
39	2,595	2,735	2,984	3,288	3,622	3,952	4,164
40	2,762	2,904	3,155	3,462	3,798	4,127	4,340
41	2,900	3,042	3,293	3,597	3,930	4,254	4,462
42	3,002	3,142	3,388	3,685	4,008	4,322	4,523
43	3,061	3,195	3,432	3,717	4,026	4,324	4,515

Source: Doubilet et al. (1997).

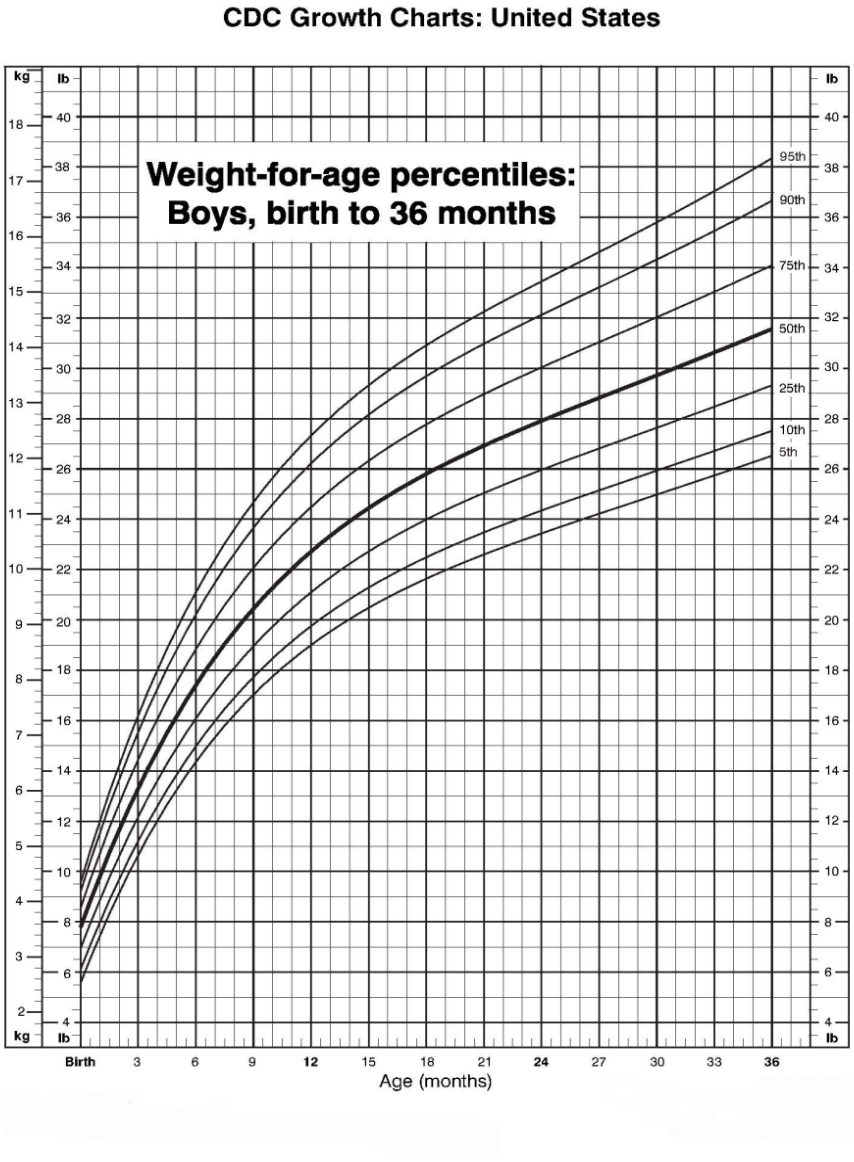

Figure 8-1. Weight by Age Percentiles for Boys Aged Birth to 36 Months.

Source: Kuczmarski et al. (2002).

