Appendix B

Reference Standards

Some of the variables included in this report required variable construction based on outside reference standards. This appendix describes the variables that were constructed, the standards that were used, and the manner in which the standards were applied. To the extent possible, standards used are those defined in the *Healthy People 2010* objectives (U.S. DHHS, 2000a).

The appendix covers all four volumes of the report; some variables are used only in selected volumes. With the exception of Healthy Eating Index (HEI) variables, which were constructed by staff at the National Center for Health Statistics (NCHS), all variable construction was carried out by the authors.

Body Weight and Height

NHANES-III examinations included measurement of body weight and stature (or recumbent length).[1] These data were used to determine Body Mass Index (BMI)[2] for both adults and children and to assess children's anthropometric status relative to reference growth charts.

Table B-1 shows the reference standards used in these analyses. As shown, BMI is interpreted differently for children, depending on age, because normal body fatness changes as children age. For children, overweight and underweight status is determined by comparing BMI to gender- and age-specific growth charts developed by the Centers for Disease Control and Prevention (CDC).[3] In addition, stature-for-age growth charts are used to assess children's linear growth. Copies of the CDC growth charts used in these analyses are provided at the end of the appendix.

Bone Density Measures

NHANES-III measured bone density for all men and non-pregnant women age 20 and over. Bone density of the proximal femur was measured during the MEC exam using dual energy x-ray absorptiometry (DXA).

Volumes I (FSP participants and nonparticipants) and IV (the elderly) present the prevalence of normal, reduced, and severely reduced bone mineral density. Standards used to define these conditions are those specified by NCHS (NCHS, 1999):

- Reduced bone mass, or osteopenia, is defined as bone mineral density 1–2.5 standard deviations below the mean of non-Hispanic white women 20–29 years of age as measured in NHANES-III.

- Severely reduced bone mass, or osteoporosis, is defined as bone mineral density more than 2.5 standard deviations below the mean of non-Hispanic white women 20–29 years of age as measured in NHANES-III.

The latter standard is used in the *Healthy People 2010* objectives.

Coronary Heart Disease Risk

The National Cholesterol Education Program (NCEP), sponsored by the National Institutes of Health (NIH), provides a methodology for estimating individuals' 10-year risk for coronary heart disease (NIH, 2001). The 10-year risk

[1] Recumbent length was measured for infants and children up to age 3; stature was measured for persons age 2 and over. Both length and height were measured for children age 24 to 36 months.

[2] BMI is equal to [weight in kilograms] / [height in meters]^2.

[3] Reference charts for assessing children's anthropometric status were originally developed by NCHS in 1977. Revised charts were released in May 2000, based on pooled data from five national U.S. health examination surveys including NHANES-III (Kuczmarski et al., 2002).

Table B-1¾ Reference Standards Used to Assess Body Mass Index and Linear Growth

Measure	Standard	Source
Adults		
Underweight	BMI < 18.5	*Healthy People 2010* (U.S. DHHS, 2000a)[1]
Healthy weight	BMI ≥ 18.5 and < 25	*Healthy People 2010* (U.S. DHHS, 2000a)
Overweight	BMI ≥ 25 and < 30	National Institutes of Health (NIH) and World Health Organization (WHO) guidelines (NIH, 1998 and WHO, 1998)
Obese	BMI ≥ 30	*Healthy People 2010* (U.S. DHHS, 2000a)
Children age 2 and over		
Underweight	< 5th percentile on BMI-for-age chart	CDC guidelines on using BMI-for-age growth charts (CDC, 2003)
At-risk of overweight	≥ 85th and < 95th percentile on BMI-for-age chart	CDC guidelines on using BMI-for-age growth charts (CDC, 2003)
Overweight	≥ 95th percentile on BMI-for-age chart	*Healthy People 2010* (U.S. DHHS, 2000a)
Growth retarded	< 5th percentile on stature-for-age chart	*Healthy People 2010* (U.S. DHHS, 2000a)
Children age 1-4-years-old (WIC volume)		
Underweight	< 5th percentile on weight-for-height chart	CDC guidelines on using weight-for-height growth charts (CDC, 2003)
At-risk of overweight	≥ 85th and < 95th percentile on weight-for-height chart	CDC guidelines on using weight-for-height growth charts (CDC, 2003)
Overweight	≥ 95th percentile on weight-for-height chart	CDC guidelines on using weight-for-height growth charts (CDC, 2003)

[1]Adapted from Health People 2010 goal, which specifies BMI ≥ 18.5 as a healthy weight.

estimate is based on six factors: gender, age, total cholesterol, smoking status, HDL cholesterol, and systolic blood pressure. In Volumes I (FSP participants and nonparticipants) and IV (the elderly), the NCEP methodology was used to estimate the 10-year- risk of coronary heart disease among adults.

Nutrient Intake Standards

In recent years, the Institute of Medicine (IOM) has issued a comprehensive set of *Dietary Reference Intakes* (DRIs), reference values for use in planning and assessing nutrient intake. DRIs replace the *Recommended Dietary Allowances* (RDAs), first developed by the Food and Nutrition Board in 1941 (National Research Council (NRC), 1989a). The DRIs were released in a series of nutrient-specific reports; the first report was released in 1999 and the most recent in late 2004 (IOM, 1999, 2000a, 2000b, 2002a, 2002b, 2004).[4] The DRIs specify up to four different reference values for each nutrient for age- and gender-specific subgroups of the population. These reference values include:

- **Estimated Average Requirement (EAR).** The EAR is the daily level of intake estimated to meet the requirements of 50 percent of healthy individuals in a specific age- and gender subgroup. EAR values are

[4] With the exception of the 2004 reports, dates are final publication dates. Pre-publication copies of all reports were available two or more years prior to final publication.

used to set RDAs and may be used to assess the adequacy of intake of groups of individuals.

- **Recommended Dietary Allowance (RDA)**. The RDA is the daily level of intake sufficient to meet the nutrient requirements of nearly all (97-98 percent) healthy individuals in a specific subgroup. RDAs are based on EARs.

- **Adequate Intake (AI)**. An AI is defined when the available data are insufficient to estimate requirements and establish an EAR and an RDA. The AI is the daily level of intake that is assumed to be adequate, based on observed or experimentally determined estimates of intake.

- **Tolerable Upper Intake Level (UL)**. The UL is the maximum daily level of intake that is safe for nearly all members of a group. Intake above the UL increases risk of toxicity.

At the time the analyses presented in this series of reports were completed, DRIs had been established for four of the nutrients examined: vitamin C, iron, zinc, and calcium. For vitamin C, iron, and zinc, EARs were used to assess prevalence of adequate usual intake (the methodology used in estimating usual intake and in determining the prevalence of adequate intake is described in appendix C). It is not possible to assess the prevalence of adequate calcium intake, however, because the DRI committee established an AI for calcium rather than an EAR (IOM, 1999). Consequently, analysis of calcium intakes focuses on comparing mean intakes for each subgroup to age- and gender-specific AIs.

