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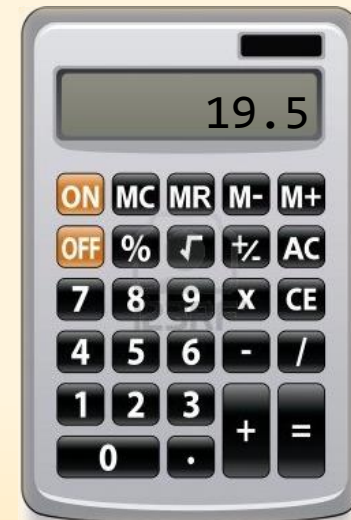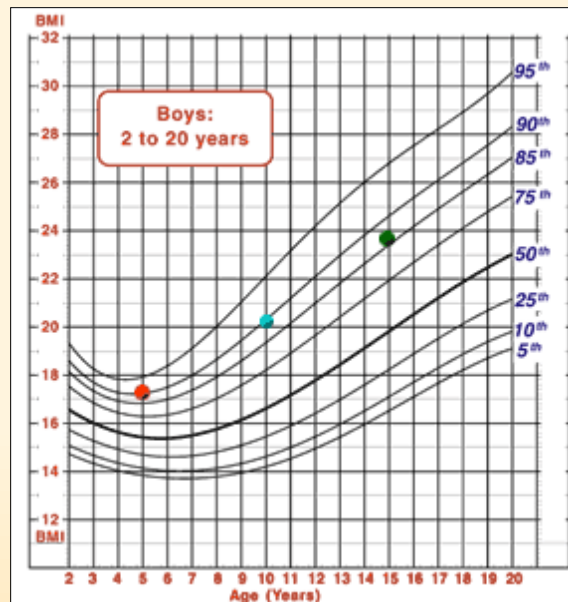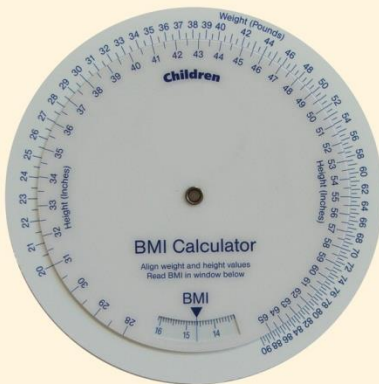
Training Objectives

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

- Select appropriate *growth chart* for age group
- Identify the *age range* for which
Body Mass Index (BMI) screening is used
- Calculate or determine *BMI value*
- *Plot BMI value* on the appropriate growth chart
- Determine *BMI-for-age percentile*
- Identify *weight category*
- *Record results* on PM 160

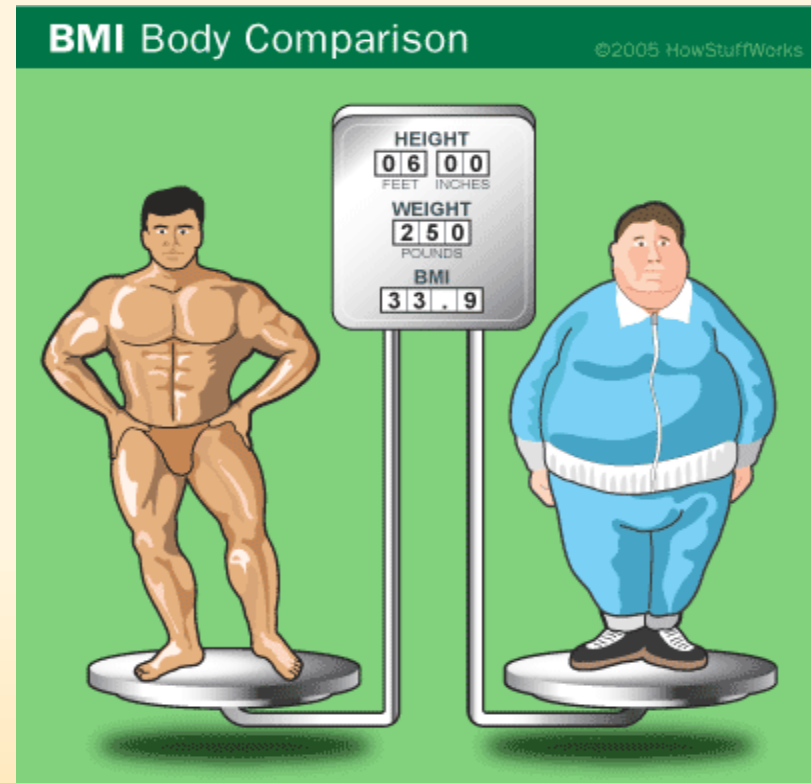# Which Growth Chart Should I Use?

- *Birth to 2?*   Use **WHO**

- *2 to 20?*   Use **CDC**

What Is Body Mass Index?

- **A number calculated using weight and height measurements:**
  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**

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*
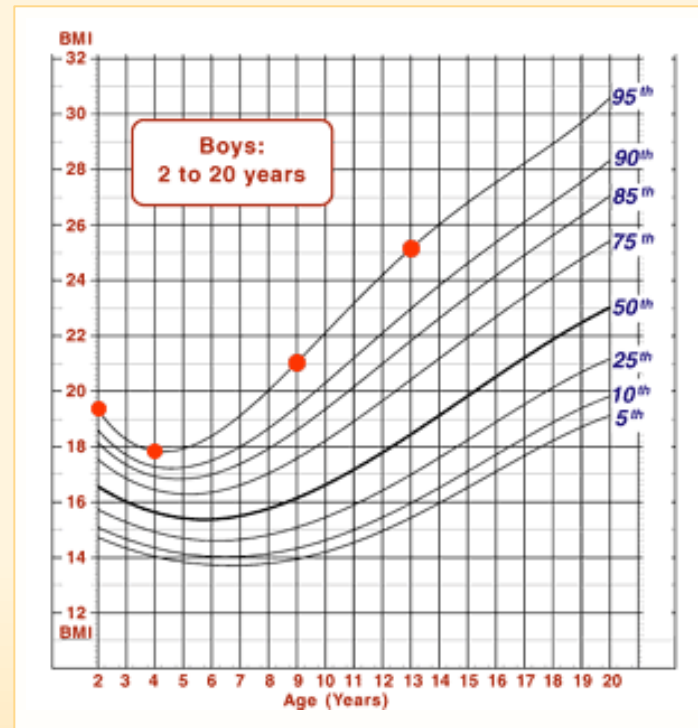
Body Mass Index Cutoff Values for Adults

