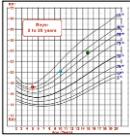


Assessing Child Growth Using Body Mass Index (BMI)-for-Age Growth Charts


Adapted by the State of California CHP Nutrition Subcommittee from materials developed by
 Health Department of the State of California, Department of Public Health
 Center for Disease Prevention and Control
 "Child Growth Assessment and Interpretation"
 November 2010

Objectives

By the end of this session, you will be able to:

- Weigh and measure children using standard techniques
- Manage common problems encountered in the clinic
- Select appropriate growth chart for age group
- Identify the age range for Body Mass Index (BMI) screening
- Calculate or determine BMI value
- Plot BMI value on the appropriate growth chart
- Determine BMI-for-age percentile
- Identify weight category



Measurements you take are important

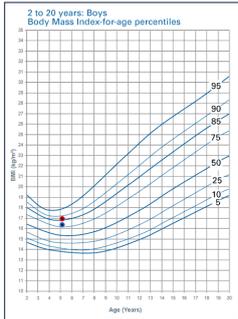
**Growth trends may indicate problems
concerning:**

- Growth
- Feeding
- Illness
- Social interaction
- Emotional wellness





Accurate measurements are critical



- BMI for 5 year old boy**
- Weight: 43.5 lb
 - Height: 43.0 in
 - BMI= 16.5
- BMI-for-age = 75-84th %ile
 • **Normal range**

- If height is inaccurate:**
- Weight: 43.5 lb
 - Height: **42.5 in**
 - BMI = 17.0
- BMI-for-age = 85-94th %ile
 • **Overweight range**



Respect privacy

Use a private area or exam room for the following:

- Removing of clothing
- Donning gown, if used
- Taking measurements
- Discussing results



Which Growth Chart Should I Use?

✓ Birth to 2? Use WHO



✓ 2 to 20? Use CDC



Compare the WHO Growth Standards and the CDC Growth Reference

Comparison	WHO Growth Chart	CDC Growth Chart
Studied population	Breastfed infants and toddlers	Breastfed and formula fed infants and toddlers
Growth pattern	How healthy children SHOULD GROW in ideal conditions	How certain groups of children HAVE GROWN in the past
Concept of growth	A STANDARD by which all children should be compared	A REFERENCE does not imply that pattern of growth is optimal



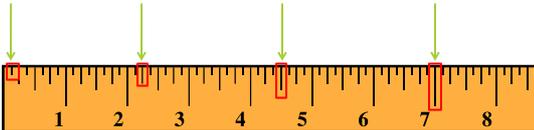
Impact of WHO Growth Charts on the Interpretation of Growth

Mode of feeding can influence infant growth rate

Mode of feeding	Growth in the first 3 months	Growth after 3 months
Breastfeeding	Faster	Slower
Formula	Slower	Faster



1/8 inch 1/4 inch 1/2 inch 1 inch



*For CHDP exams,
record the height or length measurement
to the nearest 1/4 inch*



Weighing infants and toddlers

Equipment needed:

- Beam balance or electronic scale
- Weigh in 10 g or ¼ oz increments
- Large pan or bucket seat
- Can be easily "zeroed" and calibrated



Weighing infants and toddlers



1. Weigh infant wearing only light underclothing and a clean, dry diaper.
2. Center the infant in the scale tray.
3. Weigh infant to the nearest 10 g (0.01 kg) or ½ oz.
4. Repeat measurement until measurements agree to within 100 g (0.1 kg) or ¼ lb.
5. Calculate average.
6. Record measurement.



Alternate weighing method

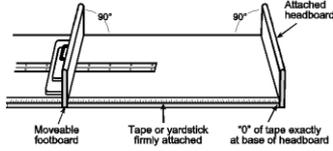
1. Weigh parent and child together = Total Weight
2. Weigh parent alone = Parent's Weight
3. $\frac{\text{Total Weight}}{\text{Parent's Weight}} = \text{Child's Weight}$
4. Record measurement and technique used



Measuring recumbent length

Equipment needed:

- Length board
- Measurements in mm or 1/8" increments
- Requires two people

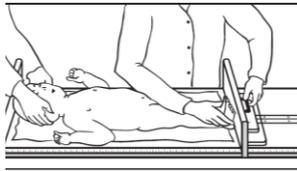


Measuring recumbent length

Person A

Person B

- 1 Infant/child on back
- 1 Straighten legs
- 2 Hold knees down

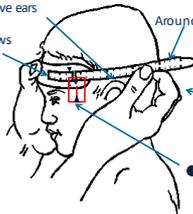


- 2 Head against headboard
- 1 Move footboard against heels
- 3 Trunk/pelvis aligned
- 1 Read and record



Measuring head circumference

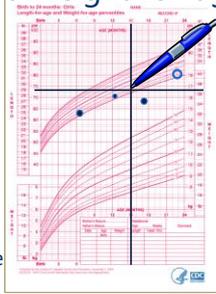
- REMOVE hair ornaments
- USE a flexible, non-stretchable measuring tape
- 3 Above eyebrows
- Above ears
- Around widest part of back of head
- 4 Pull snugly
- Read measurement to the nearest 0.1 cm (1 mm) or 1/8 inch



Plot length-for-age and weight-for-age

TIP: Use a transparent growth chart plotting aid

- Find age on horizontal axis
- Find length or weight on vertical axis
- Mark point of intersection
- Estimate growth percentile



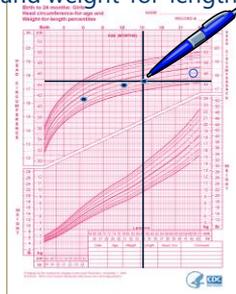
Plot head circumference and weight-for-length

For head circumference

- Find age on horizontal axis
- Find head circumference on vertical axis
- Mark point of intersection
- Estimate percentile

For weight-for-length

- Find length on horizontal axis
- Find weight on vertical axis
- Mark point of intersection
- Estimate percentile



Weighing children and adolescents

Equipment Needed:

- Beam or electronic scale
- 0.1 kg or ¼ lb increments
- Large standing platform
- Can be easily "zeroed" and calibrated



Weighing children and adolescents

1. Remove bulky outer clothing and shoes. If diaper is used, be sure it is clean and dry.
2. Balance/zero the scale.
3. Have child stand in center of the scale, feet slightly apart.
4. Read the measurement to the nearest 0.1 kg or ¼ lb.
5. Record measurement.



Weight of a child or teen unable to stand

- Use standard procedure for weighing infants
- Weigh parent and child; subtract parent's weight
- Use chair scale, bed scale, or wheelchair scale, if available



Measuring height (stature)

Equipment Needed:

- Height rod (stadiometer)
- Attached, movable headboard
- Marked to 1/8" or 0.1 cm
- Attached to a firm, vertical surface (without thick baseboard)



Measuring height (stature)

- **Remove**
 - Shoes
 - Bulky outer clothing
 - Hats, caps, scarves
 - Hair ornaments
- **Position**
 - Heels together; flat on floor
 - Knees straight; arms at sides
 - Shoulders relaxed
 - Back of head, shoulder blades, buttocks, heels touching wall



Measuring height (stature)

- Child looks straight ahead
- Lower headboard to crown of head
- Read measurement with eyes level with headboard
- Repeat until 2 readings agree within 1 cm or 1/4"
- Record measurement



Measuring height (stature)



Measuring stature of a child (over 2 year old) unable to stand

- Recumbent length; subtract ¼" or 0.8 cm
- Arm span
- Provider may estimate stature from segmental measurements obtained by a trained individual using validated formulas
 - Ulnar length
 - Tibial length
 - Knee height
 - Crown-rump length
 - Sitting height



What Is Body Mass Index?

- A number calculated using weight and height:
Body Mass Index (BMI) = Weight (kg) / Height (m)²
- It compares a person's weight to height
- It is an indirect *screening test* for body fatness

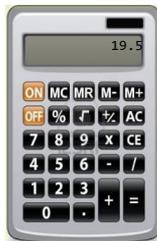


Determine BMI Value

Method 1:
Using a calculator

- **English** measurements
Wt (pounds) ÷ Ht (inches) ÷ Ht (inches) x 703
- **Metric** measurements
Wt (kg) ÷ Ht (cm) ÷ Ht (cm) x 10,000

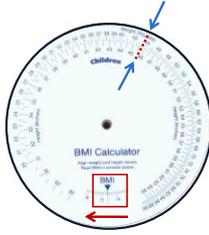
TIP: Formulas are listed on the BMI-for-age chart



Determine BMI Value

Method 2:
Using a BMI calculation wheel

- Find the **height** on inner wheel
- Line up with the **weight** on outer wheel
- Read **BMI value** in the window on the inner wheel
Read number and decimal points from right to left!