Because DRIs had not yet been established, intakes of food energy and the other nutrients and food components examined (total fat, saturated fat, cholesterol, sodium, and fiber) were assessed relative to then-current standards. Data on usual energy intake were compared to the 1989 Recommended Energy Allowance (REA) (NRC, 1989a). The prevalence of appropriate usual intakes of total fat, saturated fat, cholesterol, and sodium was assessed relative to the recommended maximum intakes defined in the *Dietary Guidelines for Americans* (U.S. Departments of Agriculture and Health and Human Services, 2000). (The standards for total fat, saturated fat, and sodium intake are also included in the *Healthy People 2010* objectives). Finally, the prevalence of adequate fiber intake was assessed on the basis of the "age-plus-5" standard. This standard, originally developed by Williams (1995), was adapted by the American Heart Association (AHA) (Van Horn, 1997) and was used in other research that preceded establishment of the DRIs for fiber (Gleason and Suitor, 2001). Under this standard, recommended fiber intake (in gm.) is equivalent to age in years plus five, up to a maximum of 25 gm.

Prior to the time the reports were to be published, DRIs were released for energy, total fat, sodium, and fiber. While it was not possible to re-do the analyses to incorporate these new standards, the text was expanded, to the extent possible, to assess usual nutrient intakes in light of the new standards. Specifically, discussions of total fat, sodium, and fiber intakes were updated by comparing means and distributions of usual intake to the new standards. It was not possible to update discussions of energy intake because the new energy standards (Estimated Energy Requirements or EERs) incorporate information on individuals' weight, height, and level of physical activity (IOM, 2002b).

Tables B-2 – B-4 show the nutrient standards used in the analysis as well as other relevant standards. Table B-2 lists EARs for vitamin C, iron, and zinc, and AIs for calcium, all of which were used in the main analysis. It also shows

Table B-2—Dietary Reference Intakes for Individuals

	Estimated Average Requirements			Adequate Intakes[1]	
	Vitamin C (mg/day)	Iron (mg/day)	Zinc (mg/day)	Calcium (mg/day)	Total fiber (g/day)
Children					
1-3 yrs	13	3.0	2.2	500	19
4-8 yrs	22	4.1	4.0	800	25
Males					
9-13 yrs	39	5.9	7.0	1,300	31
14-18 yrs	63	7.7	8.5	1,300	38
19-30 yrs	75	6.0	9.4	1,000	38
31-50 yrs	75	6.0	9.4	1,000	38
51-70 yrs	75	6.0	9.4	1,200	30
>70 yrs	75	6.0	9.4	1,200	30
Females					
9-13 yrs	39	5.7	7.0	1,300	26
14-18 yrs	56	7.9	7.5	1,300	36
19-30 yrs	60	8.1	6.8	1,000	25
31-50 yrs	60	8.1	6.8	1,000	25
51-70 yrs	60	5.0	6.8	1,200	21
>70 yrs	60	5.0	6.8	1,200	28
Pregnant Women					
14-18 yrs	66	23.0	10.5	1,300	22
19-30 yrs	70	22.0	9.5	1,000	28
31-50 yrs	70	22.0	9.5	1,000	28
Lactating Women					
14-18 yrs	96	7.0	11.6	1,300	29
19-30 yrs	100	6.5	10.4	1,000	29

[1] Estimated Average Requirements have not been set for calcium, sodium, or fiber.
Source: Dietary Reference Intakes. Institute of Medicine, Food and Nutrition Board (1999, 2000b, 2002a, 2002b, 2004).

Table B-3—1989 Recommended Dietary Allowances

	Energy allowance (REA) (kcal)	Vitamin C (mg)	Iron (mg)	Zinc (mg)	Calcium (mg)
Children					
1-3 yrs	1,300	40	10	10	800
4-6 yrs	1,800	45	10	10	800
7-10 yrs	2,000	45	10	10	800
Males					
11-14 yrs	2,500	50	12	15	1,200
15-18 yrs	3,000	60	12	15	1,200
19-24 yrs	2,900	60	10	15	1,200
25-50 yrs	2,900	60	10	15	800
51+ yrs	2,300	60	10	15	800
Females					
11-14 yrs	2,200	50	15	12	1,200
15-18 yrs	2,200	60	15	12	1,200
19-24 yrs	2,200	60	15	12	1,200
25-50 yrs	2,200	60	15	12	800
51+ yrs	1,900	60	10	12	800
Pregnant					
1st trimester ..	+0	70	30	15	1,200
2nd trimester	+300	70	30	15	1,200
3rd trimester	+300	70	30	15	1,200
Lactating					
1st 6 months	+500	95	15	19	1,200
2nd 6 months	+500	90	15	16	1,200

Source: Recommended Dietary Allowances, 10th edition. National Research Council (1989b).

Table B-4¾ Standards Used to Assess Usual Intake of Fat, Saturated Fat, Cholesterol, and Sodium

Nutrient/Food Component	*Dietary Guidelines* Standard[1]	DRI Standard	
Total fat	≤ 30% of total energy[2]	AMDRs	
		1-3 years	30-40% of total energy
		4-18 years	25-35% of total energy
		19+ years	20-35% of total energy
Saturated fat	< 10% of total energy[2]	N/A	
Cholesterol	≤ 300 mg.	N/A	
Sodium	≤ 2,400 mg.[2]	ULs	
		1-3 years	1,500 mg. (1.5 g.)
		4-8 years	1,900 mg. (1.9 g.)
		9-13 years	2,200 mg. (2.2 g.)
		14+ years	2,300 mg. (2.3 g.)

[1]Dietary Guidelines standards apply to all individuals 2 years of age and older.

[2]Also included as objective in *Healthy People 2010* (U. S. DHHS, 2000a).

newly established AIs for fiber.[5] Table B-3 shows the 1989 RDAs for vitamin C, iron, zinc, and calcium (the precursors to the DRIs), as well as the 1989 REA. Table B-4 shows the *Dietary Guidelines for Americans* recommendations for total fat, saturated fat, cholesterol, and sodium, as well as the newly-defined Acceptable Macronutrient Distribution Range (AMDR) for total fat and ULs for sodium.

Healthy Eating Index

The Healthy Eating Index (HEI), developed by USDA's Center for Nutrition Policy and Promotion (CNPP), is a summary measure of the overall quality of people's diets (Basiotis, et al., 2002). The HEI is based on 10 component scores, all of which are weighted equally in the total score. The 10 component scores measure different aspects of a healthy diet based on accepted public health recommendations. Five of the component scores are food-based and evaluate food consumption in comparison with recommendations of the USDA Food Guide Pyramid (grains, vegetables, fruits, dairy, and meat) (USDA, CNPP, 1996). A sixth component is also food-based and measures the level of dietary variety. The remaining four component scores are nutrient-based and assess compliance with the *Dietary Guidelines for Americans* recommendations for intake of fat, saturated fat, cholesterol, and sodium.[6]

Table B-5 shows the criteria used for scoring the five food-group-based components. Criteria vary by age, depending on total energy intake. Because the Food Guide Pyramid presents serving recommendations for only three levels of energy intake (1,600, 2,200, and 2,800 kilocalories) (USDA, CNPP, 1996), interpolation techniques were used to estimate the recommended number of servings for gender and age

[5]It is important to note that the fiber AIs have been defined for *total* fiber and that the data presented in this report reflect *dietary* fiber. Total fiber includes dietary fiber as well as fructo-oligosaccharides, compounds which are destroyed in the current analytical methods used to quantitate fiber in foods (IOM, 2002b). Although fructo-oligosaccharides are assumed to make up a relatively small percentage of total fiber, authors of the DRI report estimated that, on average, American adults were consuming approximately 5.1 gm. more fiber per day than estimated in the most recent Continuing Survey of Food Intakes of Individuals (CSFII), because CSFII data, like the data used in this analysis, include only *dietary* fiber (IOM, 2002b).