- **Standard weight categories**

- **Same for all ages 18 +**

- **Same for men and women**

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

For Children, BMI Changes with Age

Example: Child's growth tracking along 95th percentile

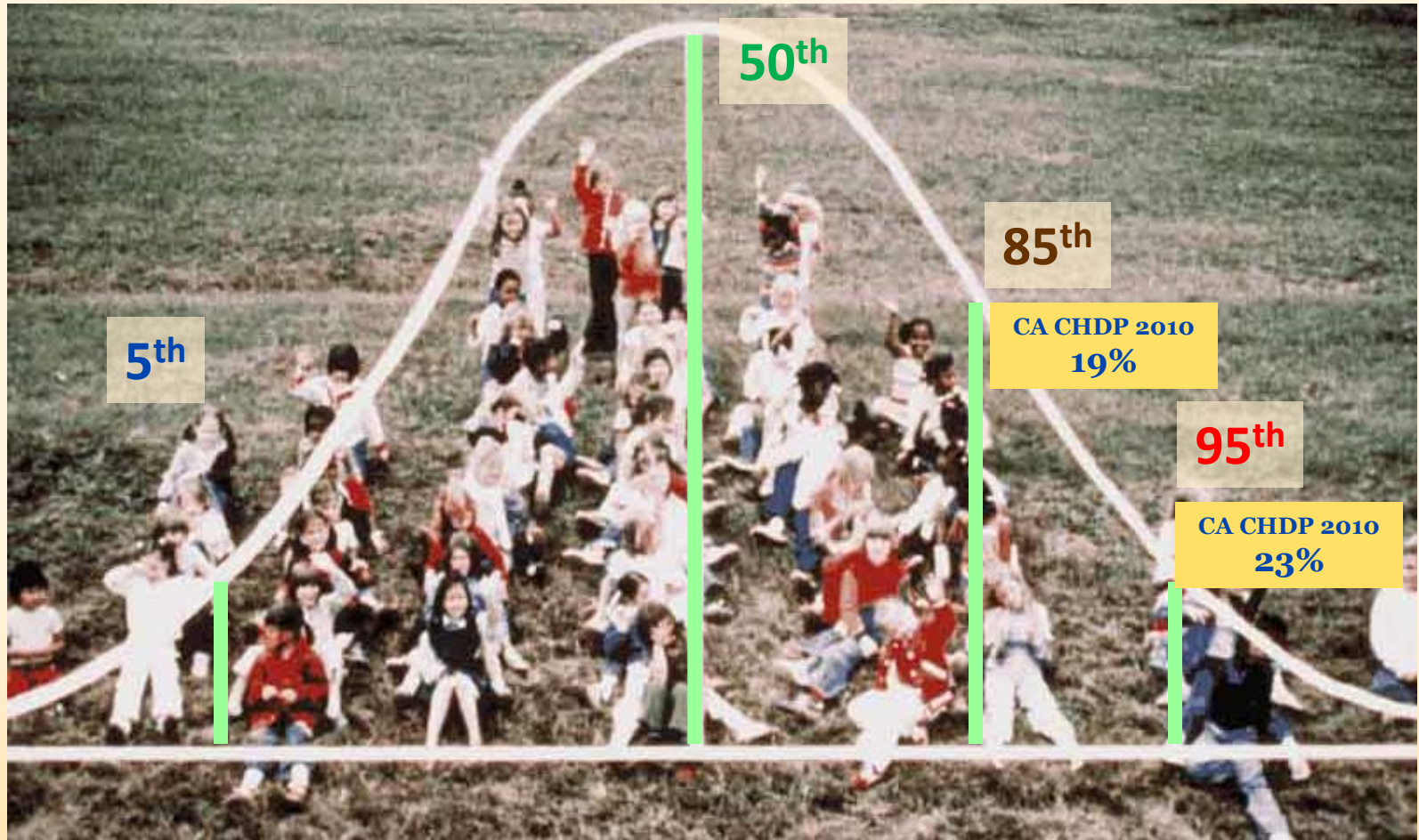| Age	2	4	9	13
BMI Value	19.3	17.8	21.0	25.1

BMI for Children and Teens

- **Age- and sex-specific**

- **Plot BMI to find percentile**
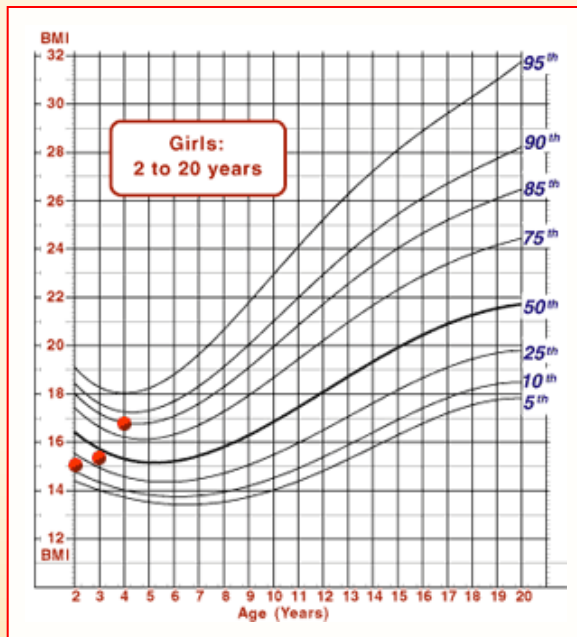
- **Determine weight status**

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

What is a Percentile?

50th

85th

CA CHDP 2010
19%

5th

95th

CA CHDP 2010
23%

Major Percentile Divisions

CDC Growth Charts

Tip: **Download and print from www.cdc.gov/growthcharts/**

Formula to calculate BMI

Percentile lines
5th - 10th - 25th - 50th
75th - 85th - 90th - 95th

**Published May 30, 2000**

(modified 2000-2001)

# 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
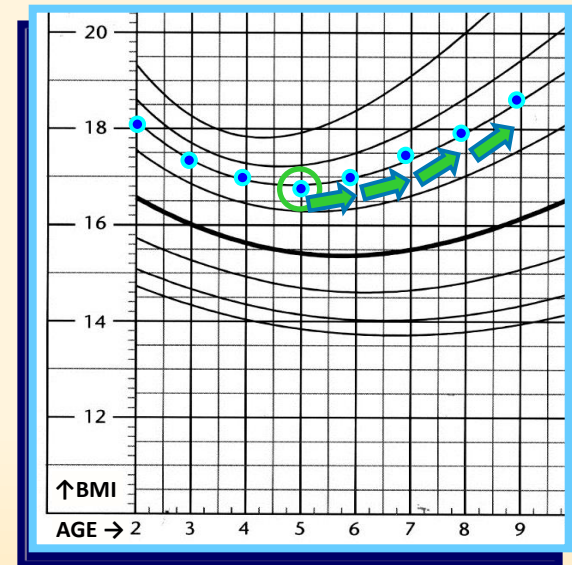
Adiposity Rebound

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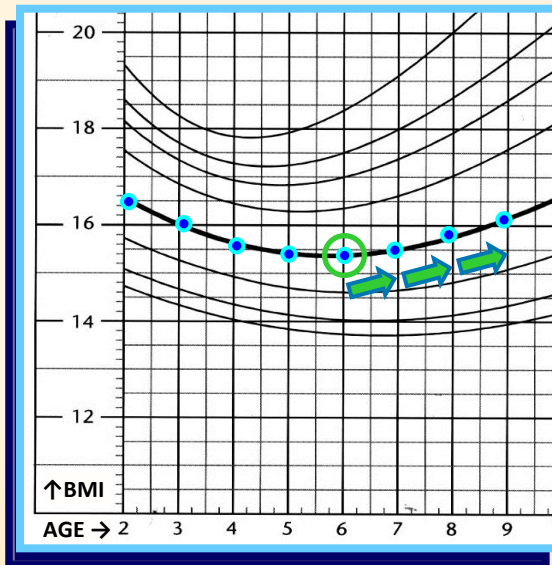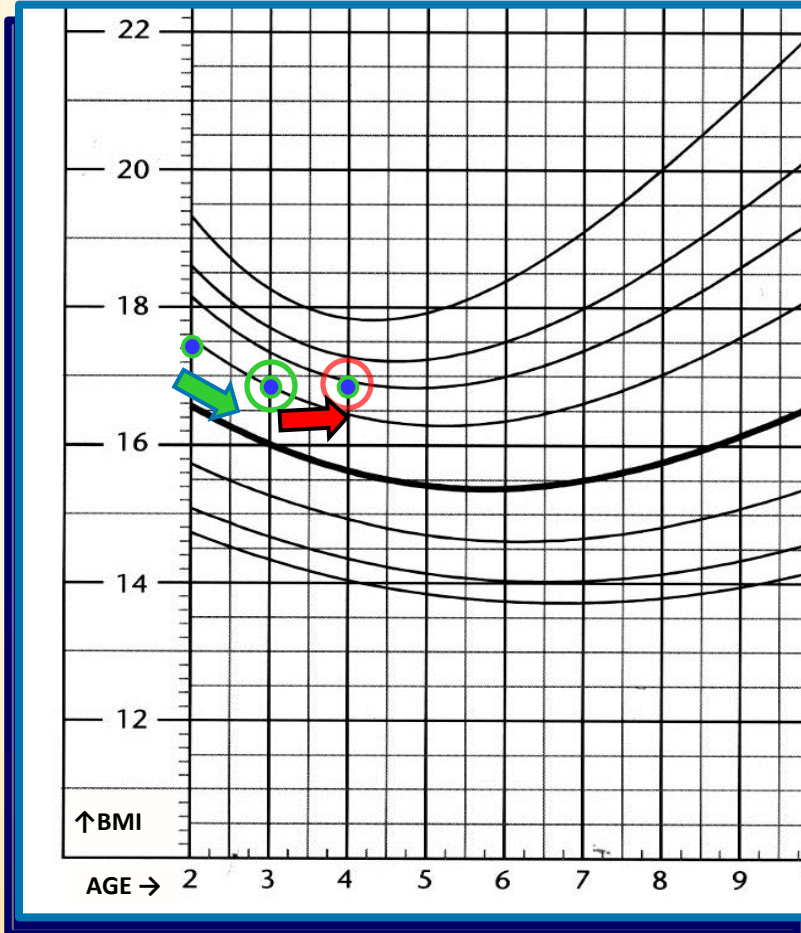