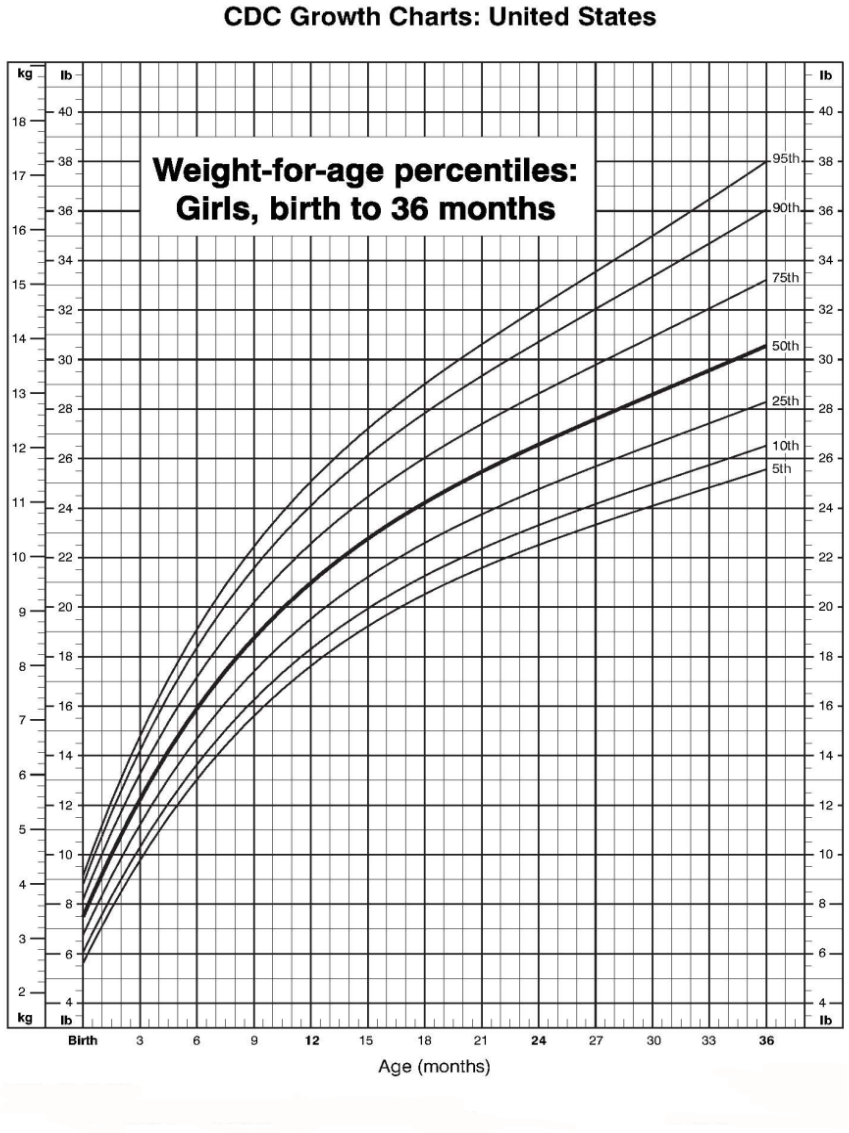

Figure 8-2. Weight by Age Percentiles for Girls Aged Birth to 36 Months.

Source: Kuczmarski et al. (2002).