[6]When the HEI was first developed, the standards for cholesterol and sodium were based on recommendations made in the NRC's *Diet and Health* report (NRC, 1989b) because the version of the *Dietary Guidelines* in effect at the time did not include quantitative standards for these nutrients (USDA and U. S. DHHS, 1995). Since that time, the NRC standards for sodium and cholesterol have been incorporated into both the Nutrition Facts section of food labels and the most recent version of the *Dietary Guidelines* (USDA and U.S. DHHS, 2000).

Table B-5¾ Scoring criteria for food-based components of the Healthy Eating Index (HEI)

	Criteria for maximum score of 10 (number of servings per day)				
Age	**Grains**	**Vegetables**	**Fruits**	**Milk**	**Meat**
2-3 years	6.0	3.0	2.0	2.0	2.0
4-6 years	7.0	3.3	2.3	2.0	2.1
7-10 years	7.8	3.7	2.7	2.0	2.3
Males					
11-14 years	9.9	4.5	3.5	3.0	2.6
15-18 years	11.0	5.0	4.0	3.0	2.8
19-24 years	11.0	5.0	4.0	3.0	2.8
25-50 years	11.0	5.0	4.0	2.0	2.8
51+ years	9.1	4.2	3.2	2.0	2.5
Females					
11-24 years	9.0	4.0	3.0	3.0	2.4
25-50 years	9.0	4.0	3.0	2.0	2.4
51+ years	7.4	3.5	2.5	2.0	2.2

Notes: The minimum score of 0 was assigned only when zero servings were consumed.
For the variety component, the maximum score of 10 was assigned if 8 or more different items were consumed; the minimum score of 0 was assigned if 3 or fewer different items were consumed.
Scores were assigned proportionately for consumption between the minimum and maximum criteria.
Source: NHANES-III documentation for the HEI file. NCHS (2000).

groups with other recommended energy allowances.

Two exceptions were made to the straight interpolation. The first involved 2-3-year-old children. The 1989 REA for 2-3 year-olds is less than the lowest level of energy intake (1,600 kilocalories) referenced in the Food Guide Pyramid.[7] Extrapolation of the Food Guide Pyramid's recommended number of servings to a lower calorie level would result in smaller numbers of servings than the minimums defined in the Pyramid. Rather than use these minimal numbers of servings, NCHS staff set the numbers of servings to be equivalent with defined minimums, but reduced reference portion sizes for food groups other than milk to two-thirds of the adult reference (NCHS, 2000). This is consistent with Pyramid guidance (i.e., that individuals with lower energy needs eat smaller servings) as well as with the approach used by other researchers (Basiotis et al., 2002).

The second exception was made for males between 15 and 50 years of age. The 1989 REA for this group is slightly higher than the highest level of energy intake (2,800 kilocalories) references in the Food Guide Pyramid. Simple extrapolation would have resulted in greater numbers of servings than the maximums defined in the Pyramid. Because the Food Guide Pyramid provides no guidance on how to accommodate greater energy needs, NCHS researchers truncated the number of servings at the maximums defined in the Pyramid. This is consistent with the approach used by other researchers (Basiotis et al., 2002). Moreover, preliminary analyses completed by NCHS indicated that truncation did not have a significant impact on HEI scores (NCHS, 2000).

The methodology used to determine serving definitions for counting servings in each of the five major food groups is the same as that used in the initial research that calculated the HEI using data from the 1989-90 Continuing Survey of Food Intake of Individuals (CSFII) (USDA, CNPP, 1995). It differs, however, from the methodology used in subsequent research to

[7] HEI computations were completed be NCHS staff prior to the release of the new REEs (see discussion on *Dietary Reference Intakes*), so the reference standard used for energy intake was the 1989 REAs.

calculate the HEI using the 1994-96 CSFII data (USDA, ARS, 1998) as well as recent research that calculated the HEI using data from NHANES 1999-2000 (Basiotis et al., 2002).

In particular, milk serving definitions in the NHANES-III data used in this report were based on grams of nonfat milk solids contained in a food divided by the amount of grams of nonfat milk solids contained in 1 cup of milk (NCHS, 2000). The alternative methodology used in the two analyses noted above based milk serving definitions on calcium equivalents. This approach defines a milk serving as one that provides the same amount of calcium as 1 cup of skim milk (302 mg). In choosing to use the "nonfat milk solids" approach rather than the "calcium equivalents" approach, NCHS researchers cited concerns that the latter may lead to low milk group component scores because of the omission of foods such as butter and cream cheese nonfat milk solids but small to negligible amounts of calcium (NCHS, 2000).

For the four other food groups, serving definitions used by NCHS researchers are similar to those used by USDA researchers and were designed to be as consistent as possible with the serving definitions used in the Food Guide Pyramid (USDA, ARS, 2003). Servings of breads and grains are defined on the basis of "flour equivalents," using the flour content of a typical slice of bread (16 gm) as the base. Servings of most vegetables are counted as ½ cup cooked or 1 cup raw. Fruits are treated similarly.

Servings of meat are based on "lean meat equivalents." The base serving is 2.5 oz. of lean meat, fish, or poultry, with a specified minimum amount of fat.[8] Numbers of servings for non-lean-meats are assigned based on fat content. As an example, 2 oz. of cooked sausage has the equivalent of 1.5 oz. of cooked lean meat, or .61 servings of meat. (For a more detailed explanation of how meat servings are determined, see USDA, ARS, 2003).

Several non-meat foods are also included in the meat group. Serving equivalents for these items are defined as ½ cup cooked dry beans or peas, 1 egg, 2 Tbsp. peanut butter, 1/3 cup nuts, ¼ cup seeds, and ½ cup of tofu (USDA, ARS, 2003). The Food Guide Pyramid considers dried beans and peas (legumes) to be considered contributors to the meat group, but they may also be counted toward vegetable intake. In computing the HEI, NCHS investigators applied any legume consumption that was not "needed" in the meat group toward the vegetable group (NCHS, 2000).

Variety Score

Both The Food Guide Pyramid and the *Dietary Guidelines for Americans* recommend consuming a variety of foods, but neither provides guidance on how to measure dietary variety. Following the protocols established in the initial HEI research (USDA, CNPP, 1995), variety scores were assigned based on the total number of different types of food a person consumed in a day. Similar foods were grouped together and the totals were computed for each individual. Fats, sweets, seasonings, and similar foods were not included in the calculations (for a complete list of excluded foods see NCHS, 2000), and neither were food components that contributed less than one-half of a serving.

A maximum score of 10 points was assigned for variety scores of 8 or more (indicating that the person consumed at least half a serving of 8 or more different types of food in the preceding 24-hour period). A minimum score of 0 was assigned for variety scores of 3 or less. Intermediate scores were assigned proportionately.

[8]Two different definitions have been used to define lean meats – no more than 2.65 gm. fat per oz. and no more than 2.4 gm. fat per oz. (USDA, ARS, 2003). The NCHS documentation does not specify which of these definitions was used in computing lean meat equivalents in the NHANES-III database (NCHS, 2000).

Table B-6¾ Scoring criteria for nutrient-based components of the Healthy Eating Index (HEI)

Component	Standard for maximum score of 10	Standard for minimum score of 0
Total fat	≤ 30% of total calories	≥ 45% of total calories
Saturated fat	< 10 percent of total calories	≥ 15 percent of total calories
Cholesterol	≤ 300 mg per day	≥ 450 mg per day
Sodium	≤ 2,400 mg per day	≥ 2,400 mg per day

Note: Standards for nutrient-based components apply to all age groups.