Determine BMI Value

Method 3:
Using an online calculator or electronic health record

- Centers for Disease Control (CDC) [BMI Calculator for Child and Teen](https://www.cdc.gov/healthyweight/bmi/calculator.html)
Available at: <https://www.cdc.gov/healthyweight/bmi/calculator.html>
- PediTools: Clinical tools for pediatric providers
[CDC Growth calculator for 2 to 20 years](http://www.peditools.org/growthpedi/)
Available at: <http://www.peditools.org/growthpedi/>
- Your clinic's electronic health record system



Determine BMI Value

Method 3: Using an online calculator or electronic health record

Enter Data

View Results

BMI Calculator for Child and Teen English | Metric

Birth Date:

Date of Measurement:

Sex: boy girl

Height, to nearest 1/8 inch:
 feet, inches, fractions of an inch
(12 inches = 1 foot; Example: 4 feet, 5 1/2 inches)

Weight, to nearest 1/4 (.25) pound:
 pounds, fractions of a pound
(8 ounces = 1/2 pounds; Example: 75 3/4 pounds)

BMI Calculator for Child and Teen Calculate again (English | Metric)

Information Entered
 Age: 6 years 0 months Sex: boy
 Birth Date: 06/01/2007 Height: 5 feet 3.375 inches
 Date of Measurement: July 01, 2013 Weight: 85.00 pounds

Results
 Based on the height and weight entered, the BMI is **14.2** (BMI for age of the 95th percentile is 14.8 and 5 years is normal, **healthy weight**).

• What does this mean?
 • What should you do?

Legend:
 underweight, less than the 5th percentile
 healthy weight, 5th percentile up to the 84th percentile
 overweight, 85th to less than the 95th percentile
 obese, equal to or greater than the 95th percentile

Why Use BMI-for-Age?

- Lifetime tracking tool
 - from age 2 through adult
- Relates weight, stature and age
- Screening for health and nutrition status required by CHDP and health plans
- Early indicator of other health risk factors
 - *Hyperlipidemia*
 - *Elevated insulin*
 - *High blood pressure*



Body Mass Index Cutoff Values for Adults

- Standard weight categories
- Same for all ages 18 +
- Same for men and women



<i>Weight Status</i>	<i>BMI</i>
Obese	30.0 and above
Overweight	25.0 - 29.9
Normal	18.5 - 24.9
Underweight	Below 18.5



BMI for Children and Teens

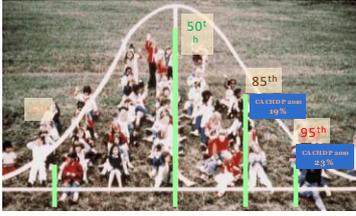
- Age- and sex-specific
- Plot BMI to find percentile
- Determine weight status



<i>Weight Status Category</i>	<i>Percentile Range</i>
Obese	≥ 95 th percentile
Overweight	85 th to < 95 th percentile
Normal	5 th to < 85 th percentile
Underweight	< 5 th percentile



What is a Percentile?



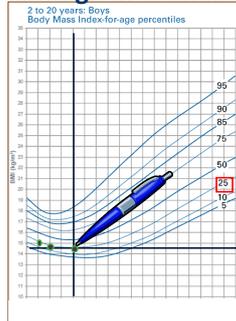
Major Percentile Divisions



Determine BMI-for-Age percentile by plotting BMI number on growth chart

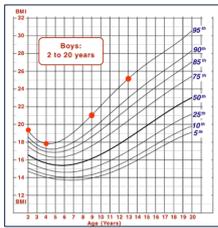
TIP: Use a transparent growth chart plotting aid

- Find age on horizontal axis
- Find BMI value on vertical axis
- Mark point of intersection
- Estimate BMI percentile



For children, BMI changes with age

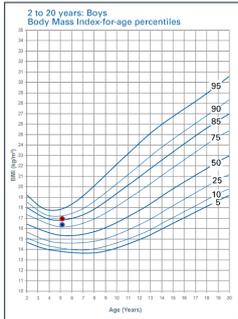
Example: Child's growth tracking along 95th %ile



Age	2	4	9	13
BMI Value	19.3	17.8	21.0	25.1



Accurate measurements are critical

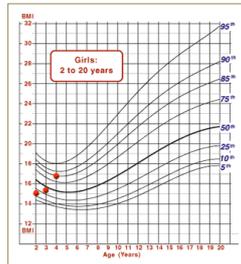


- BMI for 5 year old boy**
- Weight: 43.5 lb
 - Height: 43.0 in
 - BMI= 16.5
- BMI-for-age = 75-84th %ile**
Normal range
- If height is inaccurate:**
- Weight: 43.5 lb
 - Height: **42.5 in**
 - BMI = 17.0
- BMI-for-age = 85-94th %ile**
Overweight range



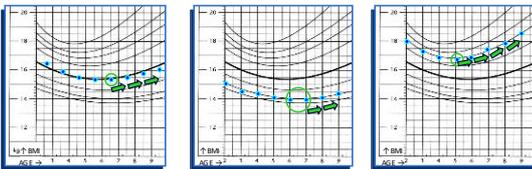
How to read and interpret the growth chart

- A single point on the curve indicates current status
- A series of BMI plots are needed to determine the growth trend
- If growth deviates from the expected growth pattern, further assessment may be needed



Adiposity rebound

A normal increase in BMI after it reaches its lowest point, usually between ages 4 and 6

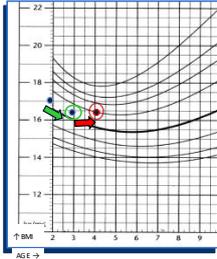


Child following 50th percentile curve

Child following 10th percentile curve

Child following 85th percentile curve

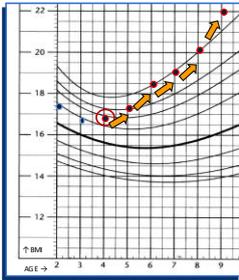
Early adiposity rebound



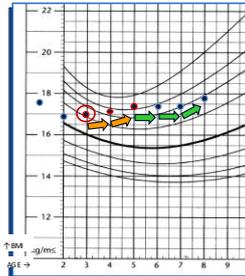
- An increase in BMI before age 5 is called *early adiposity rebound*
- An upward BMI trend before age 5 is related to higher BMI in adulthood
- This is a **red flag** indicating need for further nutrition and physical activity assessment



Early adiposity rebound

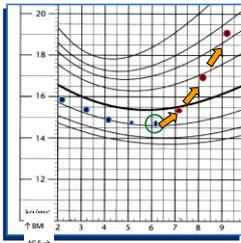


Without Intervention



With Intervention

Excessive adiposity rebound



- *Excessive adiposity rebound* is also related to higher BMI in adulthood
- Increasing BMI percentiles that cross major percentile lines are **red flags** indicating need for further nutrition and physical activity assessment



What are your challenges?

- Availability and quality of equipment
- Adaptability
- Cooperation
- Physical limitations



Resources and clinical tools

- Online tutorials
- Online resources
- Growth charts
- BMI wheels
- BMI calculators
- Plotting aids



You have learned to:

- Weigh and measure children using standard techniques
- Manage common problems encountered in the clinic
- Select appropriate growth chart for age group
- Identify the age range for Body Mass Index (BMI) screening
- Calculate or determine BMI value
- Plot BMI value on the appropriate growth chart
- Determine BMI-for-age percentile
- Identify weight category



**References:
Anthropometric measurements**

- [Maternal and Child Health Bureau Growth Charts Training](#). 2001. U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA). Available at: <http://depts.washington.edu/growth/index.htm>
- Ogata B, Feucht S. Assessment of Growth: Part 1 Equipment, Technique and Growth Charts. [Nutrition Focus](#). 2011; 26 (6) 1-11. (subscription only). Available at: <http://depts.washington.edu/nutrfoc/webapps/>
- Yang Y, Lucas B, Feucht S, editors. [Nutrition Interventions for Children with Special Health Care Needs, Third Edition](#). 2010. Washington State Department of Health. Olympia, WA. Available at: <http://here.doh.wa.gov/materials/nutrition-interventions>
- [CHDP Health Assessment Guidelines, Guideline # 4: Anthropometric Measurements](#). Available at: <http://www.dhcs.ca.gov/services/chdp/Documents/HAG/4AnthropometricMeasure.pdf>
- [CHDP Manual and Bulletins](#) > [CHDP Provider Manual](#) > Confidential Screening/Billing Report (PM 100) Claim Form Completion Instructions Available at: http://files.medical.ca.gov/pubsdoco/chdp_manual.asp



References: Body Mass Index

- [AAP Policy Statements](#)
American Academy of Pediatrics,
Institute for Healthy Childhood Weight.
Available at: <https://ihcw.aap.org/Pages/policy.aspx>
- [Obesity](#)
American Family Physician, 2017.
Available at:
<http://www.aafp.org/afp/topicModules/viewTopicModule.htm?topicModuleId=19>
- [Body Mass Index](#)
Centers for Disease Control and Prevention, 2015.
Available at:
<https://www.cdc.gov/healthyweight/assessing/bmi/index.html>



**References:
Specialty growth charts for providers**

- [Growth Charts for Children with Down Syndrome](#)
Available at:
<http://www.cdc.gov/nchsddd/birthdefects/downsyndrome/growthcharts.html>
- [New Growth Charts for Children with Cerebral Palsy](#)
Available at:
<http://www.lifeexpectancy.org/articles/NewGrowthCharts.shtml>
- [PediTools: Clinical tools for pediatric providers](#)
Available at:
<http://www.peditools.org/growthpedi/>



Illustrations/Photographs

- Slides 4-7, 11-13, 16, 22-23, 25-28, 33. Photos with permission. Ventura County CHDP Program and Mandalay Bay Women and Children's Medical Group. 2011. [Ventura County Health Care Agency](#)
- Slides 14, 15, 17. Illustrations with permission. Yang Y, Lucas B, Feucht S, editors. [Nutrition Interventions for Children with Special Health Care Needs, Third Edition](#). 2010, Washington State Department of Health, Olympia, WA. Available at: <http://here.doh.wa.gov/materials/nutrition-interventions>
- Slides 24, 29, 77. Photos with permission. Ventura County CCS Medical Therapy Program. 2011-2013 [Ventura County Health Care Agency](#)



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
Using the guide above, 3 years, 6 months, and 19 days is rounded to 3		5-7	1/2
		8-10	3/4
		11-12	1

years and 7 months. Because age for children over 2 is rounded to the nearest 1/4 year, Sam's age is rounded to 3 1/2 years.