Child following
50th percentile curve
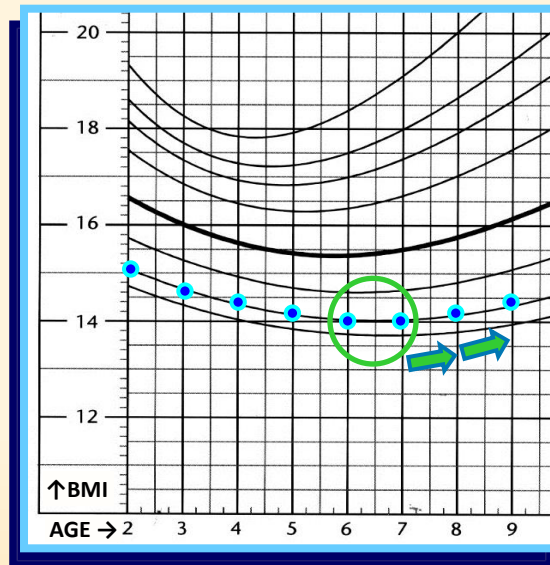
Child following
10th percentile curve

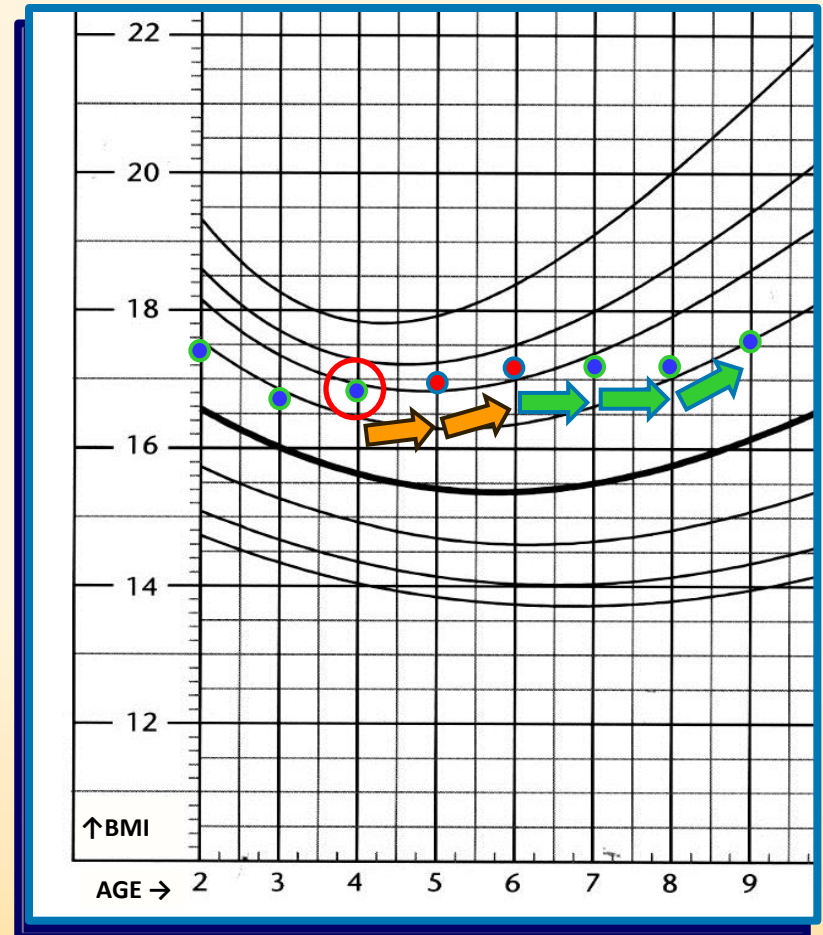Child following
85th percentile curve

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 <u>red flag</u> indicating need for further nutrition and physical activity assessment**