Source: NHANES-III documentation for the HEI file. NCHS (2000).

Nutrient-based Scores

The four nutrient-based component scores of the HEI assess compliance with the *Dietary Guidelines for Americans* recommendations for intake of total fat, saturated fat, cholesterol, and sodium (USDA and U.S. DHHS, 2000). The manner in which these recommendations were used to determine HEI component scores is summarized in table B-6.

Rating Total Scores

As noted in the preceding discussion, the maximum score for the full HEI (all ten components combined) is 100 and the minimum score is zero. Using standards defined by USDA's CNPP, individuals with total HEI scores of more than 80 were considered to have good diets. Those with scores between 51 and 80 were considered to have diets that need improvement. And those who scored below 51 on the HEI were considered to have poor diets (Basitotis et al., 2002).

Serum and Blood Measurements

Several serum and blood measurements are examined in this series of reports. Most reflect serum levels of nutrients or assess iron or lipid status. In addition, levels of blood lead were examined to assess the prevalence of lead poisoning. Serum cotinine levels were also analyzed to examine exposure to second-hand smoke. Cotinine, a breakdown product of nicotine, is used as a biological marker for tobacco use and exposure to environmental tobacco smoke.

Table B-7 lists the serum and blood measures examined, the reference standards used in assessing them, and the source of the standard. The prevalence of iron deficiency was assessed using the *Healthy People 2010* definition: abnormal results on two of three specific measures of iron status (serum ferritin, free erythrocyte protoporphorin, and transferring saturation) (U.S. DHHS, 2000a). Iron deficiency anemia was defined as the presence of iron deficiency plus an abnormally low hemoglobin. Cutoffs used to define abnormal values are summarized in table B-7.

Table B-7 ¾ Reference values for serum and blood measures

Measure	Age group	Abnormal range		Source
		Male	Female	
Hemoglobin (g/dL)[1]	1-2 years	< 11.0	< 11.0	CDC Recommendations to Prevent and Control Iron Deficiency in the U.S. (CDC, 1998)
	2-5 years	< 11.1	< 11.1	
	5-8 years	< 11.5	< 11.5	
	8-12 years	< 11.9	< 11.9	
	12-15 years	< 12.5	< 11.8	
	15-18 years	< 13.3	< 12.0	
	≥ 18 years	< 13.5	< 12.0	
Hematocrit (%)[1]	1-2 years	< 32.9	< 32.9	CDC Recommendations to Prevent and Control Iron Deficiency in the U.S. (CDC, 1998)
	2-5 years	< 33.0	< 33.0	
	5-8 years	< 34.5	< 34.5	
	8-12 years	< 35.4	< 35.4	
	12-15 years	< 37.3	< 35.7	
	15-18 years	< 39.7	< 35.9	
	≥ 18 years	< 39.9	< 35.7	
Serum ferritin (mcg/mL)	1-4 years	< 10	< 10	*Healthy People 2010* (U.S. DHHS, 2000a) and CDC Recommendations to Prevent and Control Iron Deficiency in the U.S. (CDC, 1998)
	5-11 years	< 15	< 15	
	12-49 years	< 15	< 12	
	≥ 50 years	< 15	< 15	
Free erythrocyte protoporphorin (mcg/dL)	1-2 year	> 80	> 80	*Healthy People 2010* (U.S. DHHS, 2000a)
	> 2 years	> 70	> 70	
Transferrin saturation (%)	1-2 years	< 10	< 10	*Healthy People 2010* (U.S. DHHS, 2000a) and CDC Recommendations to Prevent and Control Iron Deficiency in the U.S. (CDC, 1998)
	3-4 years	< 12	< 12	
	12-15 years	< 16	< 14	
	≥ 16 years	< 16	< 15	
Total cholesterol (mg/dL)	2-19 years	High: ≥ 200 Borderline: 170-199		National Institutes of Health, National Cholesterol Education Program (2001 (adults) and 1991 (children))
	20 years and over	High: ≥ 240 Borderline: 200-239		
LDL cholesterol (mg/dL)	2-19 years	High: ≥ 130 Borderline: 110-129		National Institutes of Health, National Cholesterol Education Program (2001 (adults) and 1991 (children))
	20 years and over	High: ≥ 160 Borderline: 130-159		
HDL cholesterol (mg/dL)	2-19 years	< 35		National Institutes of Health, National Cholesterol Education Program, 2001 (adults) and American Heart Association, 2002 (children)
	20 years and over	< 40		
Triglycerides (mg/dL)	12-19 years	≥ 150		National Institutes of Health, National Cholesterol Education Program, 2001 (adults) and American Heart Association, 2002 (children)
	20 years and over	High: ≥ 200 Borderline: 150-199		
RBC folate (ng/mL)[2]	All ages	< 95		*Dietary Reference Intakes* (IOM, 2000a)
Serum vitamin B_{12} (pg/mL)	All ages	< 200		*Dietary Reference Intakes* (IOM, 2000a)
Serum albumin (g/dL)	60 years and over	< 3.8 (liberal definition) < 3.5 (conservative)		Institute of Medicine, Committee on Nutrition Services for Medicare Beneficiaries (2000)

¾ **Continued**

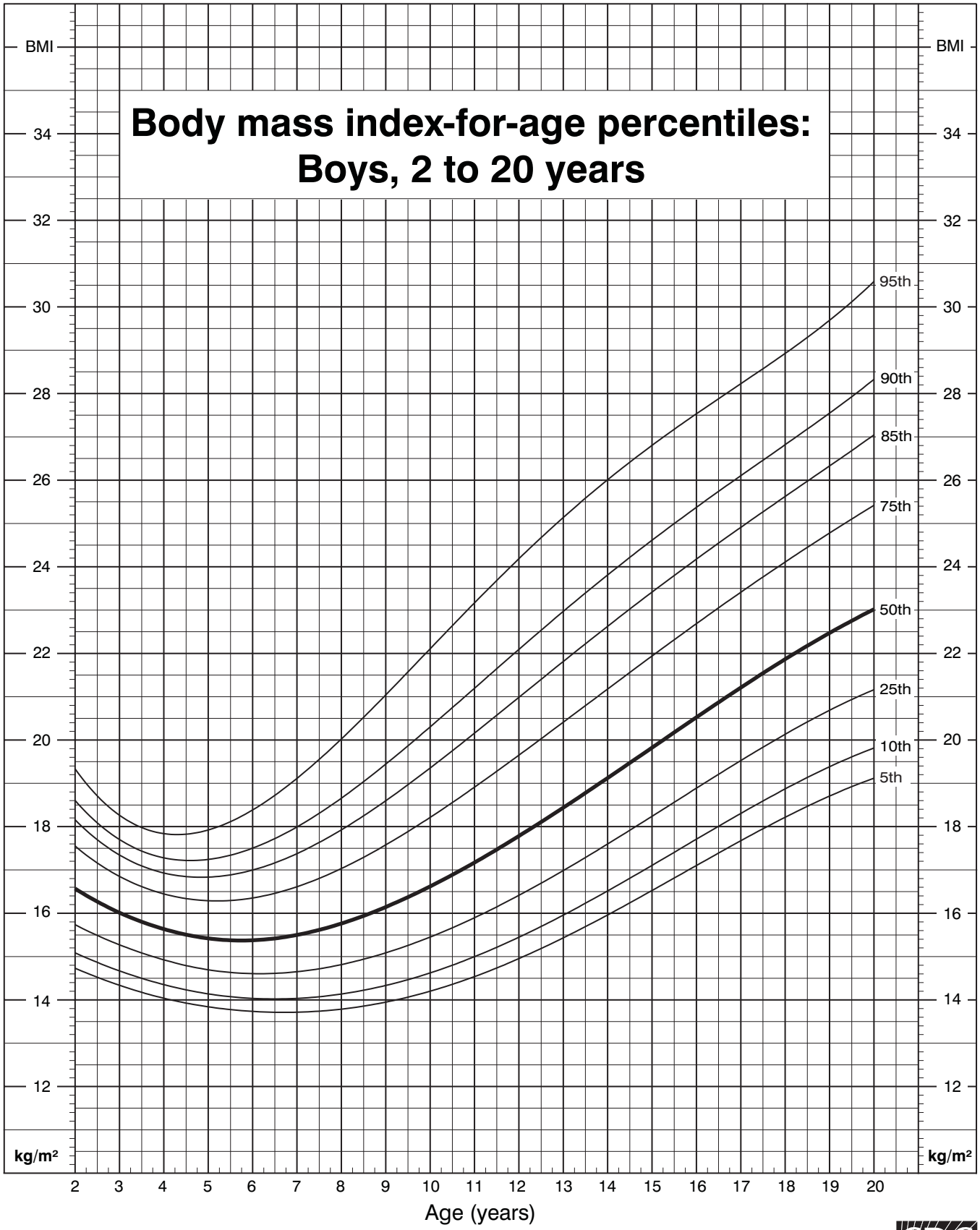
Table B-7 ¾ Reference values for serum and blood measures (continued)