4

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>

5

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.

6

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

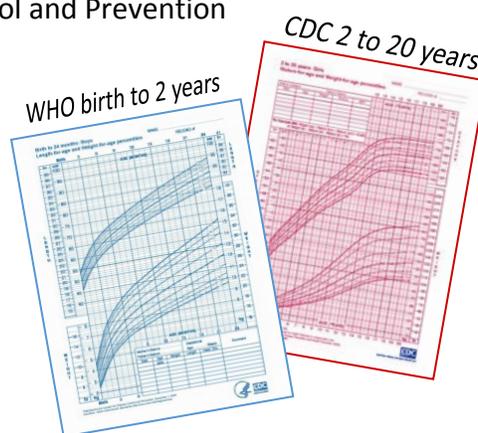
1. American Academy of Pediatrics. *Pediatric Nutrition Handbook*. 6th ed. Elk Grove Village, IL: American Academy of Pediatrics. 2009;559-564.
2. Barlow SE; and the Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight 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

Clinical Growth Charts Camera-Ready Masters

With support from the American Academy of Pediatrics and the National Institutes of Health, the Centers for Disease Control and Prevention recommends that US health care providers:

- Use the **WHO growth standards** for infants and children from birth to 2 years of age
- Use the **CDC growth charts** for children age 2 years and older



The following items are included in this packet:

Fact Sheet

Recommendations for and advantages of using the World Health Organization growth charts in the US among children ages birth to 2 years. Centers for Disease Control and Prevention; 2012. www.cdc.gov/nccdphp/dnpao/growthcharts/who/downloads/Using_WHO_growth_charts.pdf

Camera-Ready Masters (*Print double-sided copies in the combinations listed for age and gender*)

WHO Growth Charts: Birth to 24 months (2nd - 98th percentiles)

Birth to 24 months: Boys

Length-for-age and Weight-for-age percentiles
Head Circumference-for-age and Weight-for-length percentiles

Birth to 24 months: Girls

Length-for-age and Weight-for-age percentiles
Head Circumference-for-age and Weight-for-length percentiles

CDC Clinical Charts: Children 2 to 20 years (5th - 95th percentiles)

2 - 20 years: Boys

Stature-for-age and Weight-for-age percentiles
Body mass index-for-age percentiles

2 - 20 years: Girls

Stature-for-age and Weight-for-age percentiles
Body mass index-for-age percentiles

Visit www.cdc.gov/growthcharts for additional information, downloadable growth charts, interactive training modules and educational materials.

Reference:

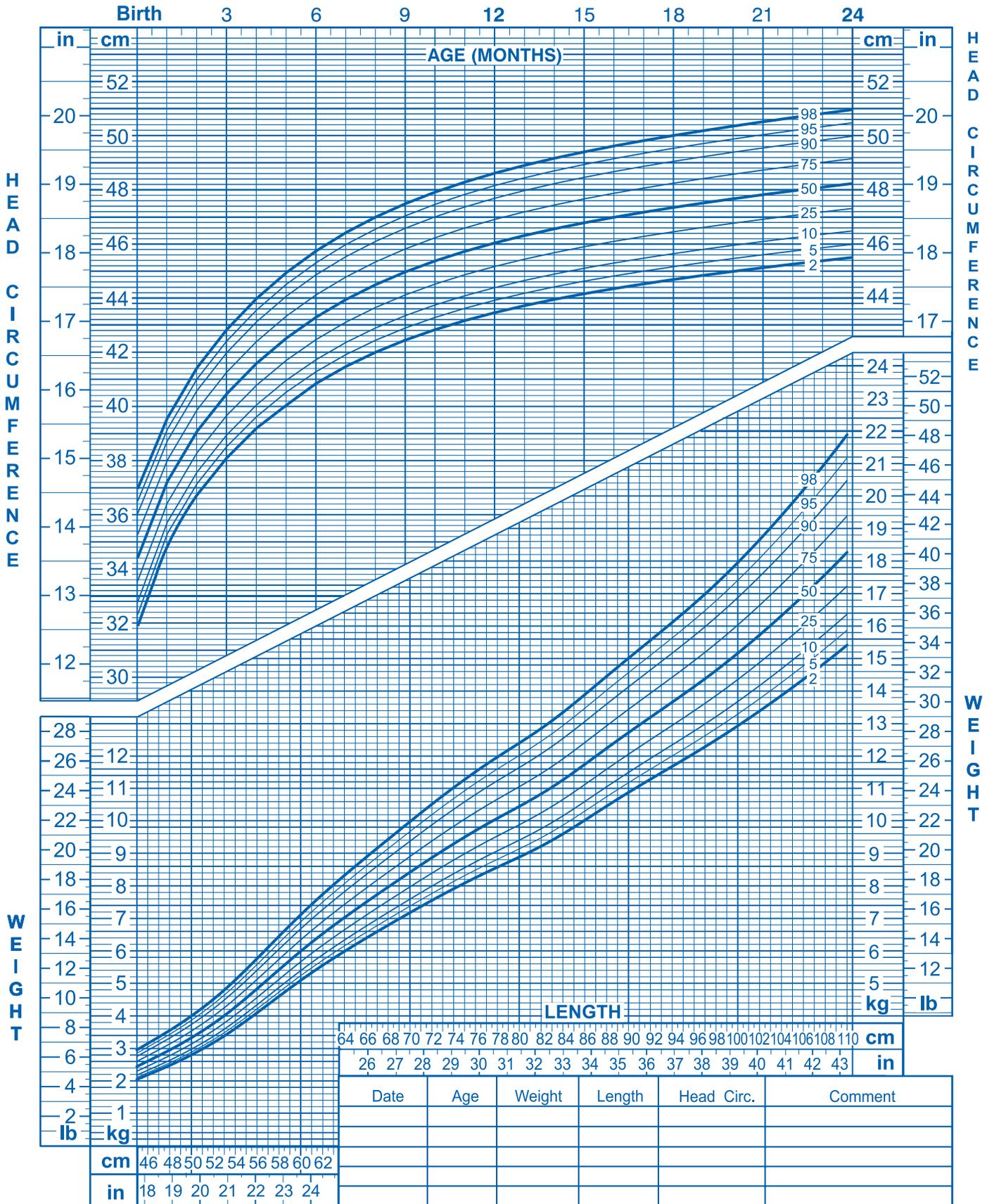
Eidelman AI, Schanler RJ. American Academy of Pediatrics Section on Breastfeeding. Breastfeeding and the use of human milk. Pediatrics. 2012;129(3):e827–e841. Epub 2012 Feb 27. Available from: <http://pediatrics.aappublications.org/content/129/3/e827.full.pdf>.