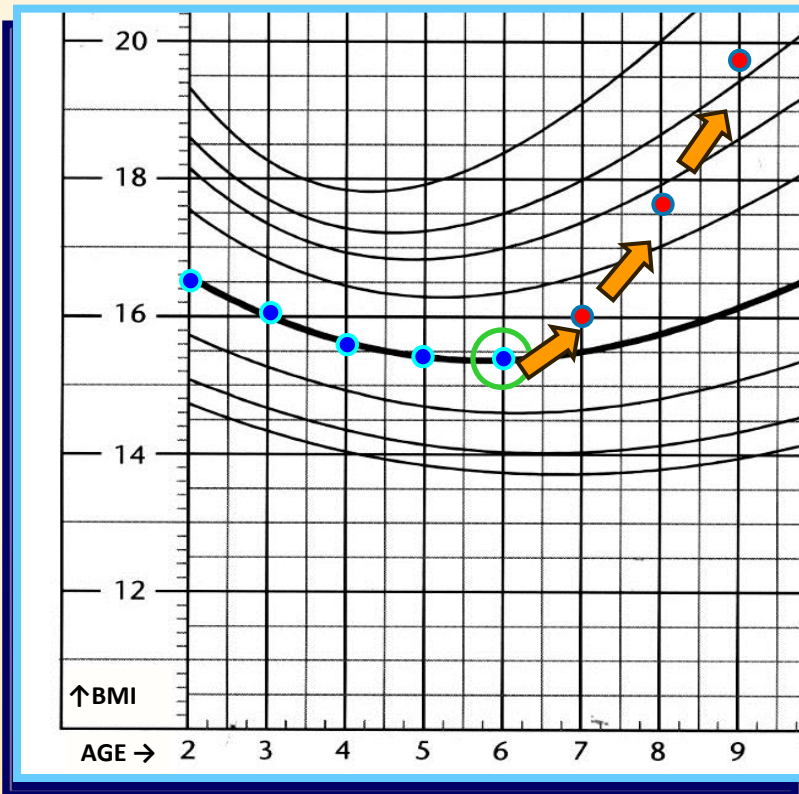# Early Adiposity Rebound
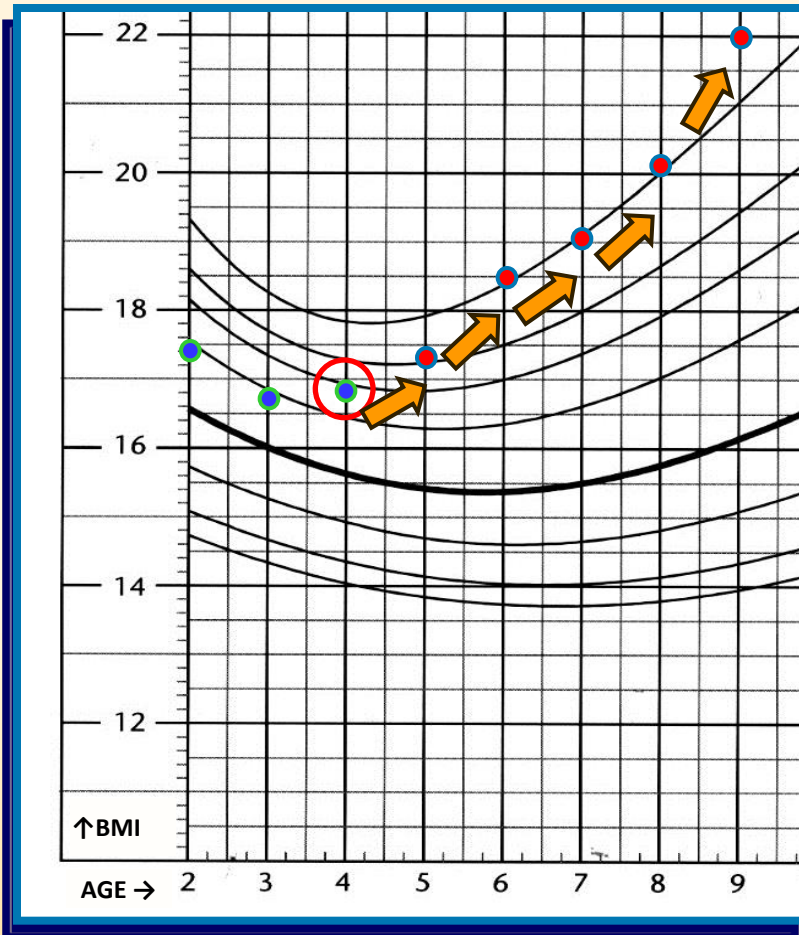
Without Intervention

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

Steps to Plot BMI-for-age

1. Select appropriate growth chart

2. Measure standing height accurately

3. Measure weight accurately

4. Determine BMI value

5. Determine BMI-for-age percentile

6. Record BMI percentile on PM 160

7. Determine weight category

Chart Carlos Correctly

Step 1:

Select Appropriate Growth Chart

- **CDC 2 to 20 years: Boys**
  - **Stature-for-age**
  - **Weight-for-age**
  - **BMI-for-age**

Step 2: Measure Standing Height
Record on growth chart and PM 160

Date	Age	Weight	Stature	BMI*
	3	32 #	38 ½ "	15.2
	4	36 #	41 "	15.0
	6		45 ¾ "	

HEIGHT IN INCHES	WEIGHT LBS	OZS	BODY MASS INDEX (BMI) PERCENTILE	BLOOD PRESSURE
0 4 5 ³ ⁄4				
HEMOGLOBIN	HEMATOCRIT	.0%	%	BIRTH WEIGHT LBS OZS

Step 3: Measure Weight
Record on growth chart and PM 160

Date	Age	Weight	Stature	BMI*
	3	32 #	38 ½ "	15.2
	4	36 #	41 "	15.0
	6	43 ½ #	45 ¾ "	

HEIGHT IN INCHES	WEIGHT LBS OZS	BODY MASS INDEX (BMI) PERCENTILE	BLOOD PRESSURE
0 4 5 ³4	0 4 3 0 8		
HEMOGLOBIN	HEMATOCRIT .0%	%	BIRTH WEIGHT LBS OZS

© 2001 C Trahms

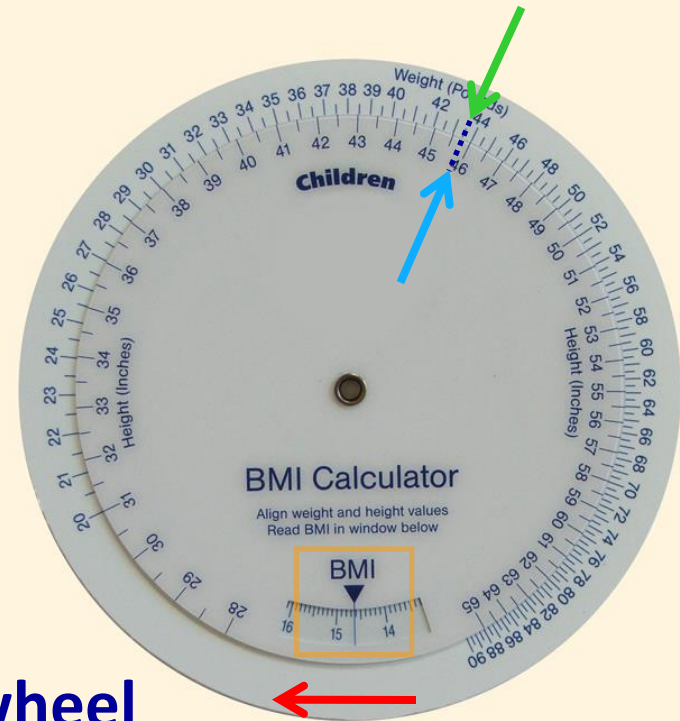# Step 4A: Determine BMI Value

Method 1:

Using a calculator
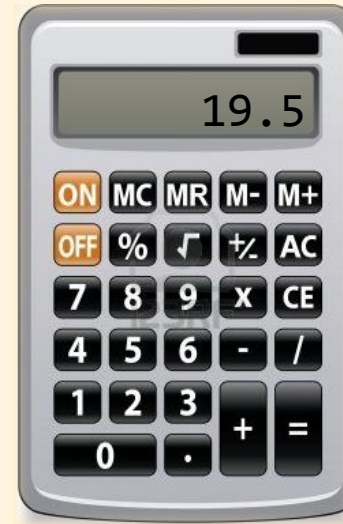
- **English measurements**
  Wt (pounds) ÷ Ht (inches) ÷ Ht (inches) x 703

- **Metric measurements**
  Wt (kg) ÷ Ht (cm) ÷ Ht (cm) x 10,000

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

Step 4A:

Determine BMI Value

Method 2:
Using a
BMI calculation wheel

- **Line up the height on inner wheel 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!