Measure	Age group	Abnormal range		Source
		Male	Female	
Lead exposure				CDC Report on Blood Levels in the U.S.: 1991-1994. (CDC, 1997)
Lead (mcg/dL)	All ages	≥ 10.0		
Exposure to second-hand smoke				*Healthy People 2010* (U.S. DHHS, 2000a)
Cotinine (ng/dL)	All ages	> 0.10		

[1]Hemoglobin and hematocrit cutoffs were adjusted for smokers, per CDC recommendations (1998). Adjustment for high altitudes is also suggested, but data on the altitude at which respondents live is not available in NHANES-III. Hemoglobin cutoffs for smokers were adjusted based on reported daily cigarette use, as follows: +0.3 for 0.5 to less than 1 pack per day; +0.5 for 1 to less than 2 packs per day; +0.7 for 2 or more packs per day. Parallel adjustments for hematocrit were +1.0, +1.5, and +2.0.

[2]The cutoff of 95 ng/mL is specific to the radioassay kit used by NHANES-III beginning in December 1993, and is applied to all NHANES-III RBC folate measures because NCHS adjusted the data for comparability (Wright, et al., 1998). This cutoff differs from that recommended based on NHANES-II data (less than 140 ng/mL) due to use of the revised test kit.

CDC Growth Charts: United States



Published May 30, 2000.

SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).

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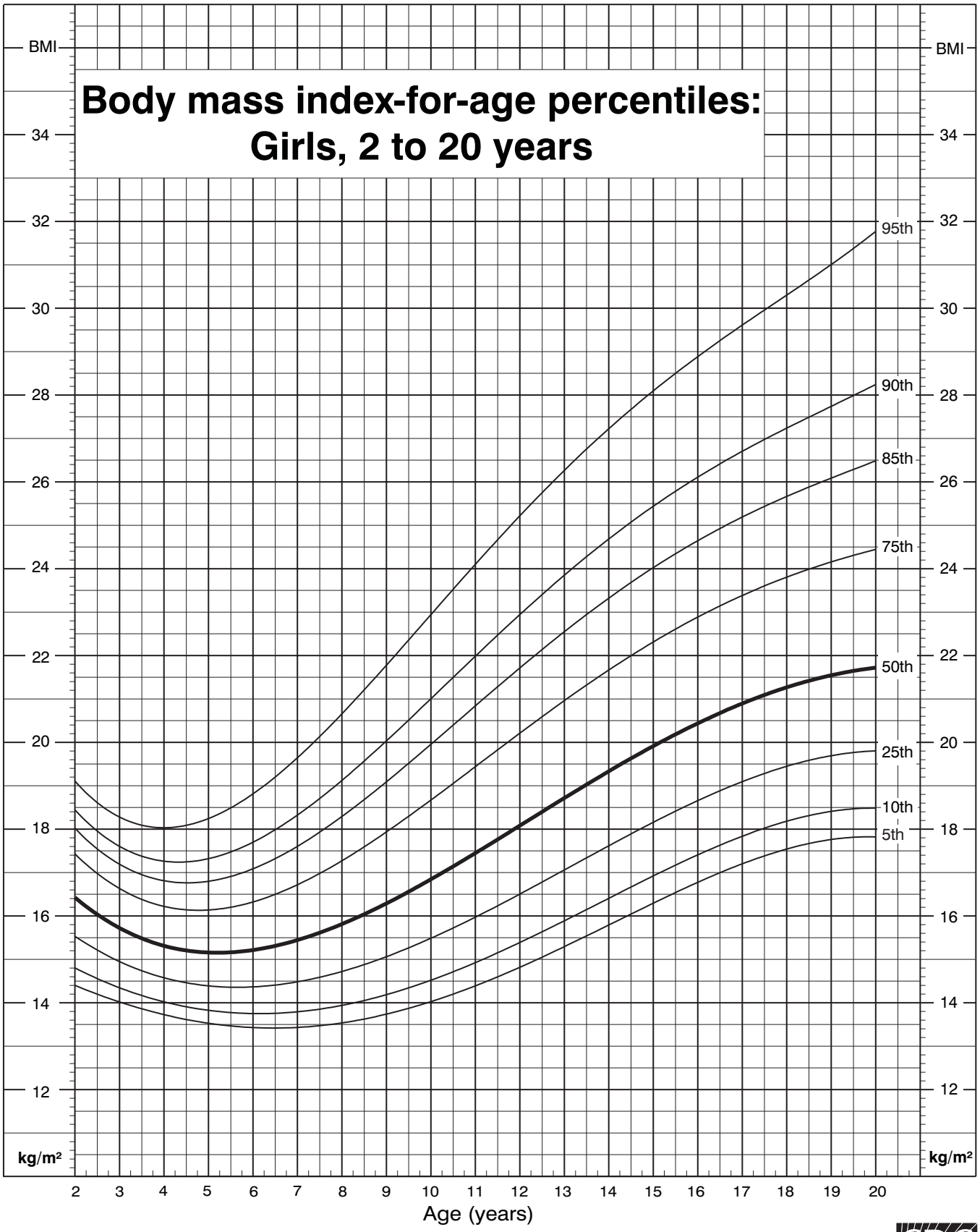
CDC Growth Charts: United States