Birth to 24 months: Boys

Head circumference-for-age and Weight-for-length percentiles

NAME _____

RECORD # _____

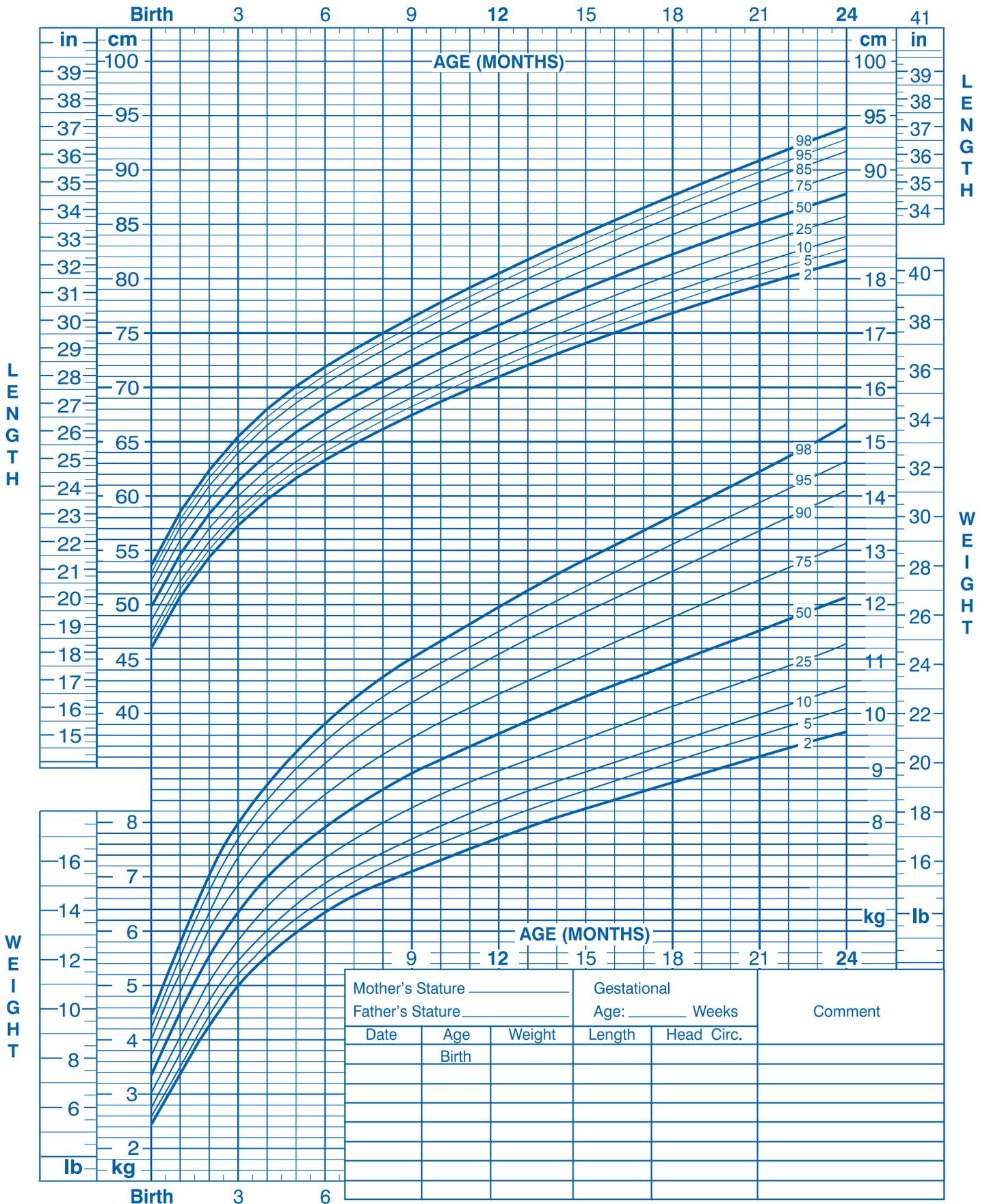


Birth to 24 months: Boys

Length-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____

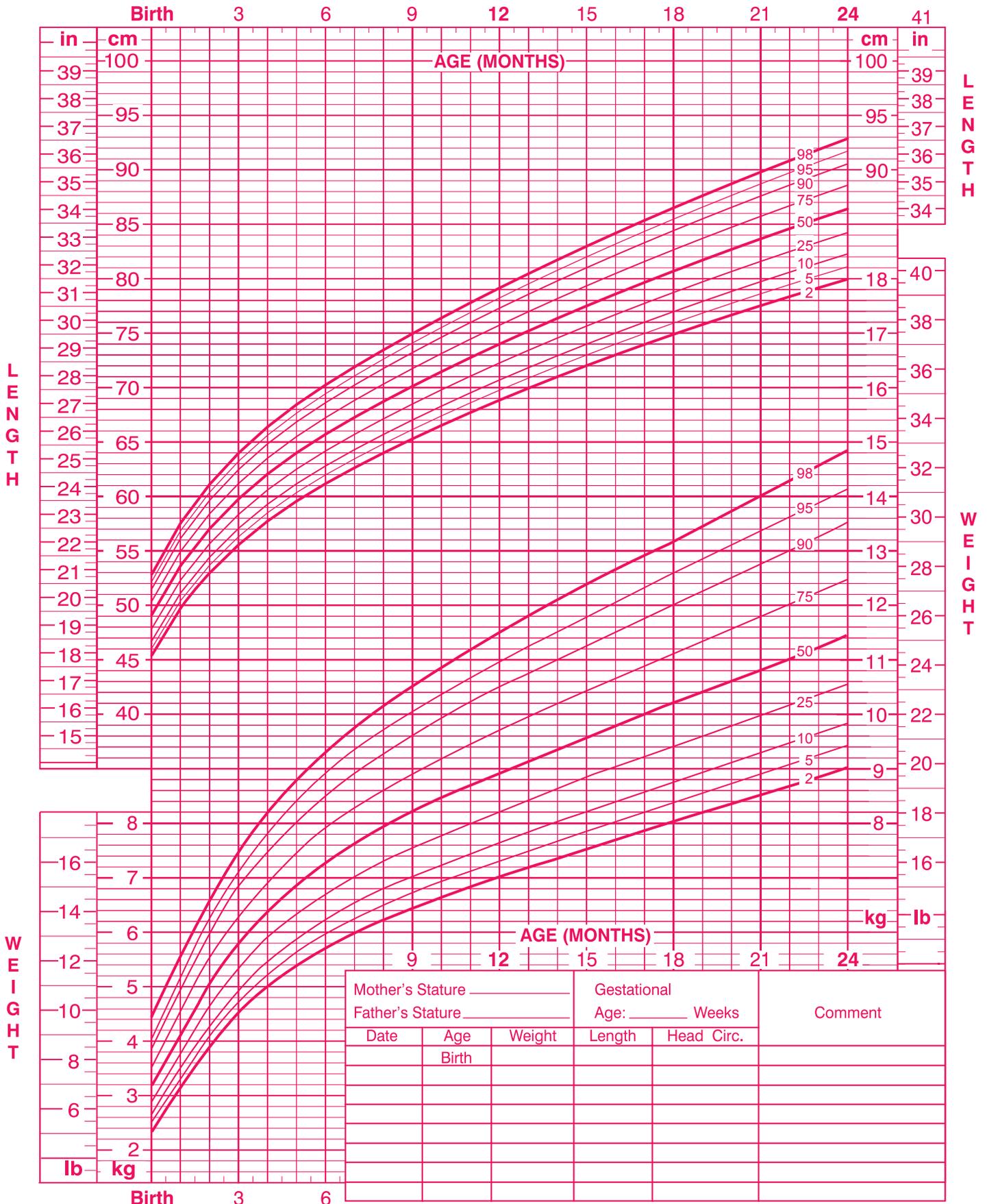


Birth to 24 months: Girls

Length-for-age and Weight-for-age percentiles

NAME _____

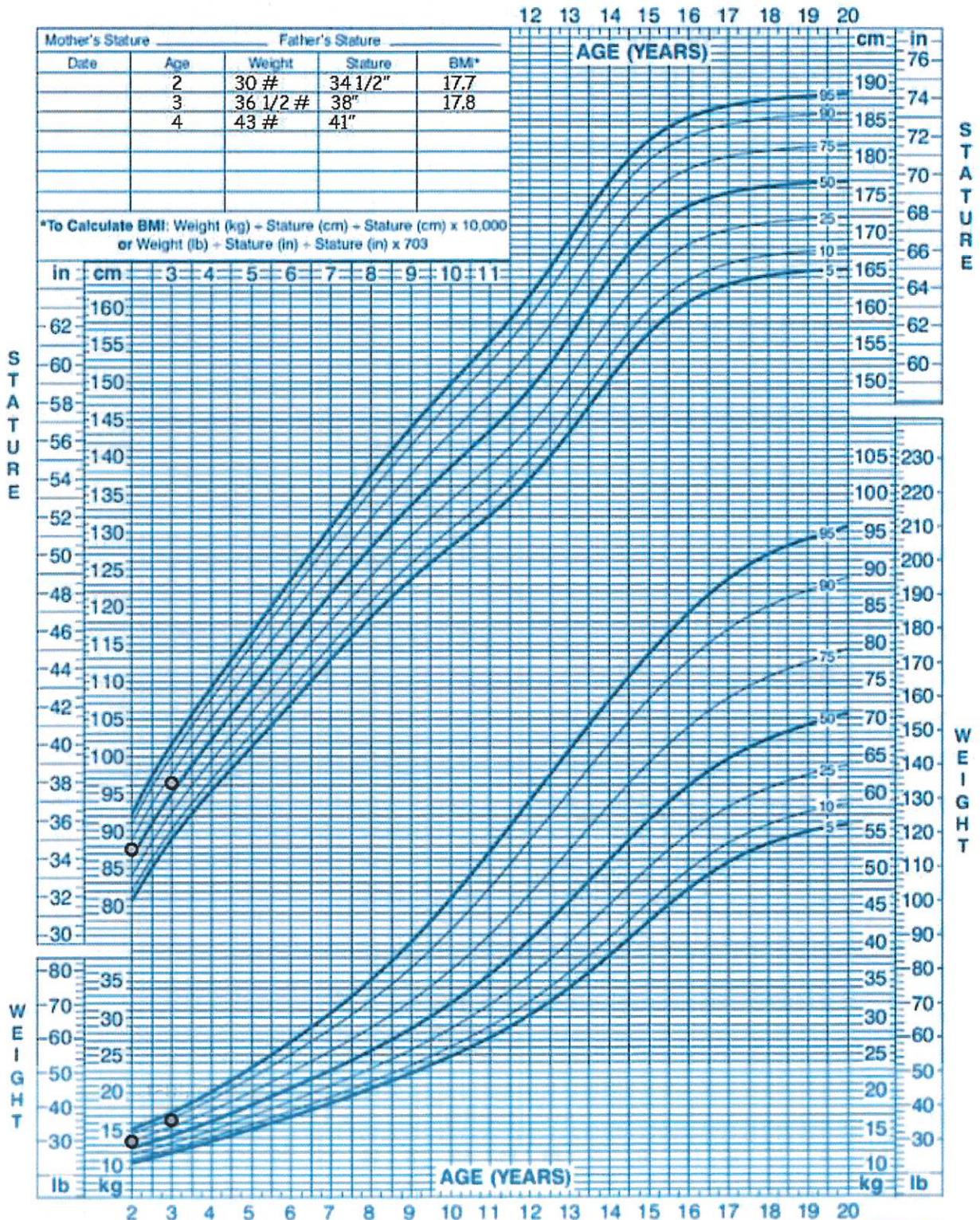
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Practice growth chart for entering BMI value and plotting BMI-for-age