Step 4A:
Determine BMI Value

Method 3:
Using an online calculator or electronic health record

- **CDC BMI Calculator for Child and Teen**
  http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx

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

- **Your clinic's electronic health record system**

Step 4A: 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:
July | 1 | 2007

Date of Measurement:
July | 1 | 2013

Sex:
● boy   ○ girl

Height, to nearest 1/8 inch:

3 feet, 9 inches, 3/4 fractions of an inch
(12 inches = 1 foot; Example: 4 feet, 5 1/2 inches)

Weight, to nearest 1/4 (.25) pound:

43 pounds, 1/2 fractions of a pound
(8 ounces = 1/2 pounds; Example: 75 3/4 pounds)

Calculate

BMI Calculator for Child and Teen — Calculate again: English | Metric

Information Entered

Age: 6 years 0 months
Birth Date: July 01, 2007
Date of Measurement: July 01, 2013

Sex: Boy
Height: 3 feet 9–3/4 inch(es)
Weight: 43–1/2 pounds

Results

Based on the height and weight entered, the **BMI is 14.6**, placing the BMI-for-age **at the 24th percentile** for boys aged 6 years 0 months. This child has a **healthy weight.**

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

healthy weight

0 5   85   95 100

☐ underweight, less than the 5th percentile

☐ healthy weight, 5th percentile up to the 85th percentile

☐ overweight, 85th to less than the 95th percentile

☐ obese, equal to or greater than the 95th percentile

Step 4B: Determine BMI Value
Record on growth chart

Date	Age	Weight	Stature	BMI*
	3	32 #	38 ½ "	15.2
	4	36 #	41 "	15.0
	6	43 ½ #	45 ¾ "	14.6
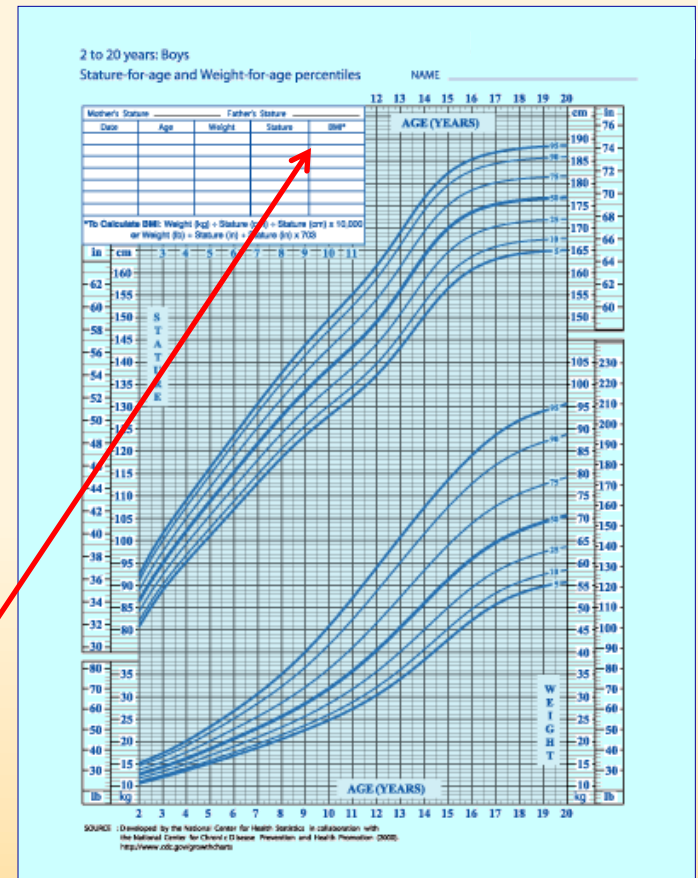
Step 5: Determine BMI-for-Age %ile

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**

2 to 20 years: Boys
Body Mass Index-for-age percentiles

Step 6:

Record BMI Percentile on PM 160

- **Estimate a whole number between 1 and 99 that best represents the percentile point plotted on the growth chart**

Step 7A:
Determine Weight Category

Determined by certified
CHDP health care provider (MD, NP, or PA)

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

Step 7B: Record Abnormal Results

- **On PM 160, enter follow up code in appropriate column under PROBLEM SUSPECTED**

- **Enter diagnosis under COMMENTS/PROBLEMS**
  - *Underweight*
  - *Overweight*
  - *Obese*

- **Carlos' weight status is normal so there is nothing to record in the comments**

Accurate Measurements Are Critical

2 to 20 years: Boys
Body Mass Index-for-age percentiles
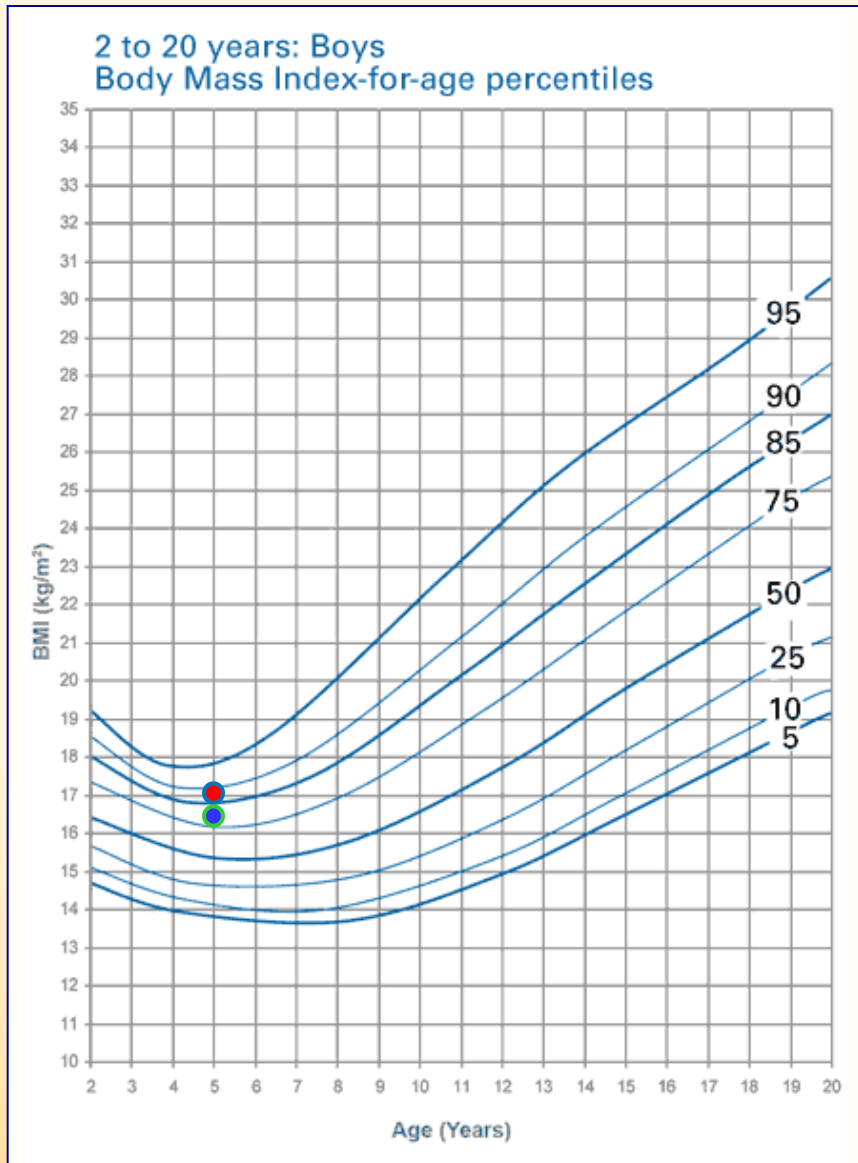
BMI for 5 year old boy

- **Weight: 43.5 lb**
- **Height: 43.0 in**
- **BMI= 16.5**

- **BMI-for-age = 75-84th percentile**
- *Normal range*

If height is inaccurate:

