

Use and Interpretation of the WHO and CDC Growth Charts for Children from Birth to 20 Years in the United States

CDC Recommendation

- Use the WHO growth charts for all children from birth up to 2 years of age to monitor growth in the United States. The WHO growth standards for children younger than 2 years have been adapted for use in the United States.*
- Use the CDC growth charts for children and teens aged 2 through 19 years to monitor growth in the United States.*

Background

- The WHO growth charts are international standards that show how healthy children should grow. The standards describe the growth of children living in six countries (including the United States) in environments believed to support optimal growth. One of the several criteria defined for optimal growth is breastfeeding. The WHO growth charts use the growth of breastfed infants as the norm for growth. This is in agreement with national guidelines that recommend breastfeeding as the optimal infant feeding method. The WHO growth charts should be used with all children up to aged 2 years, regardless of type of feeding.
- The CDC growth charts are a national reference that represent how US children and teens grew primarily during the 1970s, 1980s and 1990s. The CDC recommends using the references from ages 2 through 19 years so health care providers can track weight, stature, and body mass index (BMI) from childhood through age 19 years.

Purpose

- This guide instructs health care providers on how to use and interpret the WHO and CDC growth charts to assess physical growth among children and teens. Comparing body measurements with the appropriate age- and sex-specific growth chart enables health care providers to monitor growth and identify potential health- or nutrition-related problems.
- During routine screening, health care providers assess physical growth using the head circumference, weight and length of infants and children up to 2 years of age and the weight, stature (also referred to as height), and BMI of children and teens from aged 2 through 19 years. Although one measurement plotted on a growth chart can be used to screen children for nutritional risk, it does not provide adequate information to determine the child's growth pattern. When plotted correctly, a series of accurate measurements offer important information about a child's growth pattern. Gestational age, birth weight, and parental stature should be considered since they may influence a child's growth pattern. Parental stature, for example, should be considered before assuming there is a health or nutrition concern. Other factors, such as the presence of a chronic illness or special health care need, must be considered, and further evaluation may be necessary.

STEP

1

Obtain accurate measurements When weighing and measuring children, follow procedures that yield accurate measurements and use equipment that is well maintained. For information about accurate weighing and measuring procedures, see *Accurately Weighing and Measuring Infants, Children and Adolescents: Technique* at <http://depts.washington.edu/growth/module5/text/page1a.htm>

2

Select the appropriate growth chart Select the growth chart to use based on the age and sex of the child being weighed and measured.

Enter the child's name and the record number, if appropriate.

Use the charts listed below when measuring weight and length of children from **birth up to 2 years of age:**

- WHO Weight-for-age
- WHO Length-for-age
- WHO Weight-for-length

Use the charts listed below when measuring weight and stature in children and teens aged **2 through 19 years:**

- CDC Weight-for-age
- CDC Stature-for-age
- CDC BMI-for-age

3

Record data After selecting the appropriate chart and entering the patient’s name and record number, if appropriate, complete the data entry table.

First, record information about factors obtained at the initial visit that influence growth.

- Enter mother’s and father’s stature as reported.
- Enter the gestational age in weeks. (Omit this step when using the CDC growth charts for children and teens aged 2 to 20 years.)

The next line is reserved for recording the child’s birth data. (Omit this step when using the CDC growth charts for children and teens aged 2 to 20 years.)

- Enter the date of birth.
- Enter birth weight and length.
- Add notable comments (e.g., breastfeeding).

Record information obtained during the current visit.

- Enter today’s date.

Determine age to the nearest month for infants and children up to 2 years and to the nearest 1/4-year for children aged 2 to 20 years.

- Enter the child’s age.
- Enter weight, and length or stature, immediately after taking the measurement.
- Add any notable comments (e.g., was not cooperative).

Example of how to calculate the child’s age: To calculate Sam’s age, subtract his birth date from the date of the visit or measurement. To subtract, it will be necessary to convert months to days and years to months if either the month or day in the birth data is larger than in the date of measurements. When converting one month to days, subtract 1 from the number of months in the date of measurement, then add 28, 30, or 31, as appropriate, to the number of days. When converting one year to months, subtract 1 from the number of years in the date of measurement, then add 12 to the number of months.

	Year	Month	Day
Date of Measurement	1998	4	4
Convert one month to days		(-1)	(+30)
	1998	3	34
Convert one year to months	(-1)	(+12)	
	1997	15	34
Birth Date	1994	9	15
Child’s Age	3	6	19

Sam is aged 3 years, 6 months, and 19 days.

Days → Months		Months → Year	
0-15	0	0-1	40
16-31	1	2-4	1/4
		5-7	1/2
		8-10	3/4
		11-12	1

Using the guide above, 3 years, 6 months, and 19 days is rounded to 3 years and 7 months. Because age for children over 2 is rounded to the nearest ¼ year, Sam’s age is rounded to 3 ½ years.

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Calculate BMI when a child is aged 2 to 20 years BMI is calculated using weight and stature measurements, then used to compare a child's weight relative to stature with other children of the same age and sex in the reference population.