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

NAME Pete
RECORD # 002



Published May 30, 2000 (modified 11/21/00)
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>



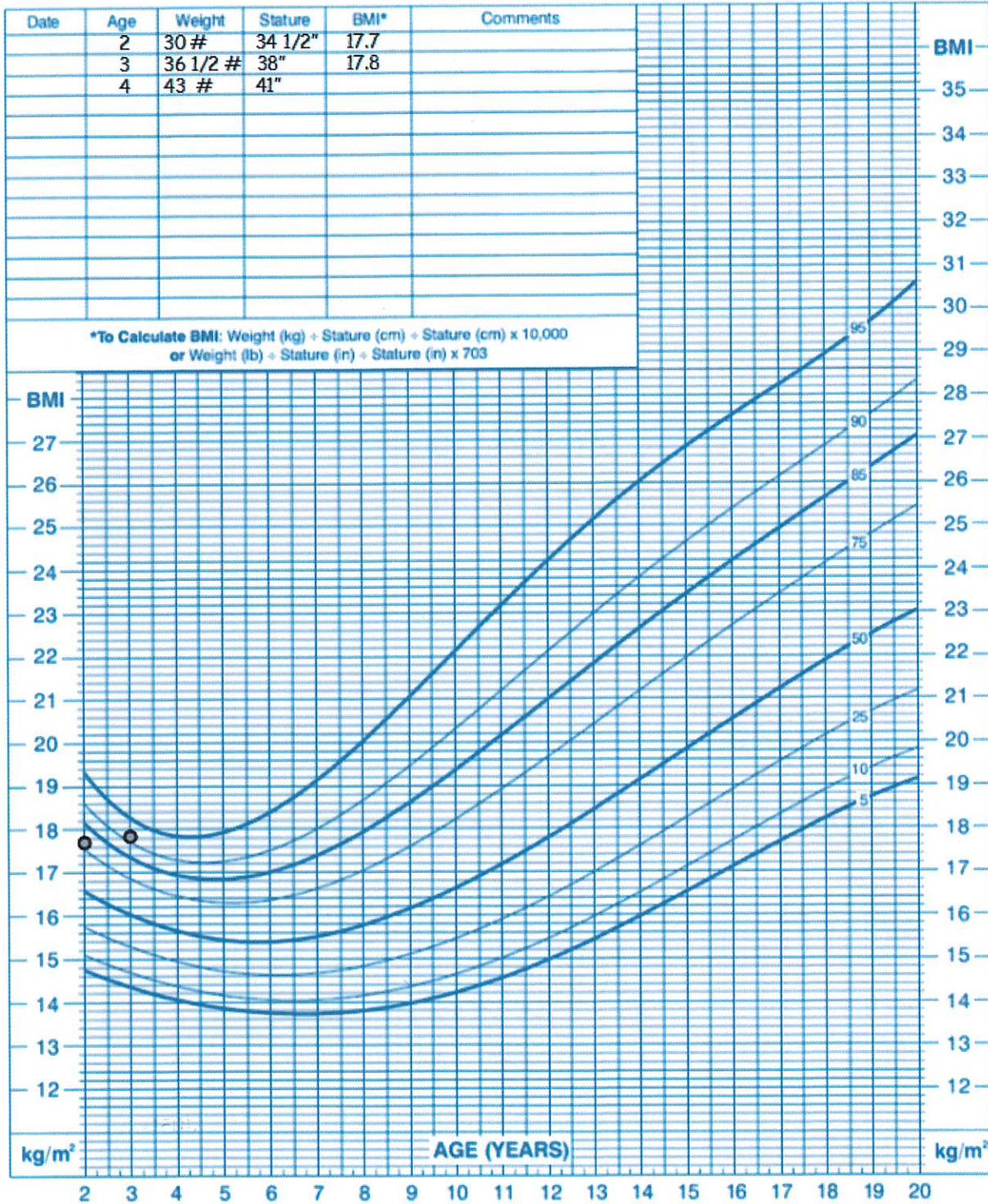
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Practice growth chart for entering BMI value and plotting BMI-for-age

2 to 20 years: Boys
Body mass index-for-age percentiles

NAME Pete

RECORD # 002



Published May 30, 2000 (modified 10/16/00).

SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>



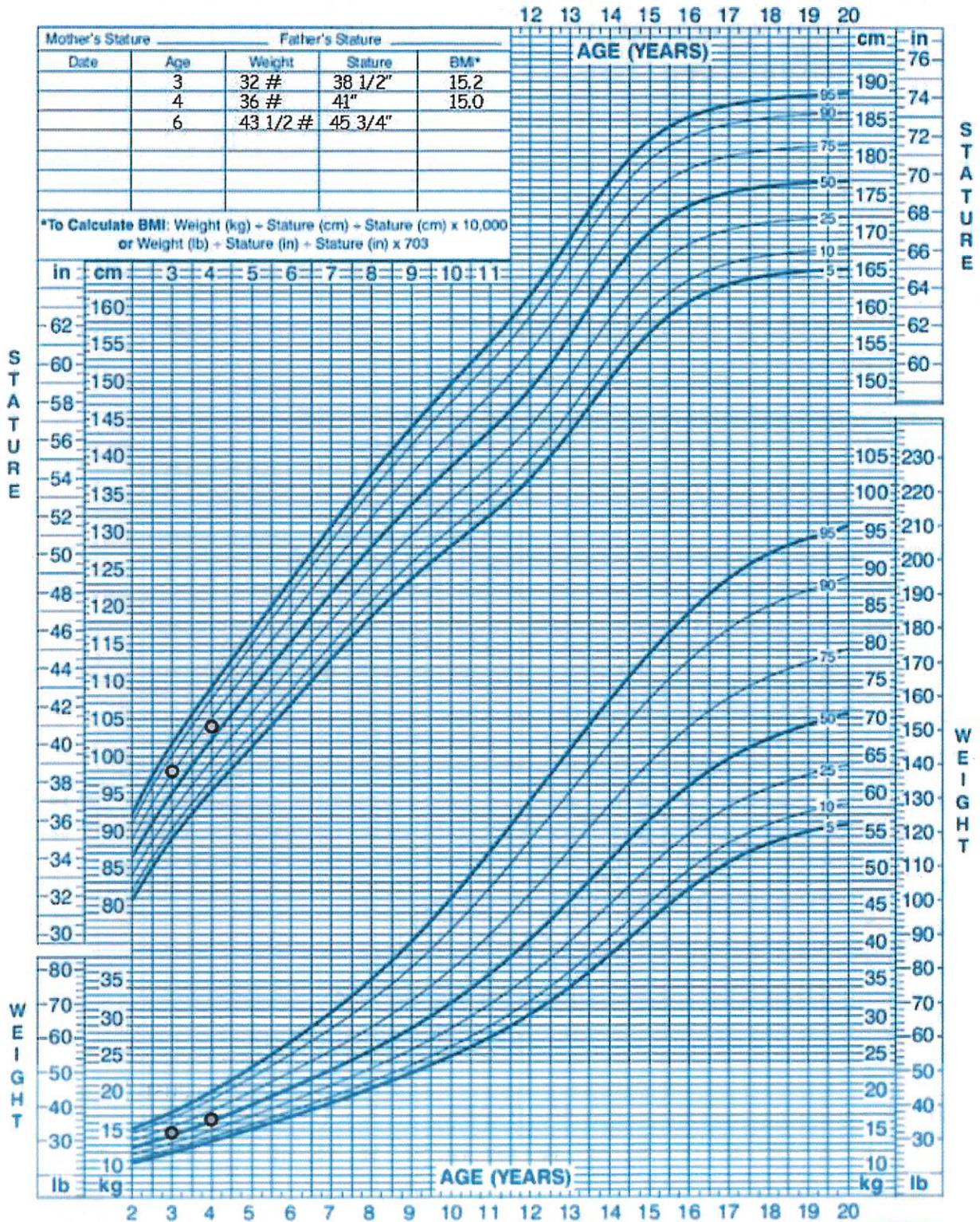
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Practice growth chart for entering BMI value and plotting BMI-for-age

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

NAME Carlos

RECORD # 001



Published May 30, 2000 (modified 11/21/00)

SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000)
<http://www.cdc.gov/growthcharts>