- **Weight: 43.5 lb**
- **Height: 42.5 in**
- **BMI = 17.0**

- **BMI-for-age = 85-94th percentile**
- *Overweight range*

Practice Using BMI-for-Age Growth Charts

Pete - 4 yrs

Liz - 4 yrs

Gabriela - 4 yrs

Plot Pete Precisely
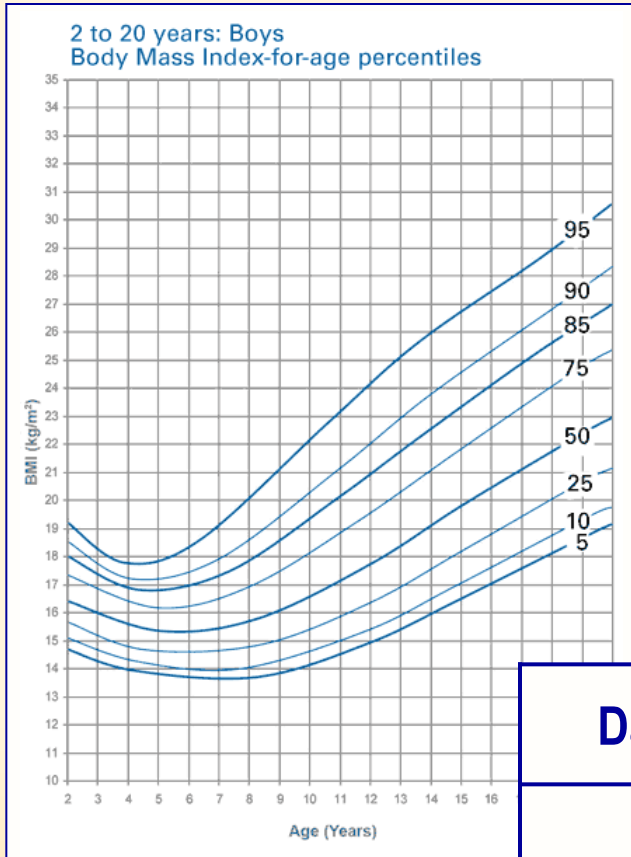
2 to 20 years: Boys
Body Mass Index-for-age percentiles

FIRST STEPS

1. **Select appropriate growth chart**

2. **Measure standing height**

3. **Measure weight**

Date	Age	Weight	Stature	BMI*
	2	30 #	34 ½ "	17.7
	3	36 ½ #	38 "	17.8
	4	43 #	41 "	

Plot Pete Precisely
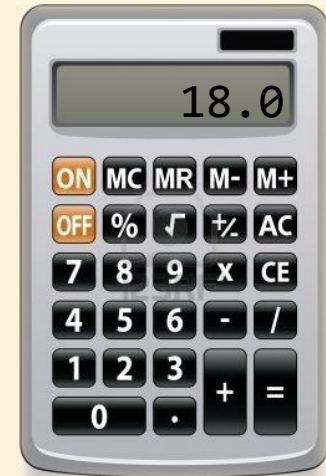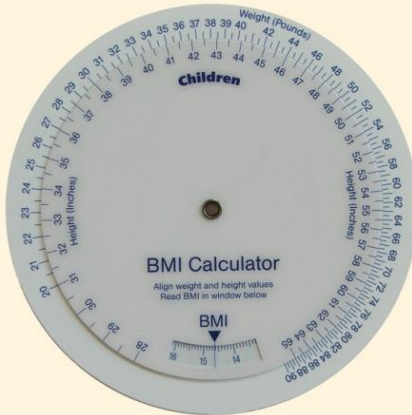
18.0

NEXT STEP

4. Determine BMI Value

Date	Age	Weight	Stature	BMI*
	2	30 #	34 ½ "	17.7
	3	36 ½ #	38 "	17.8
	4	43 #	41 "	18.0

Plot Pete Precisely

NEXT STEP

5. **Determine BMI-for-age percentile**

2 to 20 years: Boys
Body Mass Index-for-age percentiles
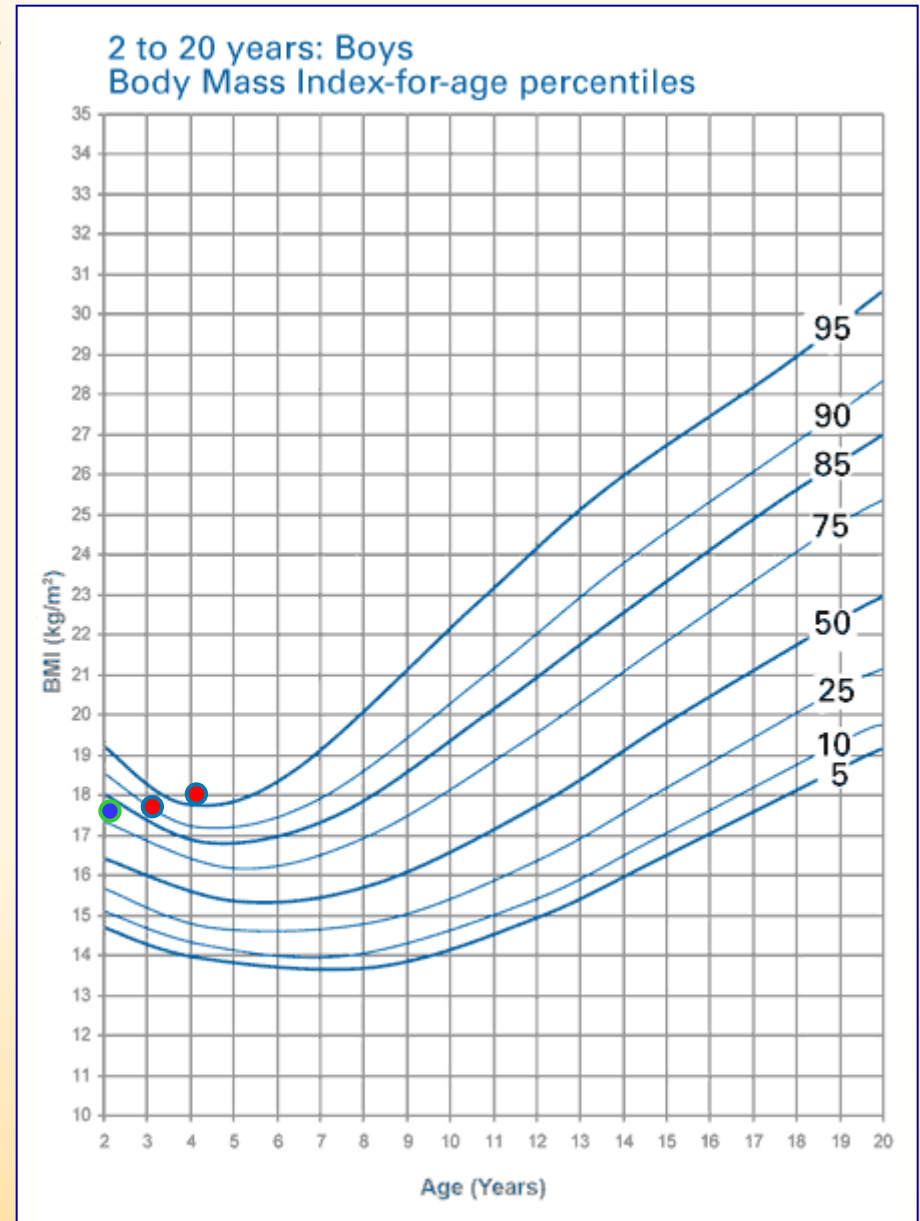
Plot Pete Precisely

NEXT STEP

6. **Record BMI Percentile on PM 160**

– *Estimate a whole number between 1 and 99 that best represents the percentile point plotted on the growth chart*