- Using a calculator, hand-held device or software, determine BMI using the calculation below.

$$\text{BMI} = \text{Weight (kg)} \div \text{Stature (cm)} \div \text{Stature (cm)} \times 10,000$$

Or

$$\text{BMI} = \text{Weight (lb)} \div \text{Stature (in)} \div \text{Stature (in)} \times 703$$

It is necessary to convert the weight and stature measurements to the appropriate decimal value shown in Table 1.

Example: 37 lbs. 4 oz. = 37.25 lbs., 41-1/2 inches = 41.5 in.

Table 1. Decimal Conversions

Fraction	Ounces	Decimal
1/8	2	.125
1/4	4	.25
3/8	6	.375
1/2	8	.5
5/8	10	.625
3/4	12	.75
7/8	14	.875

- Enter BMI to one place after the decimal point (Example: 15.204 = 15.2).

For more information and additional resources on calculating BMI, see *Using the CDC BMI-for-age Growth Charts for Children and Teens Aged 2 to 20 Years* at

<http://www.cdc.gov/nccdphp/dnpa/growthcharts/training/modules/module1/text/page1a.htm>

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Plot measurements On the appropriate WHO or CDC growth chart, plot the measurements recorded in the data entry table for the current visit.

- Find the child's age on the horizontal axis. When plotting weight-for-length, find the length on the horizontal axis. Use a straight edge or right-angle ruler to draw a vertical line up from that point.
- Find the appropriate measurement (weight, length, stature, or BMI) on the vertical axis. Use a straight edge or right-angle ruler to draw a horizontal line across from that point until it intersects the vertical line.
- Make a small dot where the two lines intersect.

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Interpret the plotted measurements The curved lines on the growth chart show selected percentiles that indicate the rank of the child’s measurement. For example, when the dot is plotted on the 95th percentile line on the CDC BMI-for-age growth chart, it means that 5 of 100 children (5%) of the same age and sex in the reference population have a higher BMI-for-age.

The WHO growth standard charts use the 2nd and the 98th percentiles as the outer most percentile cutoff values indicating abnormal growth.

The CDC growth reference charts use the 5th and the 95th percentiles as the outermost percentile cutoff values indicating abnormal growth.

Interpret the plotted measurements based on the percentile ranking on the WHO or the CDC growth charts and the percentile cutoff value corresponding to the nutrition indicator shown in the table below. If the percentile rank indicates a nutrition-related health concern, additional monitoring and assessment are recommended.

- Determine the percentile rank.
- Determine if the percentile rank suggests that the anthropometric index is indicative of nutritional risk based on the percentile cutoff value.
- Compare today’s percentile rank with the rank from previous visits to identify any major shifts in the child’s growth pattern and the need for further assessment.

When transitioning from the WHO growth charts to the CDC growth charts at aged 2 years, a change in growth classification may occur. During this transition, caution should be used in interpreting any changes in classification.

Anthropometric Index	Percentile Cut-off Values	Nutritional Status Indicator
WHO Growth Charts 2nd and 98th percentiles		
Length-for-age	< 2nd	Short stature
Weight-for-length	< 2nd	Low weight-for-length
Weight-for-length	> 98th	High weight-for-length
CDC Growth Charts 5th and 95th percentile		
BMI-for-age	≥ 95th	Obesity
BMI-for-age	≥ 85th and < 95th	Overweight
BMI-for-age	< 5th	Underweight
Stature-for-age	< 5th	Short Stature

References and Resources

1. American Academy of Pediatrics. *Pediatric Nutrition Handbook*. 6th ed. Elk Grove Village, IL: American Academy of Pediatrics. 2009;559-564.
2. Barlow SE; and the Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007;120(suppl 4):S164-S192.
http://pediatrics.aappublications.org/cgi/content/abstract/120/Supplement_4/S164
3. Grummer-Strawn LM, Reinold C, Krebs NF; Centers for Disease Control and Prevention (CDC). Use of the World Health Organization and CDC growth charts for children aged 0-59 months in the United States. Recommendations and Reports. *MMWR Recomm Rep* 2010; 59(RR-9);1-15.
<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5909a1.htm>
4. Kuczmarski RJ, Ogden C, Grummer-Strawn L, et al. CDC Growth Charts: United States. Advance Data Report No. 314. *Vital and Health Statistics of the Centers for Disease Control and Prevention*, National Center for Health Statistics, 2000.
5. World Health Organization. *Physical Status: The Use and Interpretation of Anthropometry*. Geneva: World Health Organization, 1995. WHO Technical Report Series 854.
6. World Health Organization. *WHO Child Growth Standards: Length/Height-for-Age, Weight-for-Age, Weight-for-Length, Weight-for-Height and Body Mass Index-for-Age: Methods and Development*. Geneva: World Health Organization; 2006.

*The WHO and CDC growth charts are available at http://www.cdc.gov/growthcharts/who_charts.htm and http://www.cdc.gov/growthcharts/clinical_charts.htm