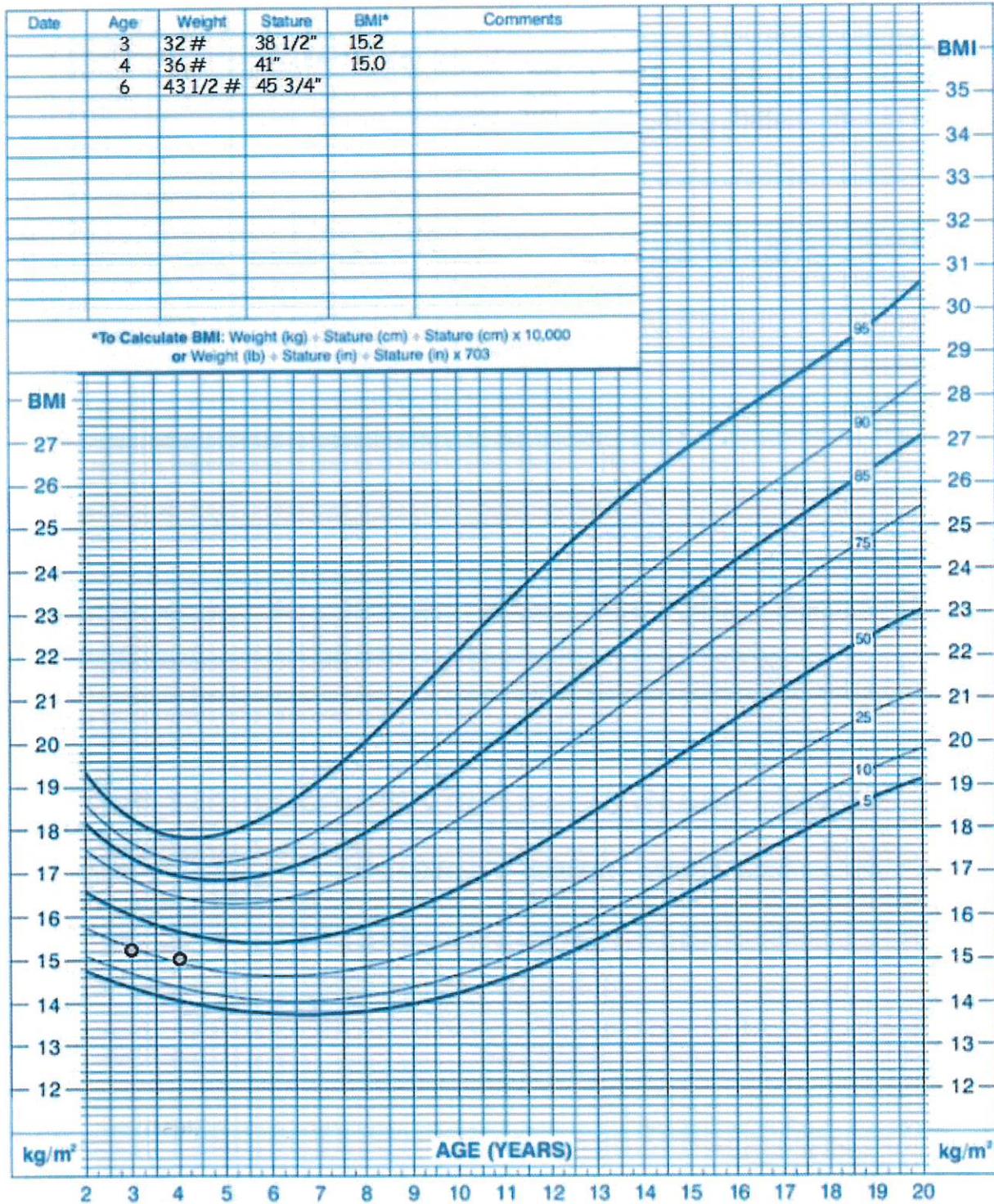
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Practice growth chart for entering BMI value and plotting BMI-for-age

2 to 20 years: Boys
Body mass index-for-age percentiles

NAME Carlos

RECORD # 001



Published May 30, 2000 (modified 10/16/00)

SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000). <http://www.cdc.gov/growthcharts>

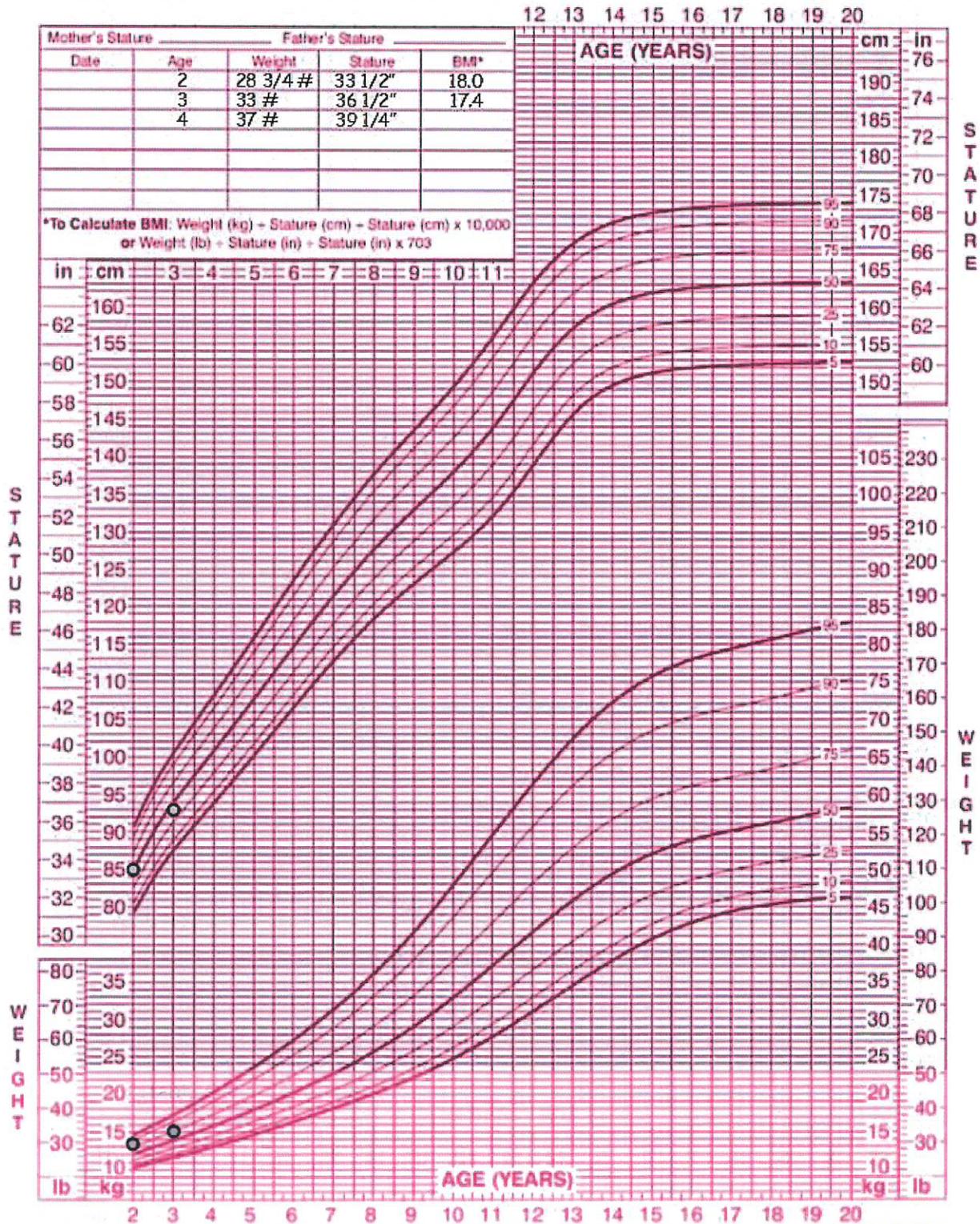


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Practice growth chart for entering BMI value and plotting BMI-for-age

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME Liz
RECORD # 003



Published May 30, 2000 (modified 11/21/00)
SOURCE: Developed by the National Center for Health Statistics in collaboration with
the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>