Plot Pete Precisely

FINAL STEP

7. **Determine category and record on PM 160 if needed**

   – **Enter follow up code in appropriate column under PROBLEM SUSPECTED**

   – **Enter diagnosis under COMMENTS/PROBLEMS**

      • *Underweight*

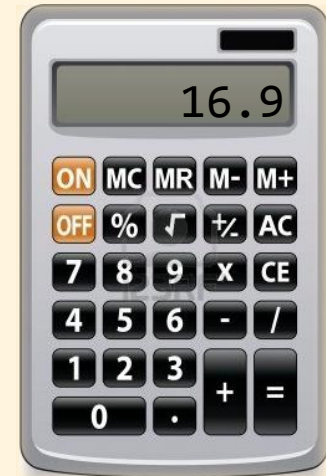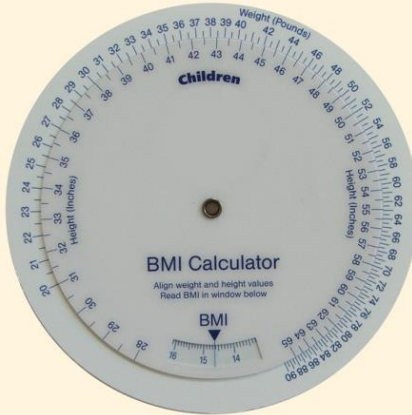   • *Overweight*

      • *Obese*

Let's Look at Liz

2 to 20 years: Girls
Body Mass Index-for-age percentiles

FIRST STEPS

1. Select appropriate growth chart

2. Measure standing height

3. Measure weight
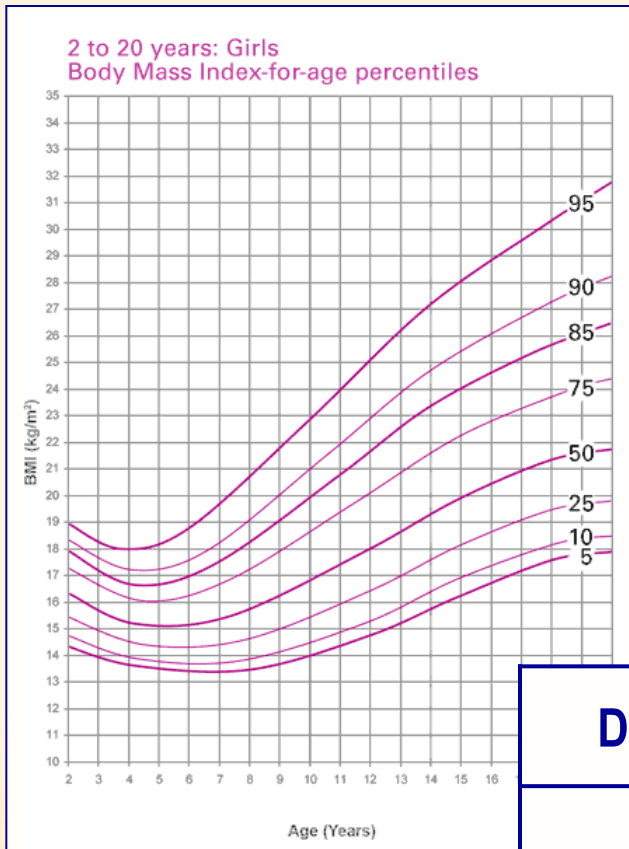
Date	Age	Weight	Stature	BMI*
	2	28 ¾ #	33 ½ "	18.0
	3	33 #	36 ½ "	17.4
	4	37 #	39 ¼ "	

Let's Look at Liz

NEXT STEP

4. **Determine BMI Value**

Date	Age	Weight	Stature	BMI*
	2	28 ¾ #	33 ½ "	18.0
	3	33 #	36 ½ "	17.4
	4	37 #	39 ¼ "	16.9

Let's Look at Liz

NEXT STEP

5. **Determine BMI-for-age percentile**

2 to 20 years: Girls
Body Mass Index-for-age percentiles
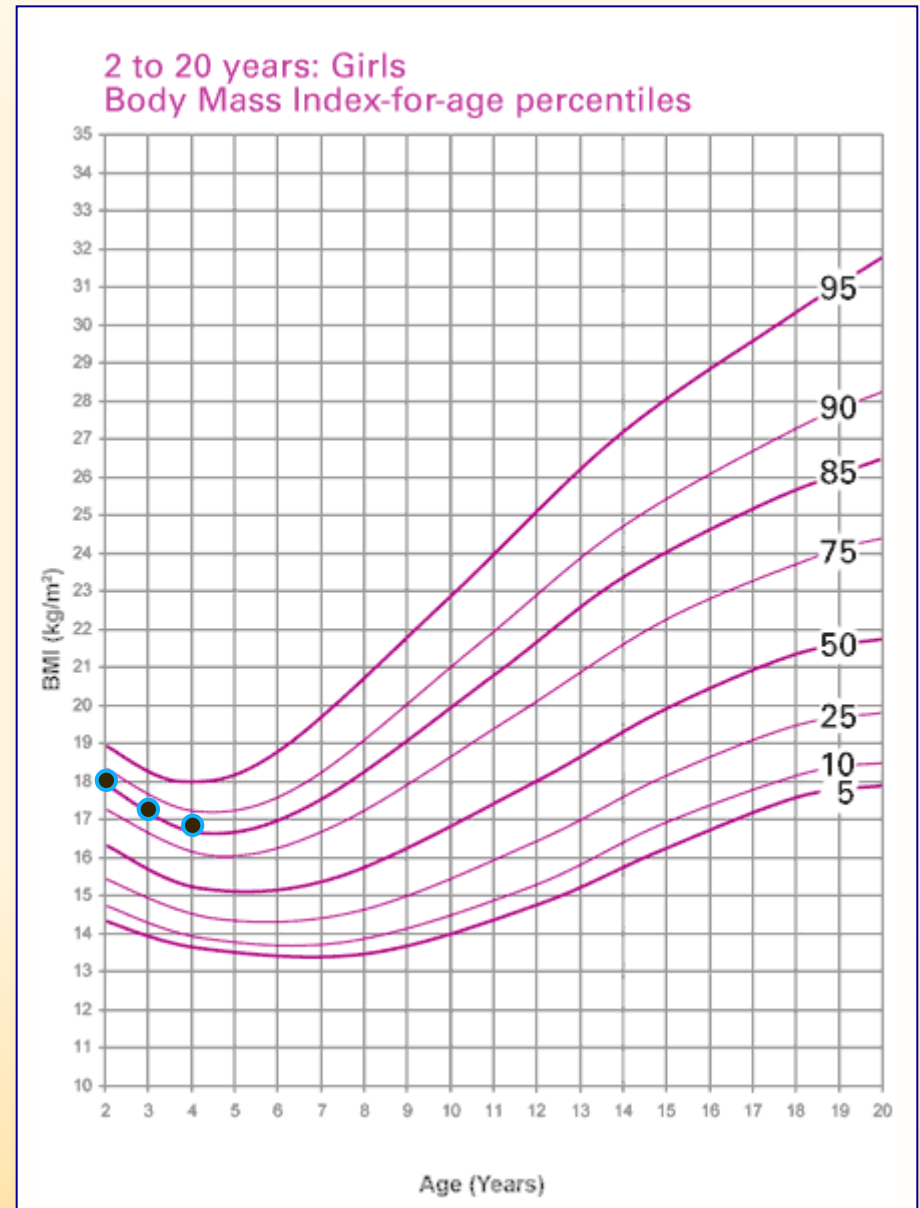
Let's Look at Liz

NEXT STEP

6. Record BMI Percentile on PM 160

  – *Estimate a whole number between 1 and 99 that best represents the percentile point plotted on the growth chart*

HEIGHT IN INCHES	WEIGHT LBS · OZS	BODY MASS INDEX (BMI) PERCENTILE	BLOOD PRESSURE
0 3 9 ¼	0 3 7 0 0		
HEMOGLOBIN	HEMATOCRIT .0%	8 7 %	BIRTH WEIGHT LBS · OZS