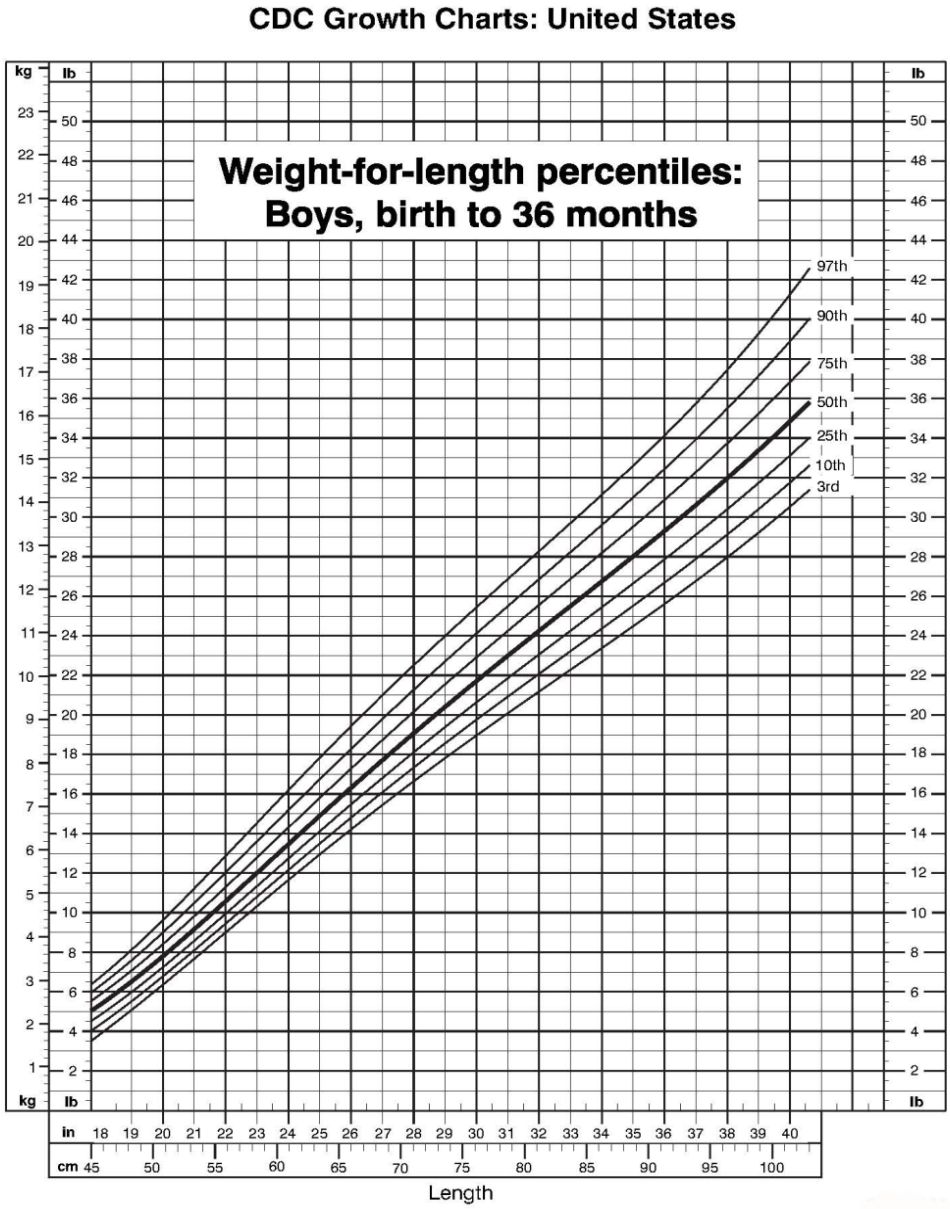

Figure 8-3. Weight by Length Percentiles for Boys Aged Birth to 36 Months.

Source: Kuczmarski et al. (2002).