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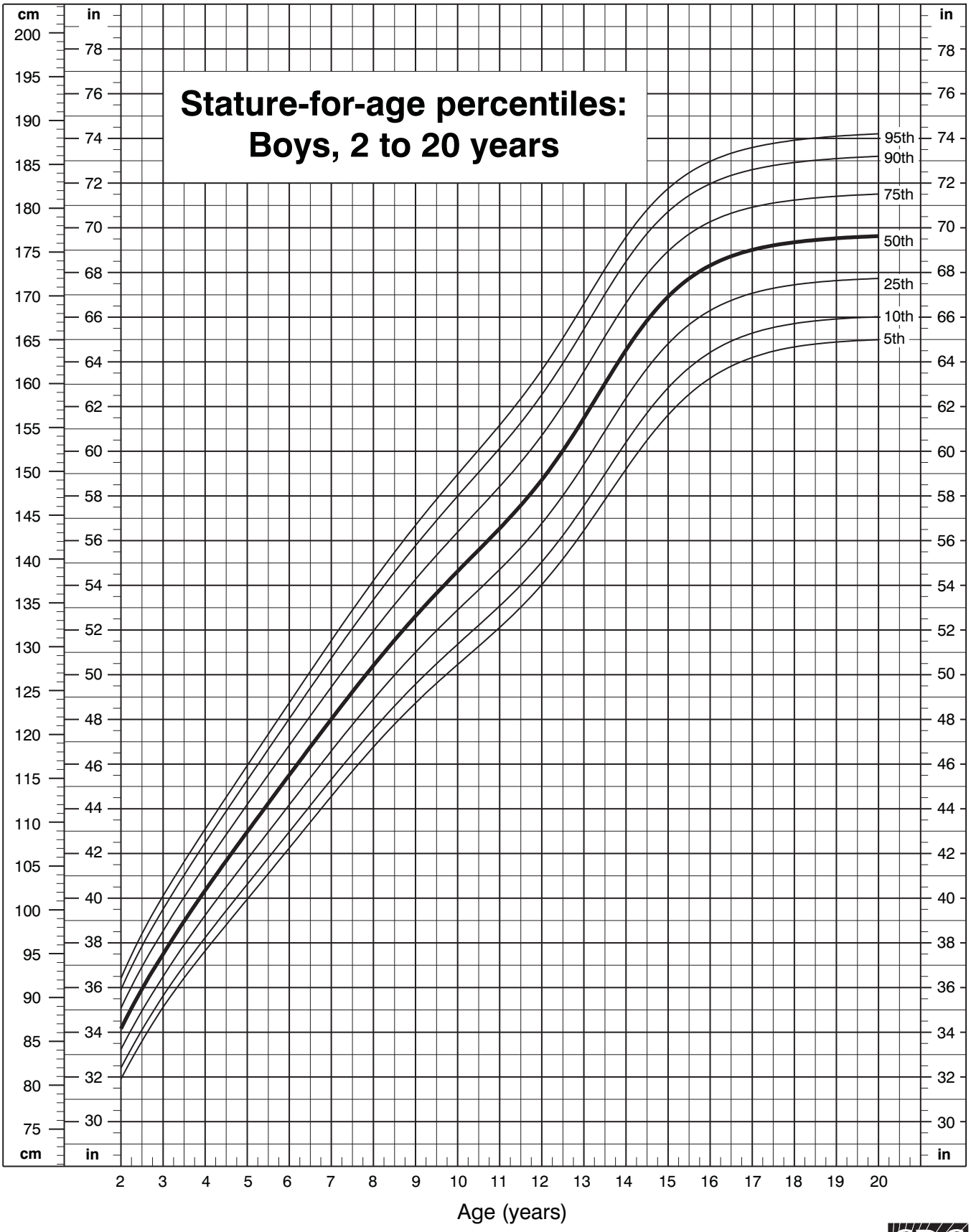

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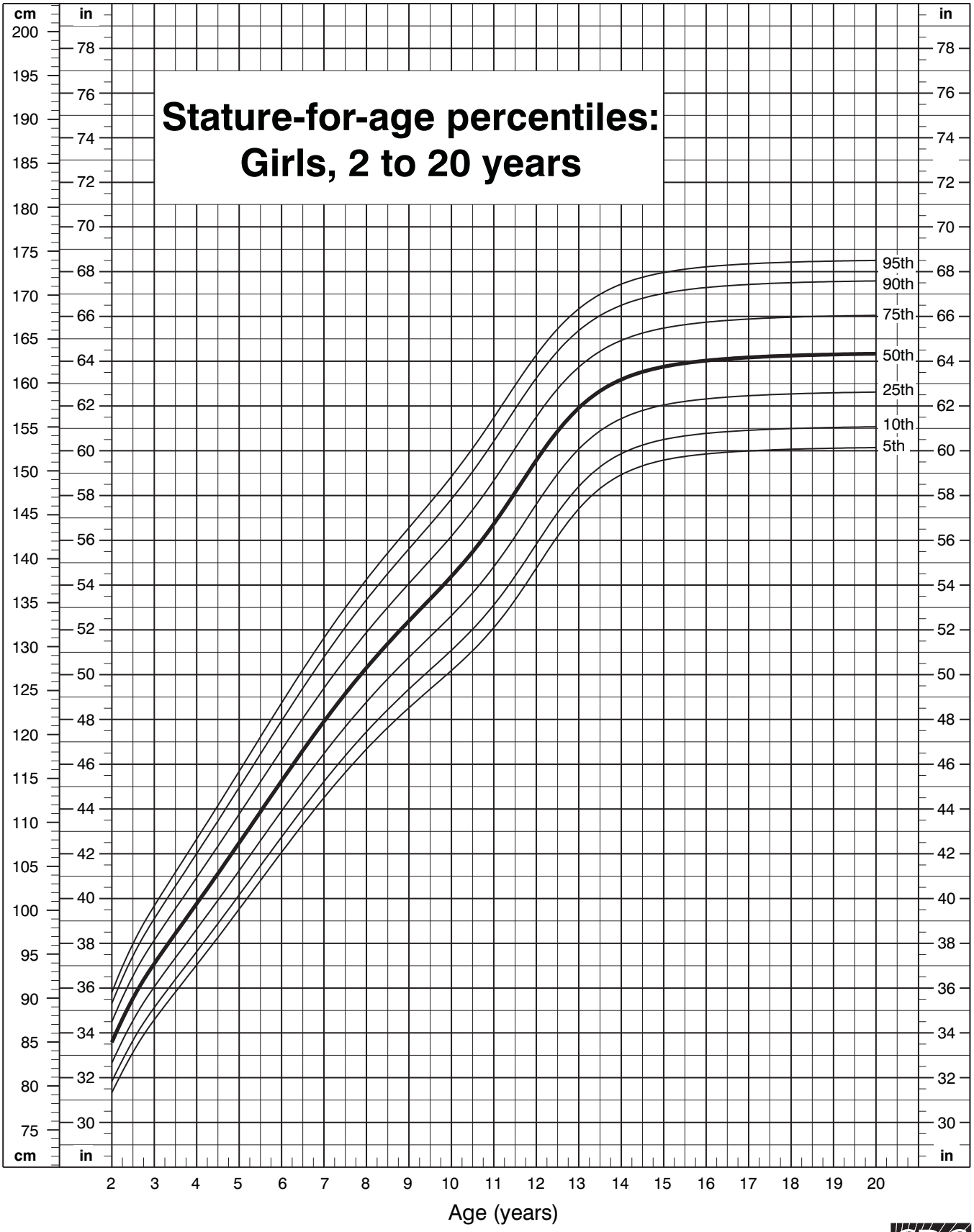