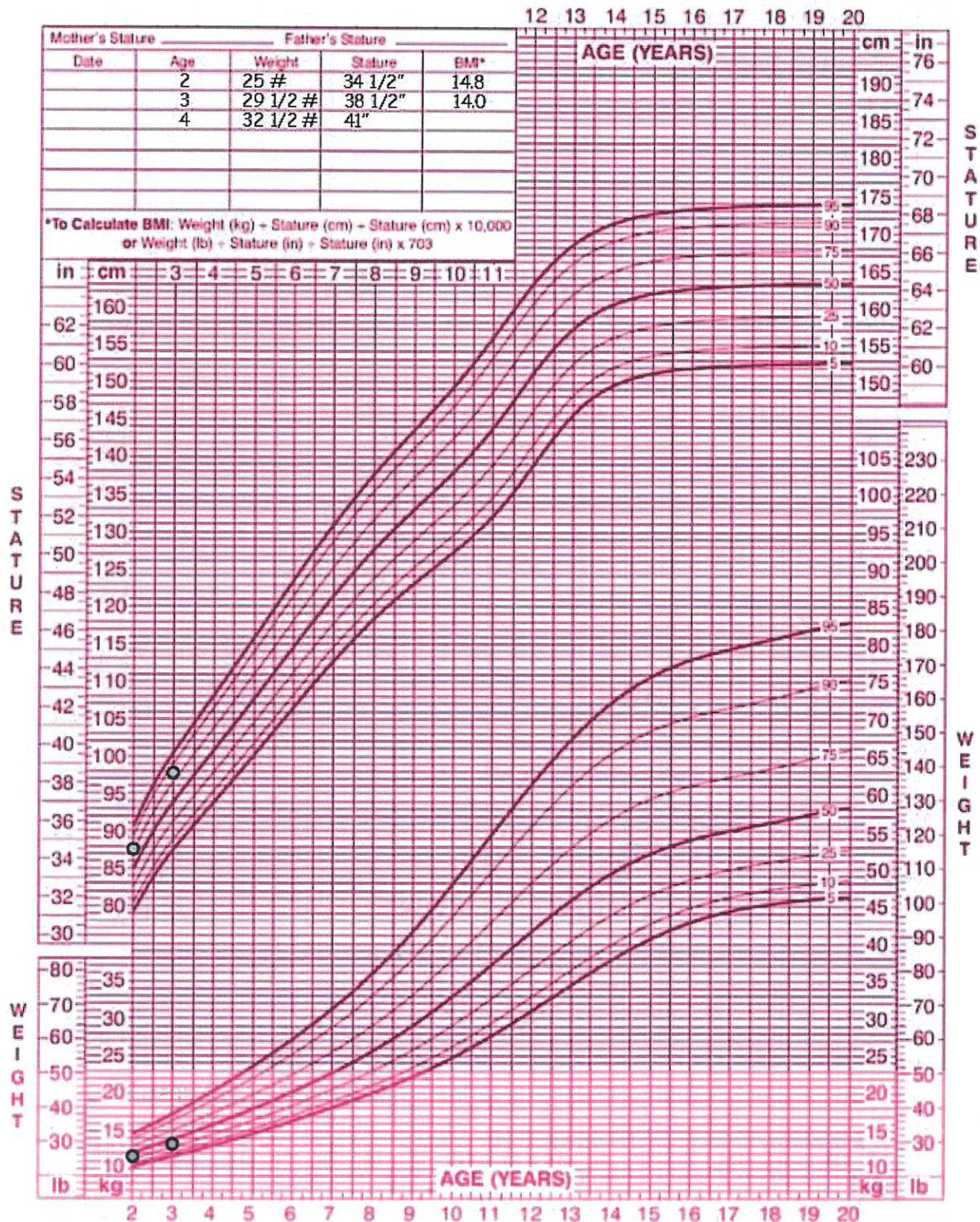


Practice growth chart for entering BMI value and plotting BMI-for-age

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME Gabriela

RECORD # 004



Published May 30, 2000 (modified 11/21/00)
SOURCE: Developed by the National Center for Health Statistics in collaboration with
the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>



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BMI and Plotting Tool

Order Information

1. Pediatric BMI Wheel: Plastic, CD sized wheel permits rapid and accurate calculation of BMI in children.

Available from:

Perspective Enterprises (800) 323-7452 or www.perspectiveent.com



2. BMI Calculator: Pocket-sized calculator automatically calculates BMI.
Available from:
SECA (800) 541-7322
3. Plotting aids: Transparent overlay facilitates quick and accurate plotting of weight and stature measurements on growth charts.
Available from:
The PrecisePlot: Perspective enterprises (800) 323-7452
Graph Ease Plotting Tool: SECA (800) 542-7322

This equipment guide is not comprehensive, as vendors and manufacturers continually update and change their stock. This guide is not an endorsement of any product or distributor.

Prepared by Nutrition Sub-Committee of the Child Health and Disability Prevention (CHDP) Program
Bay Area Deputy Directors (BADD)

Measuring Length

Infants: Birth - 2 years

Step 1 – Dress Code

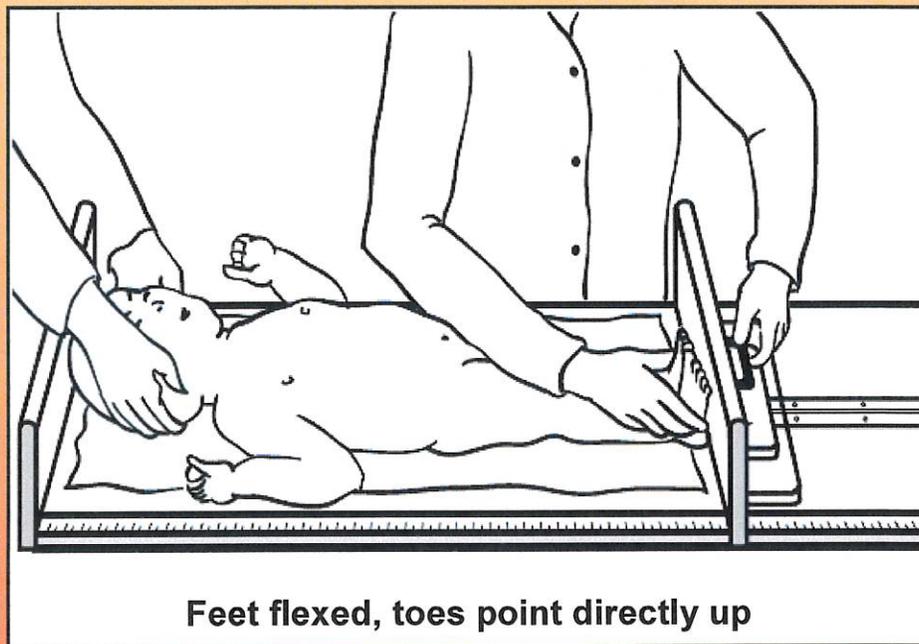
Measure infant wearing underclothing or clean diaper. No shoes!

Step 2 – Child Positioning is Crucial!

Two people perform measurement:

Caregiver
holds head firmly
against head board

Staff
Straightens and holds knees and hips,
then moves footboard
until it rests firmly against heels



Feet flexed, toes point directly up

Step 3 – Read and Document the Measurements

Read measurement to nearest 1/8 inch (0.1 cm) and write it down.

For more information on accurately measuring infants, children and adolescents, visit www.dhcs.ca.gov/services/chdp/ > Support and Educational Materials.

Illustration © Nutrition Interventions for Children with Special Health Care Needs, Third Edition, Yang Y, Lucas B, Feucht S, editors. Washington State Department of Health, Olympia, WA, April 2010. Used with permission.

Measuring Weight

Infants: Birth - 2 years

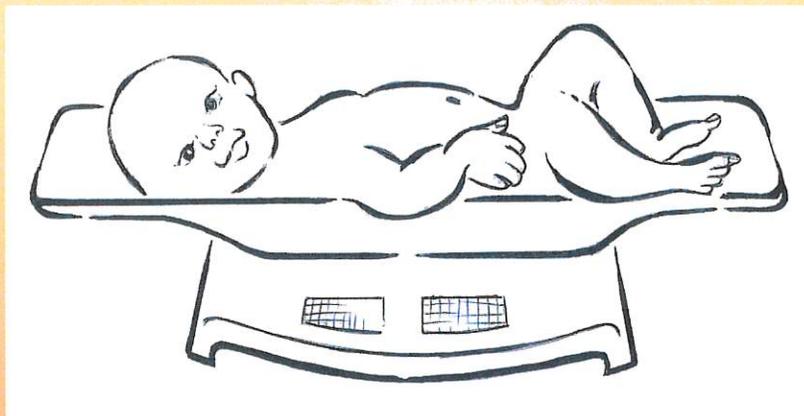
Step 1 – Dress Code

Weigh infant wearing light underclothing or a clean dry diaper.

Step 2 – Center Child on Scale

Balance and zero the scale including the paper drape

Place infant on the center of the scale platform



Respect Privacy

Provide a private area for:

- Clothing removal
- Taking and discussing measurements



Alternate Weighing Method

- 1) Weigh both caregiver and child
- 2) Weigh caregiver alone
- 3) Subtract caregiver's weight from the combined weight

Step 3 – Read and Document the Measurements

Read measurement to nearest 1/2 ounce (0.01 kg) and write it down.

Conversion Chart

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

For more information on accurately measuring infants, children and adolescents, visit www.dhcs.ca.gov/services/chdp/.

Select *Support and Educational Materials*.

Illustration:
Copyright George Toth-Fejel, 2012.
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Measuring Stature

Children and Adolescents: 2 - 20 years

Step 1 – Dress Code

Remove bulky outer clothing (jackets, hat and shoes) and second layers.