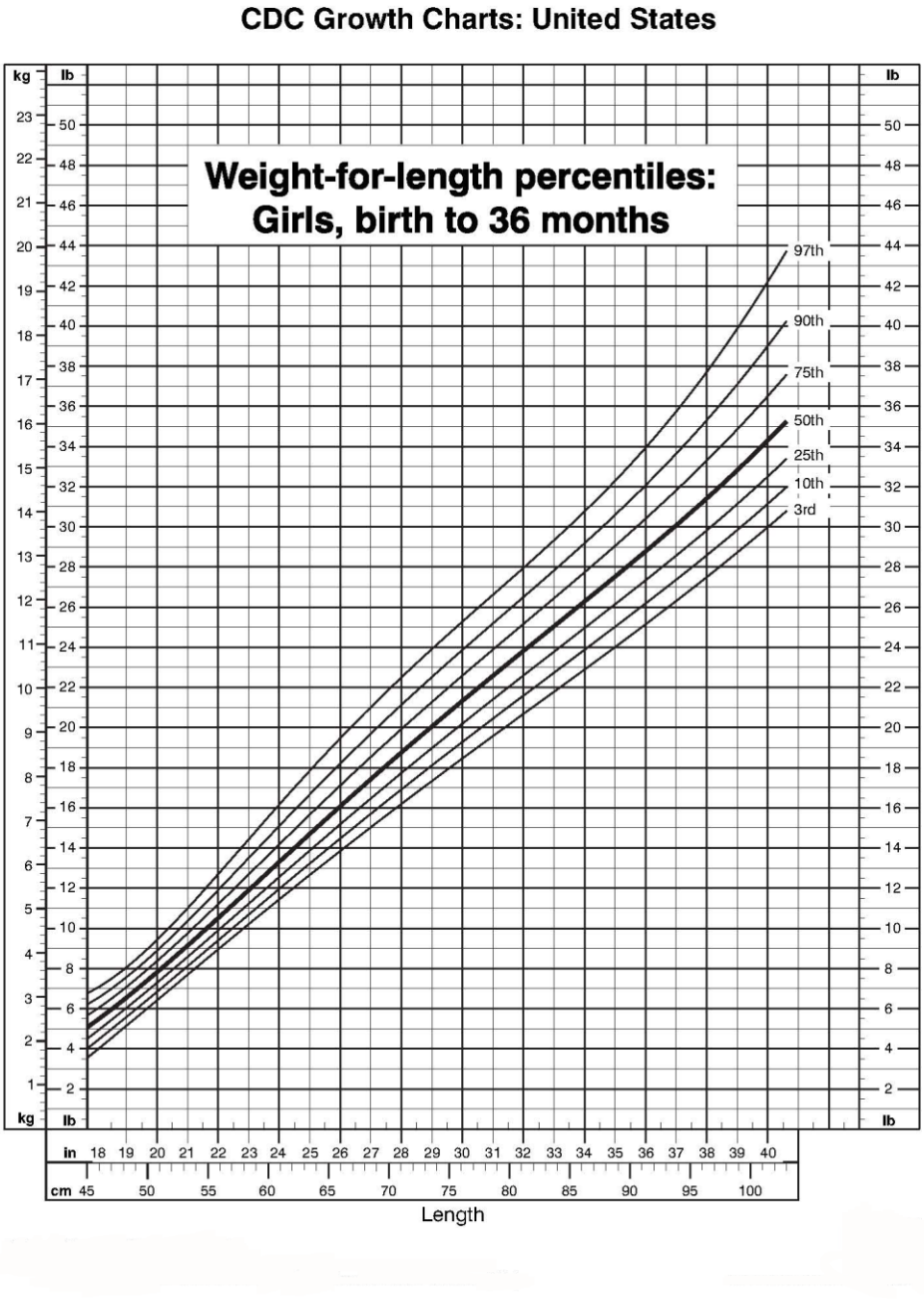

Figure 8-4. Weight by Length Percentiles for Girls Aged Birth to 36 Months.

Source: Kuczmarski et al. (2002).