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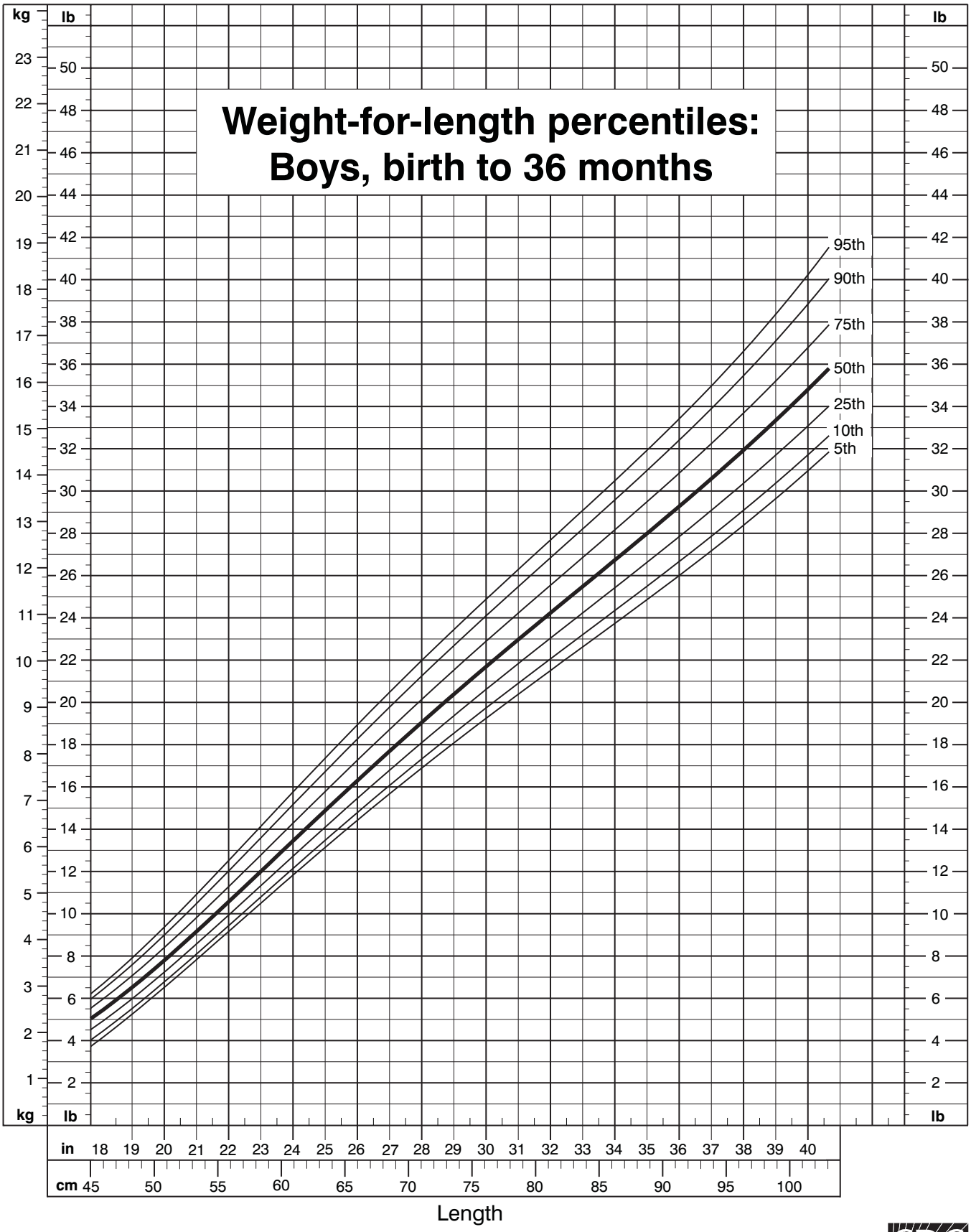
CDC Growth Charts: United States



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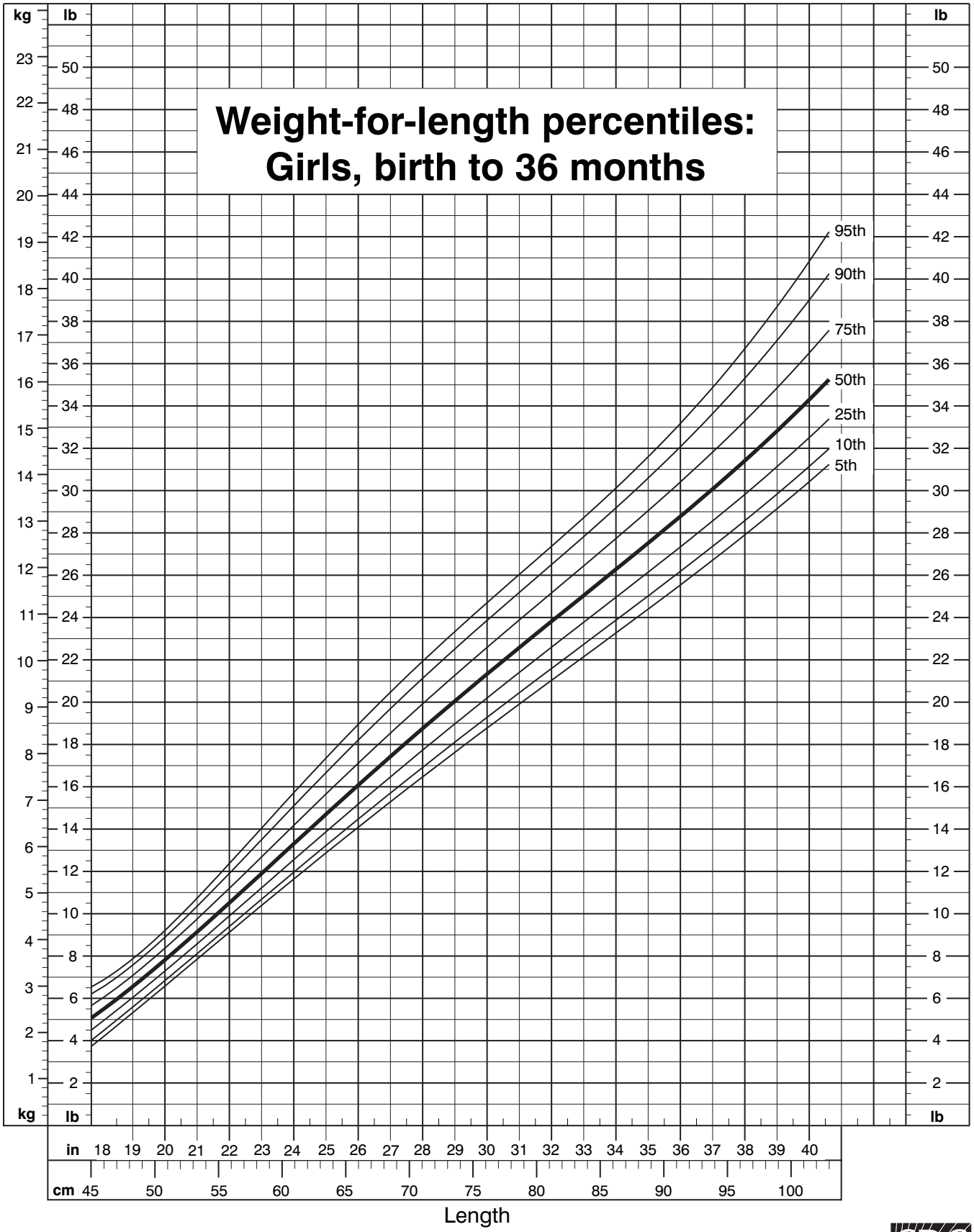