Step 2 – Positioning is Crucial

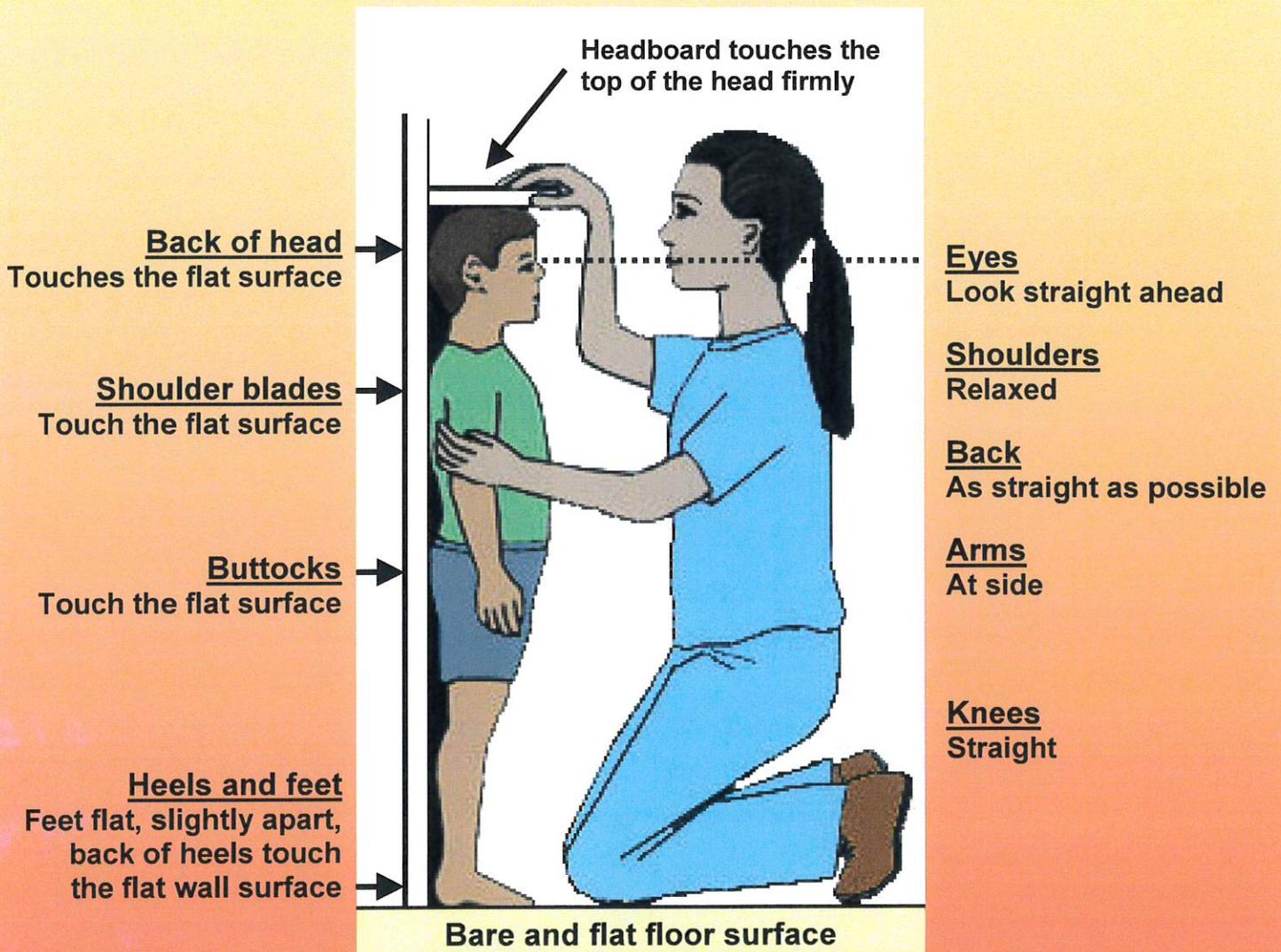


Illustration adapted from: Measuring Children's Height and Weight Accurately At Home.
2011. www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/measuring_children.html

Step 3 – Read and Document the Measurements

Read measurement to nearest 1/8 inch (0.1 cm) and write it down.

For more information on accurately measuring infants, children and adolescents,
visit www.dhcs.ca.gov/services/chdp/ > Support and Educational Materials.

Measuring Weight

Children and Adolescents: 2 - 20 years

Step 1 – Dress Code

Remove bulky outer clothing (jackets, hat and shoes).
If a diaper is used, be sure it is clean and dry.

Step 2 – Center Child on Scale

Before child steps on platform, balance and zero the scale

Ask child to stand on center of scale platform with heels slightly apart



Respect Privacy
Provide a private area for:

- Clothing removal (provide gown if needed)
- Taking and discussing measurements



Alternate Weighing Method

- 1) Weigh both caregiver and child
- 2) Weigh caregiver alone
- 3) Subtract caregiver's weight from the combined weight

Step 3 – Read and Document the Measurements

Read measurement to nearest 1/4 lb (0.1 kg) and write it down.

Conversion Chart		
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

For more information on accurately measuring infants, children and adolescents, visit www.dhcs.ca.gov/services/chdp/.

Select *Support and Educational Materials*.

Photograph:
Ventura County CHDP Program and
Mandalay Bay Women and Children's Medical Group,
August 19, 2011. Ventura County Health Care Agency.
www.vchca.org/
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Growth Assessment Resources

Online Tutorials

[Centers for Disease Control and Prevention \(CDC\) Growth Chart Training](http://www.cdc.gov/nccdphp/dnpa/growthcharts/training/modules/index.htm)

<http://www.cdc.gov/nccdphp/dnpa/growthcharts/training/modules/index.htm>

[CDC: Using the WHO Growth Charts to Assess Growth in the United States](http://www.cdc.gov/nccdphp/dnpao/growthcharts/who/index.htm)

<http://www.cdc.gov/nccdphp/dnpao/growthcharts/who/index.htm>

[Maternal and Child Health Bureau: Growth Charts Training Modules](http://depts.washington.edu/growth/)

<http://depts.washington.edu/growth/>

Online Resources

[AAP Prevention and Treatment of Childhood Overweight and Obesity](http://www2.aap.org/obesity/index.html)

<http://www2.aap.org/obesity/index.html>

[CHDP Body Mass Index \(BMI\)-for-Age Percentile Job Aid \(Program Information Notice No.: 08-02\)](http://www.dhcs.ca.gov/services/chdp/Documents/Letters/chdppin0802.pdf)

<http://www.dhcs.ca.gov/services/chdp/Documents/Letters/chdppin0802.pdf>

[CHDP Provider Support and Educational Materials](http://www.dhcs.ca.gov/services/chdp/Pages/Support.aspx)

<http://www.dhcs.ca.gov/services/chdp/Pages/Support.aspx>

[California Medical Association Foundation Programs: Obesity](http://www.thecmafoundation.org/Programs/Obesity)

<http://www.thecmafoundation.org/Programs/Obesity>

[Expert Committee Recommendations](http://pediatrics.aappublications.org/content/120/Supplement_4/S164.full)

[on the Assessment, Prevention and Treatment of Childhood Overweight and Obesity](http://pediatrics.aappublications.org/content/120/Supplement_4/S164.full)

http://pediatrics.aappublications.org/content/120/Supplement_4/S164.full

[National Institute for Children's Health Quality: Healthy Care for Healthy Kids Obesity Toolkit](http://obesity.nichq.org/resources/healthy%20care%20for%20healthy%20kids%20obesity%20toolkit)

<http://obesity.nichq.org/resources/healthy%20care%20for%20healthy%20kids%20obesity%20toolkit>

Website links were selected and reviewed by the statewide CHDP Nutrition Subcommittee.

This listing is for informational purposes only.

No endorsement of any commercial product is intended or implied.

California Department of Health Care Services

[Child Health and Disability Prevention Program](http://www.dhcs.ca.gov/services/chdp/ProviderSupportandEducationalMaterials) • [http://www.dhcs.ca.gov/services/chdp/ Provider Support and Educational Materials](http://www.dhcs.ca.gov/services/chdp/ProviderSupportandEducationalMaterials)



Growth Assessment Resources

Pediatric Growth Charts

[CDC Growth Charts \(Ages 2 to 20\)](http://www.cdc.gov/growthcharts/cdc_charts.htm)

http://www.cdc.gov/growthcharts/cdc_charts.htm

[WHO Growth Charts \(Birth to 24 Months\)](http://www.cdc.gov/growthcharts/who_charts.htm)

http://www.cdc.gov/growthcharts/who_charts.htm

[American Academy of Pediatrics: shopAAP](http://shop.aap.org)

<http://shop.aap.org>

[52 10 Let 's Go! Color-Coded BMI Charts](http://www.lets-go.org/programs/healthcare/toolkits/) > Health Care > Provider Tools

<http://www.lets-go.org/programs/healthcare/toolkits/>

[Eat Smart, Move More North Carolina Color-Coded BMI Charts](http://www.eatsmartmovemorenc.com/PediatricObesityTools/PediatricObesityTools.html)

<http://www.eatsmartmovemorenc.com/PediatricObesityTools/PediatricObesityTools.html>

BMI Calculation Wheels

[Perspective Enterprises](http://www.perspectiveent.com/) > Growth Assessment Tools > The BMI Wheel

<http://www.perspectiveent.com/>

Online BMI Calculator

[CDC Body Mass Index](http://www.cdc.gov/healthyweight/assessing/bmi/index.html) > Child and Teen BMI Calculator

<http://www.cdc.gov/healthyweight/assessing/bmi/index.html>

[The Children 's Hospital of Philadelphia: Body Mass Index and Z-Score Calculation in Children](http://stokes.chop.edu/web/zscore/)

<http://stokes.chop.edu/web/zscore/>

Pocket Calculator with BMI function (Seca 491 BMI Calculator)

[QuickMedical Medical Equipment and Supplies: Pocket Calculator with BMI Function](http://quickmedical.com/seca/accessories/491.html)

<http://quickmedical.com/seca/accessories/491.html>

Growth Chart Plotting Tools

[Perspective Enterprises](http://www.perspectiveent.com/) > Growth Assessment Tools > The PrecisePlot™

<http://www.perspectiveent.com/>

[QuickMedical Medical Equipment and Supplies: Graph Ease Growth Chart Plotting Tool](http://www.quickmedical.com/seca/pediatrics/404.html)

<http://www.quickmedical.com/seca/pediatrics/404.html>

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California Department of Health Care Services

[Child Health and Disability Prevention Program](http://www.dhcs.ca.gov/services/chdp/) • <http://www.dhcs.ca.gov/services/chdp/> Provider Support and Educational Materials

