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

Adapted by the State of California CHDP Nutrition Subcommittee from materials developed by California Department of Health Care Services — Children’s Medical Services Branch
Centers for Disease Control and Prevention
Maternal and Child Health Bureau
July 2013
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:
  \[
  \text{Body Mass Index (BMI)} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}
  \]

- It compares a person’s weight to height

- It is an indirect \textit{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

<table>
<thead>
<tr>
<th>Weight Status</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>30.0 and above</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0 - 29.9</td>
</tr>
<tr>
<td>Normal</td>
<td>18.5 - 24.9</td>
</tr>
<tr>
<td>Underweight</td>
<td>Below 18.5</td>
</tr>
</tbody>
</table>
For Children, BMI Changes with Age

Example: Child’s growth tracking along 95\textsuperscript{th} percentile

<table>
<thead>
<tr>
<th>Age</th>
<th>BMI Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>19.3</td>
</tr>
<tr>
<td>4</td>
<td>17.8</td>
</tr>
<tr>
<td>9</td>
<td>21.0</td>
</tr>
<tr>
<td>13</td>
<td>25.1</td>
</tr>
</tbody>
</table>
BMI for Children and Teens

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

<table>
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<tr>
<th>Weight Status Category</th>
<th>Percentile Range</th>
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<td>≥ 95\textsuperscript{th} percentile</td>
</tr>
<tr>
<td>Overweight</td>
<td>85\textsuperscript{th} to &lt; 95\textsuperscript{th} percentile</td>
</tr>
<tr>
<td>Normal</td>
<td>5\textsuperscript{th} to &lt; 85th percentile</td>
</tr>
<tr>
<td>Underweight</td>
<td>&lt; 5\textsuperscript{th} percentile</td>
</tr>
</tbody>
</table>
What is a Percentile?

Major Percentile Divisions

- 5th percentile: 19%
- 50th percentile: 23%
CDC Growth Charts

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

Formula to calculate BMI

Percentile lines
5\(^{th}\) - 10\(^{th}\) - 25\(^{th}\) - 50\(^{th}\)
75\(^{th}\) - 85\(^{th}\) - 90\(^{th}\) - 95\(^{th}\)

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(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 **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.
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*

<table>
<thead>
<tr>
<th>Date</th>
<th>Age</th>
<th>Weight</th>
<th>Stature</th>
<th>BMI*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>32 #</td>
<td>38 ½ ”</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>36 #</td>
<td>41 ”</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>45 ¾ ”</td>
<td></td>
</tr>
</tbody>
</table>
**Step 3: Measure Weight**

*Record on growth chart and PM 160*

<table>
<thead>
<tr>
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<td>15.0</td>
</tr>
<tr>
<td>6</td>
<td>43 ½</td>
<td>43 ½ #</td>
<td>45 ¾ &quot;</td>
<td></td>
</tr>
</tbody>
</table>
Step 4A: Determine BMI Value

Method 1: Using a calculator

- English measurements
  \( \text{Wt (pounds)} \div \text{Ht (inches)} \div \text{Ht (inches)} \times 703 \)

- Metric measurements
  \( \text{Wt (kg)} \div \text{Ht (cm)} \div \text{Ht (cm)} \times 10,000 \)

*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

- 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

BMI Calculator for Child and Teen

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: 43.5 pounds

Results
- 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?

View Results
### Step 4B: Determine BMI Value

*Record on growth chart*

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>3</td>
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<td>38 ½ ″</td>
<td>15.2</td>
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<td>36 #</td>
<td>41 ″</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>43 ½ #</td>
<td>45 ¾ ″</td>
<td>14.6</td>
<td></td>
</tr>
</tbody>
</table>
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
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)

<table>
<thead>
<tr>
<th>Weight Status Category</th>
<th>Percentile Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>≥ 95&lt;sup&gt;th&lt;/sup&gt; percentile</td>
</tr>
<tr>
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<td>85&lt;sup&gt;th&lt;/sup&gt; to &lt; 95&lt;sup&gt;th&lt;/sup&gt; percentile</td>
</tr>
<tr>
<td>Normal</td>
<td>5&lt;sup&gt;th&lt;/sup&gt; to &lt; 85&lt;sup&gt;th&lt;/sup&gt; percentile</td>
</tr>
<tr>
<td>Underweight</td>
<td>&lt; 5&lt;sup&gt;th&lt;/sup&gt; percentile</td>
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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

**BMI for 5 year old boy**
- Weight: 43.5 lb
- Height: 43.0 in
- BMI = 16.5
- BMI-for-age = 75-84\textsuperscript{th} percentile
- *Normal range*

*If height is inaccurate:*
- Weight: 43.5 lb
- Height: 42.5 in
- BMI = 17.0
- BMI-for-age = 85-94\textsuperscript{th} percentile
- *Overweight range*
Practice Using BMI-for-Age Growth Charts

Photos from UC Berkeley Longitudinal Study, 1973
**FIRST STEPS**

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

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</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>30</td>
<td>34 ½</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>36 ½</td>
<td>38</td>
<td>17.8</td>
<td></td>
</tr>
<tr>
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<td>43</td>
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Plot Pete Precisely

**NEXT STEP**

4. Determine BMI Value

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Plot Pete Precisely

NEXT STEP

5. Determine BMI-for-age percentile
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
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

Plot Pete Precisely
Let’s Look at Liz

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

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# Let’s Look at Liz

## NEXT STEP

4. Determine BMI Value

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<td>39 ¼ ”</td>
<td>16.9</td>
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</tr>
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</table>
Let’s Look at Liz

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

**FIRST STEPS**

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

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</tbody>
</table>
Graph Gabriela’s Growth

NEXT STEP

4. Determine BMI Value

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<td>13.6</td>
</tr>
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**Graph**

**Gabriela’s Growth**

**NEXT STEP**

5. Determine BMI-for-age percentile
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


Image Credits