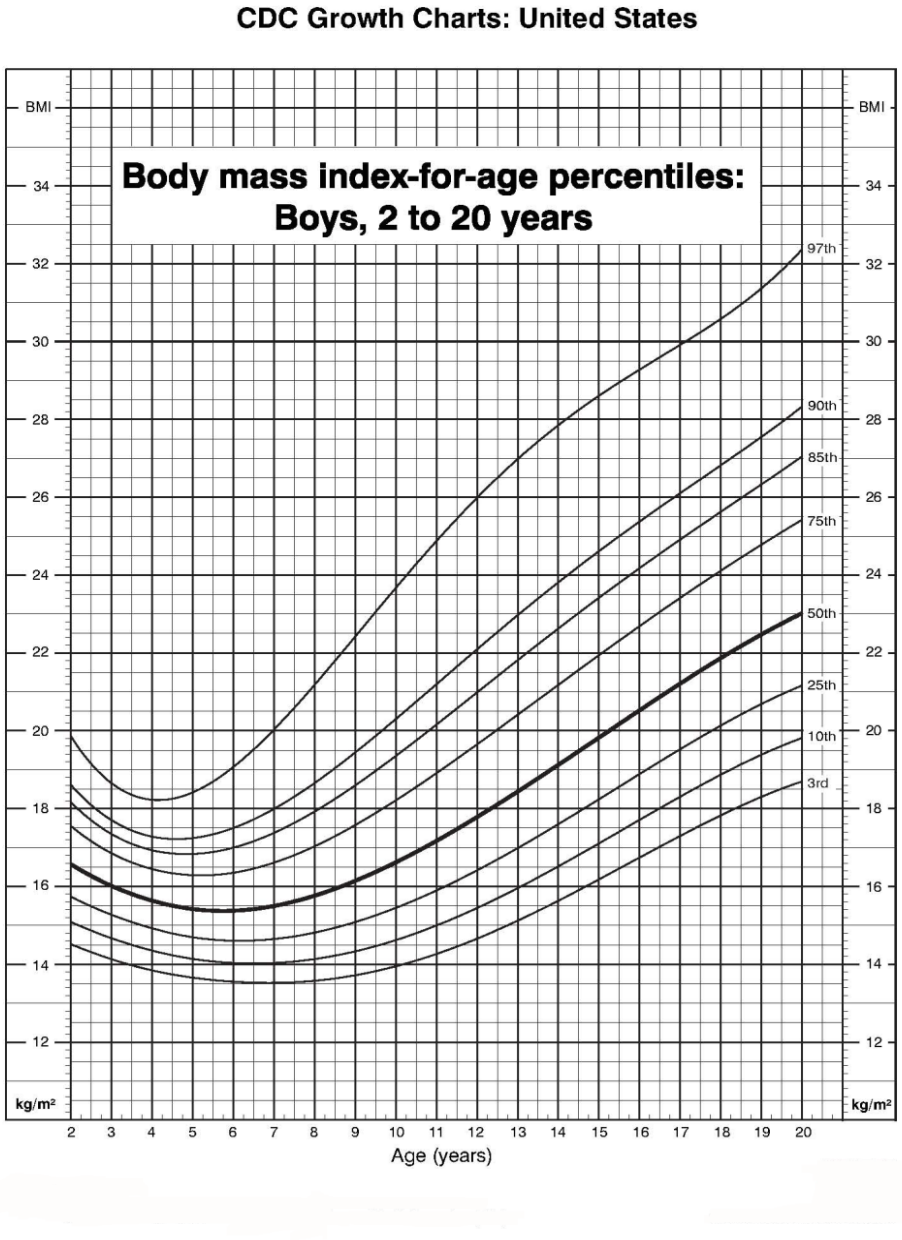

Figure 8-5. Body Mass Index-for-Age Percentiles: Boys, 2 to 20 Years.

Source: Kuczmarski et al. (2002).

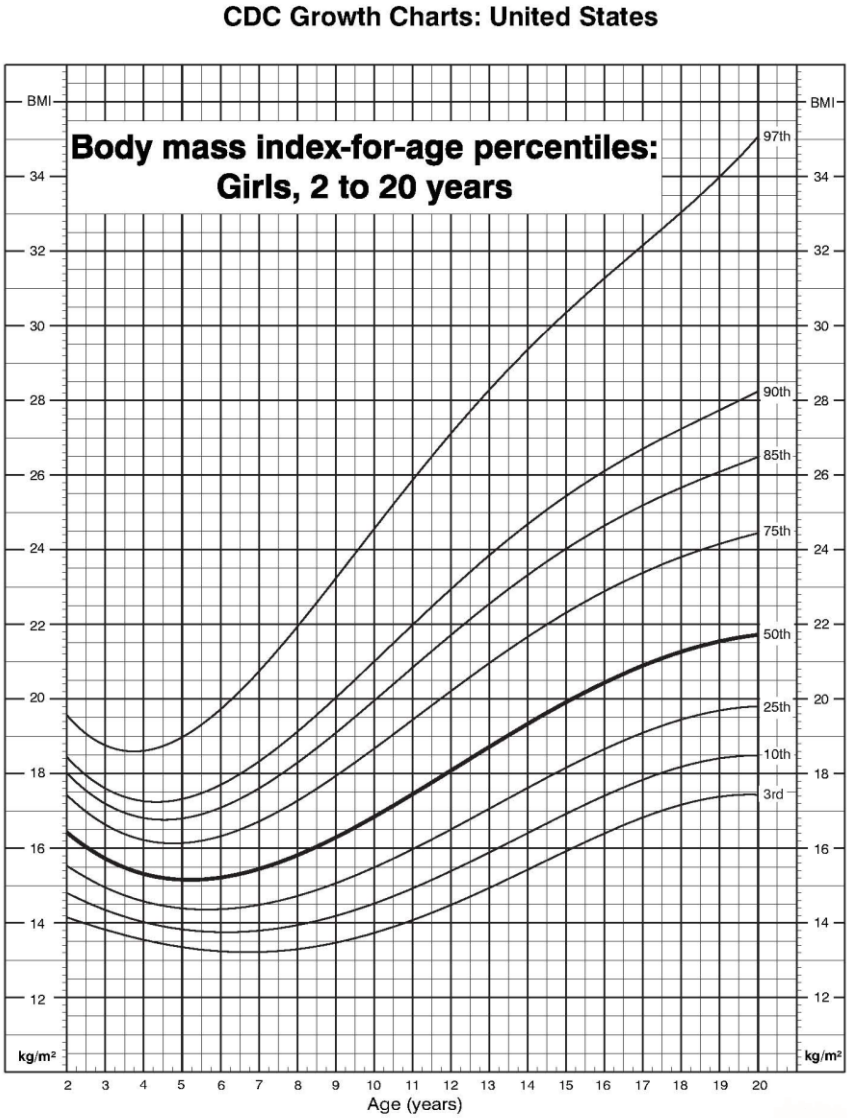

Figure 8-6. Body Mass Index-for-Age Percentiles: Girls, 2 to 20 Years.

Source: Kuczmarski et al. (2002).