Let's Look at Liz

FINAL STEP

7. **Determine category and record on PM 160 if needed**

   – **Enter follow up code in appropriate column under PROBLEM SUSPECTED**

   – **Enter diagnosis under COMMENTS/PROBLEMS**

      • *Underweight*
      • *Overweight*
      • *Obese*

Graph Gabriela's Growth

2 to 20 years: Girls
Body Mass Index-for-age percentiles

FIRST STEPS

1. **Select appropriate growth chart**
2. **Measure standing height**
3. **Measure weight**

Date	Age	Weight	Stature	BMI*
	2	25 #	34 ½ "	14.8
	3	29 ½ #	38 ½ "	14.0
	4	32 ½#	41 "	

Graph Gabriela's Growth

BMI Calculator
Align weight and height values
Read BMI in window below

BMI

`13.5`

NEXT STEP

4. Determine BMI Value

Date	Age	Weight	Stature	BMI*
	2	25 #	34 ½ "	14.8
	3	29 ½ #	38 ½ "	14.0
	4	32 ½ #	41 "	13.6

Graph Gabriela's Growth

NEXT STEP

5. **Determine BMI-for-age percentile**

2 to 20 years: Girls
Body Mass Index-for-age percentiles
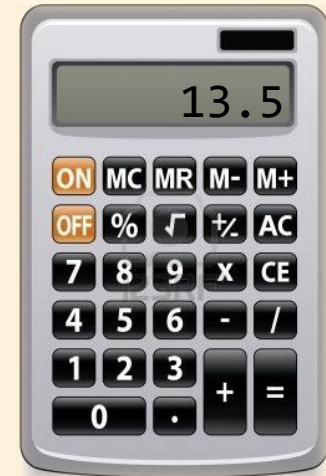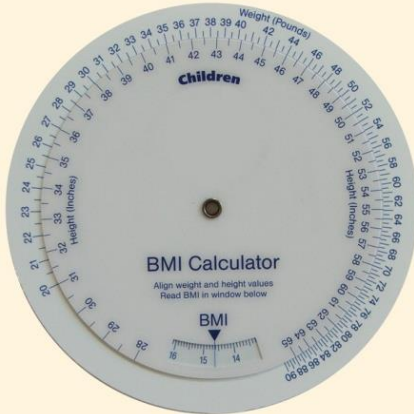
Graph Gabriela's Growth

NEXT STEP

6. Record BMI Percentile on PM 160

– *Estimate a whole number between 1 and 99 that best represents the percentile point plotted on the growth chart*

Graph Gabriela's Growth

FINAL STEP

7. Determine category and record on PM 160 if needed

– **Enter follow up code in appropriate column under PROBLEM SUSPECTED**

– **Enter diagnosis under COMMENTS/PROBLEMS**

  • *Underweight*

  • *Overweight*

  • *Obese*

You have learned to:

- Select appropriate *growth chart* for age group

- Identify the *age range* for which
  Body Mass Index (BMI) screening is used

- Calculate or determine *BMI value*

- Plot *BMI value* on the appropriate growth chart

- Determine *BMI-for-age percentile*

- Identify *weight category*

- *Record results* on PM 160

Resources and Clinical Tools

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

Color-coded BMI Charts
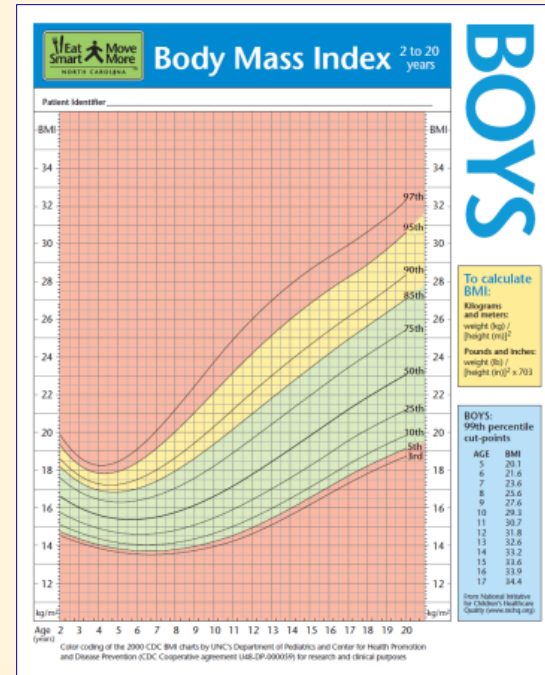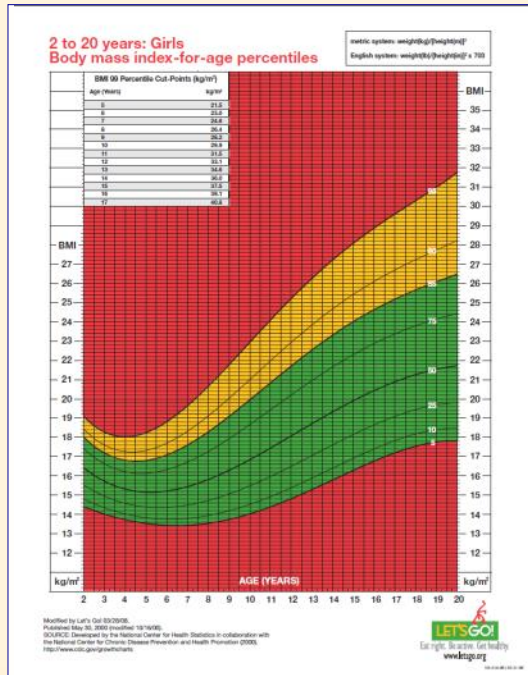
- **5210 Let's Go!**
  www.letsgo.org/programs/healthcare/provider-resources/

- **Eat Smart, Move More North Carolina**
  www.eatsmartmovemorenc.com/PediatricObesityTools/PediatricObesityTools.html

References

- **Prevention of pediatric overweight and obesity. *Pediatrics.* 112: 424-430, 2003.**
  http://aappolicy.aappublications.org/cgi/content/full/pediatrics;112/2/424

- **Assessment of child and adolescent overweight and obesity.**
  ***Pediatrics* 120: S193-S228, 2007.**
  http://pediatrics.aappublications.org/cgi/content/full/120/Supplement_4/S193

- **Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report.**
  ***Pediatrics* 120 : S164-S192, 2007.**
  http://pediatrics.aappublications.org/cgi/content/abstract/120/Supplement_4/S164

- **Recommendations for prevention of childhood obesity.**
  ***Pediatrics* 120 : S229-S253, 2007.**
  http://pediatrics.aappublications.org/cgi/content/abstract/120/Supplement_4/S229

- **The validity of BMI as an indicator of body fatness and risk among children.**
  ***Pediatrics* 124: S23-S34, 2009.**
  http://pediatrics.aappublications.org/cgi/content/abstract/124/Supplement_1/S23

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- **Slide 3. Photos with permission. Ventura County CHDP Program and Mandalay Bay Women and Children's Medical Group. 2011. Ventura County Health Care Agency. http://www.vchca.org/**

- **Slide 4. Wilson, Stephanie. Body Mass Index. 2007. Retrieved July 31, 2012 from Discovery Enterprises, LLC: http://health.howstuffworks.com/wellness/diet-fitness/weight-loss/bmi3.htm**

- **Slides 17, 18. Photos with permission. Ventura County CHDP Program and Magnolia Family Medical Group. 2004. Ventura County Health Care Agency. http://www.vchca.org/**

- **Slide 19. US Department of Health and Human Services. Health Resources and Services Administration. Maternal and Child Health Bureau. Accurately Weighing and Measuring Infants, Children and Adolescents: Technique http://depts.washington.edu/growth/**

- **Slide 28. UC Berkeley Longitudinal Study, 1973. Adapted from the CDC Growth Charts 2000 Slide Set. Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease and Prevention. 2002. http://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/index.htm#slides**