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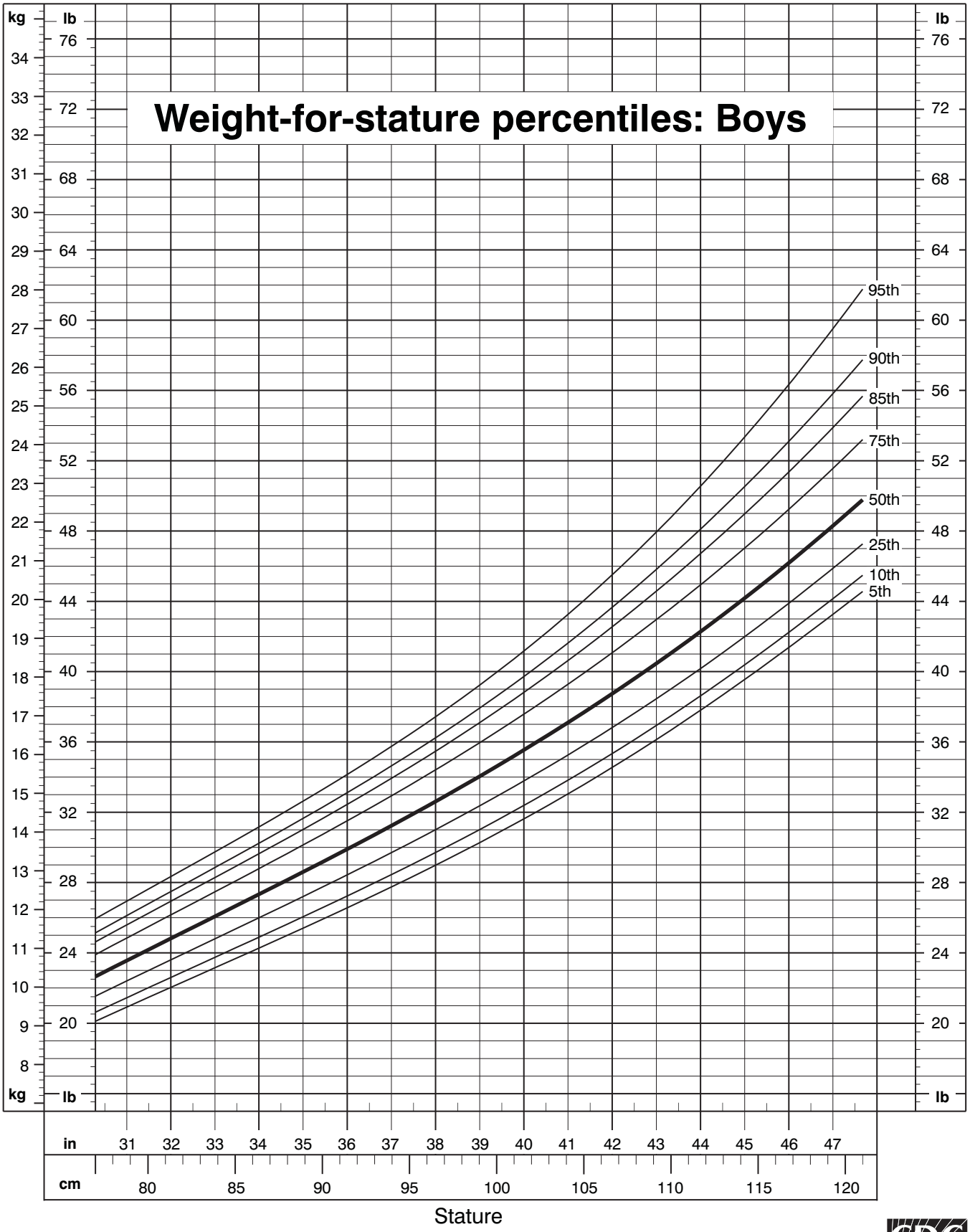

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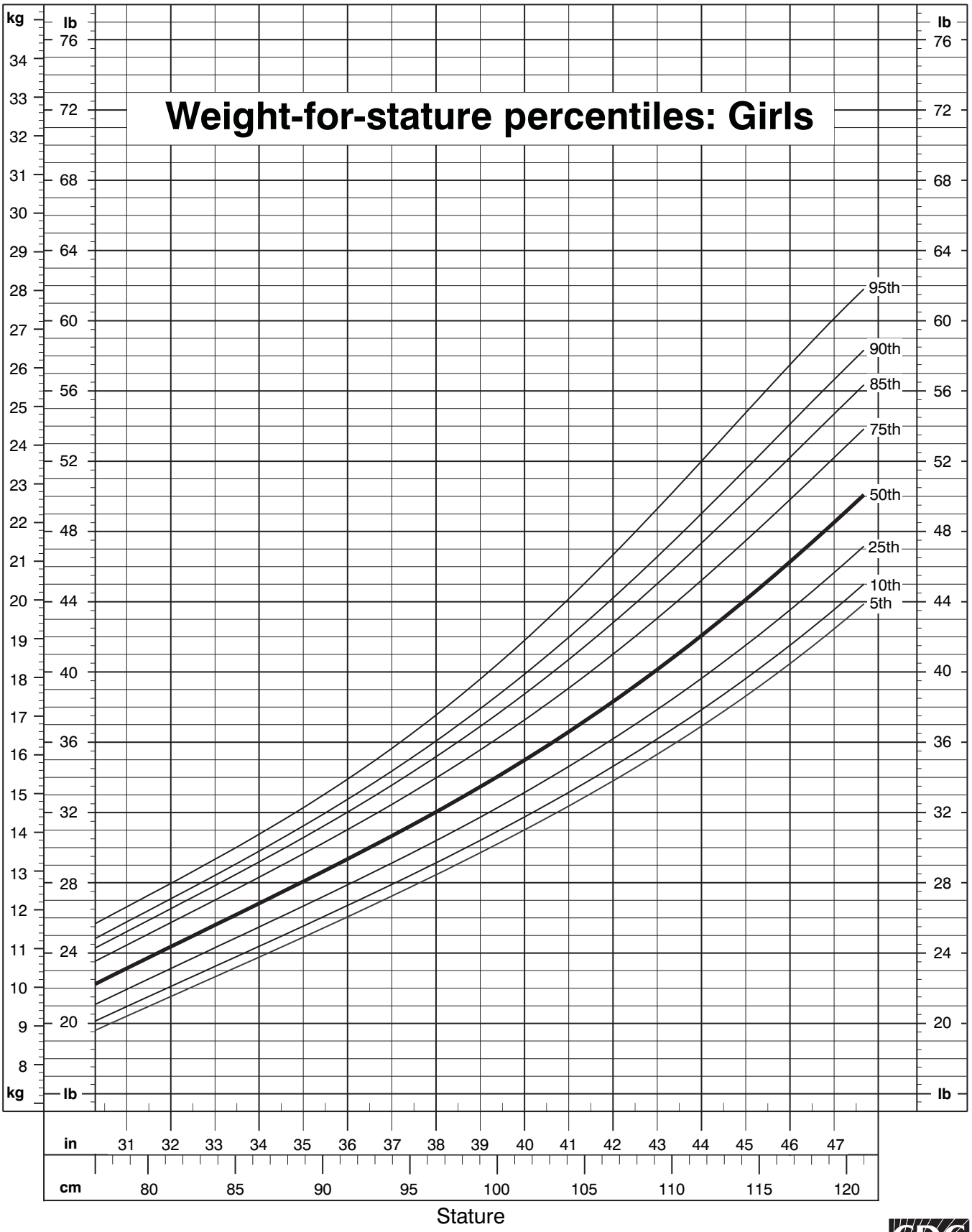
CDC Growth Charts: United States



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