Growth is influenced by factors such as gestational age, birth weight, type of feeding (breast or formula), parental stature, environment, nutrition, chronic illness or special health care needs. When evaluating growth that does not follow a normal pattern, each of these factors should be considered.

This guide describes ways to use and interpret the 2000 CDC Growth Charts to assess physical growth in infants, children and adolescents. During routine screening, physical growth is assessed using a child’s weight, length/stature, and head circumference (infants & toddlers). One-time measurements, taken and plotted accurately on a growth chart, maybe used to screen children for nutritional risk. However, they do not provide adequate information to determine a child’s growth pattern. A series of weight and length/stature measurements are more informative.

The 2000 CDC charts offer improvements to the 1977 NCHS charts including addition of 3rd and 97th outer percentile curves and addition of Body Mass Index (BMI) for age charts to evaluate weight as a function of height, a feature previously missing on growth charts for older children and adolescents. The collaborative Canadian growth statement recommends usage of the 2000 CDC growth charts containing the 3rd and 97th percentiles to reduce the chance of error in identifying too many children as having potential growth problems when it is not warranted.

Selecting the appropriate growth charts:

See CDC web site to download growth charts

http://www.cdc.gov/nchs/about/major/nhanes/growthcharts/clinical_charts.htm#Clin%202

The clinical growth charts of the 2000 CDC charts are recommended because they contain both the Weight-for-Age and Stature-for-Age curves on one page, have grids scaled in metric units with English units in a secondary scale, and include a table for recording the anthropometric measurements. Set 2 (with outer limits of the curves at the 3rd and 97th percentiles) are favored, with one exception. For those who have chosen to use BMI-for-age for a measure of underweight, the BMI-for-age chart in Set 1 should be used because it contains the 5th percentile, the cutoff for underweight.

- Birth to 36 months: Length-for-age, Weight-for-age, Head circumference-for-age and Weight-for-length
- 2 to 20 years: Stature-for-age, Weight-for-age, BMI-for-age
- Plus optional chart Weight-for-stature for younger children about 2-5 years old

Pre-term Infants (<37 weeks): Plot measurements using gestation-adjusted age (until 24-36 months) on either the regular CDC charts or use charts for VLBW and LBW infants from the IHDP.

Breasted infants: as growth rates may differ, misinterpretation of the growth rate of an exclusively breastfed infant plotted on charts that include formula fed infants might lead to inappropriate counselling to discontinue breastfeeding.

Children with Special Health Needs: The CDC growth charts should be used in this population with consideration of the potential influence of specific conditions on growth. Disease-specific growth charts (i.e. Down Syndrome) may be used in conjunction with the CDC charts.

Body Mass Index-for-Age [BMI-for-age = Weight (kg) ÷ Height (m²)] is a tool used to screen children 2 to 20 years old to help identify individuals who are potentially overweight; however, it is not a diagnostic tool. Additional investigations such as skinfold measurements are needed to determine whether a child who has a high BMI-for-age has excess fat. Careful consideration of the differing body compositions of males and females and the individual child’s stage of pubertal maturity is important.

Interpreting measurements on the growth charts:

The curves on the growth chart represent selected percentiles of the reference population and can be used to identify the child’s rank relative to other children of similar age and sex. For example, when a plotted weight is on the 90th percentile for Weight-for-age, it means that only 10 of 100 children (10%) of the same age and sex in the reference population have a higher Weight-for-age.

Single plotted measurements can be interpreted using the cut-off values and corresponding nutrition indicators shown in the table below. In most children, serial height and weight measurements follow consistently along a ‘channel’ on or between the same percentile(s). It is normal for children to change 1-2 percentile lines during the first 2-3 years, usually moving towards the 50th percentile line. With the exception of the first two to three years of life and puberty, crossing percentile lines is potentially a sign of growth disturbance. Serial measurements showing unexpected crossing of 2 or more percentile lines downwards is considered to be reflective of failure to thrive or growth failure.
### Recommended Cut-off Values and Nutritional Indicators for Canadian Children

<table>
<thead>
<tr>
<th>Anthropometric Index</th>
<th>Cut-off Values</th>
<th>Nutritional Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length / Stature –for –Age</td>
<td>&lt; 3rd percentile</td>
<td><strong>Stunting/shortness:</strong> the infant or child may be short because parents are short or they may be stunted because of long-term malnutrition, delayed maturation, chronic illness or a genetic disorder.</td>
</tr>
<tr>
<td>Weight-for-Length /Stature</td>
<td>&lt; 3rd percentile</td>
<td><strong>Underweight or wasting:</strong> may be indicative of recent malnutrition, dehydration or a genetic disorder. Traditional measures of underweight (weight for length /stature and % IBW *) continue to be recommended until validity of using BMI –for-age to assess underweight is established. Alternatively BMI-for-age may be used to screen for underweight (&gt; 2yrs) with awareness of existing limited experience of its role in underweight.</td>
</tr>
<tr>
<td>(available for use up to about 5 years of age), or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent ideal body weight (% IBW)*</td>
<td>≤ 89% IBW*</td>
<td></td>
</tr>
<tr>
<td>BMI-for-Age (&gt; 2 yrs age)</td>
<td>&lt; 5th percentile</td>
<td></td>
</tr>
<tr>
<td>BMI-for-Age</td>
<td>≥ 85th and &lt; 95th percentile</td>
<td><strong>Overweight:</strong> further evaluation necessary, looking for co-morbidities and possible causes.</td>
</tr>
<tr>
<td>Weight-for-Length (&lt; 2 years old) or</td>
<td>≥97th percentile</td>
<td><strong>Obesity:</strong> should undergo evaluation for possible underlying genetic or endocrine causes.</td>
</tr>
<tr>
<td>BMI-for-Age (≥ 2 years old)</td>
<td>≥ 95th percentile</td>
<td></td>
</tr>
<tr>
<td>Head Circumference-for-Age</td>
<td>&lt; 3rd or &gt; 97th percentile</td>
<td><strong>Obesity:</strong> should undergo evaluation for possible underlying genetic or endocrine causes.</td>
</tr>
</tbody>
</table>

*% IBW: plot length or height on growth chart to identify length/height-for-age percentile. Locate ideal body weight as the weight at the same percentile as the height, for the same age and gender. Calculated % IBW = actual weight ÷ ideal body weight x 100

### Accurate Measurement Equipment and Techniques – see MCHB training modules:

**Accuracy in equipment and measurement technique are essential because these measurements will be used to make fundamental decisions about the child.**

#### Weighing Infants:
- The infant should be weighed nude on a calibrated beam or electronic scale.
- The scale should be accurate and reliable with a maximum weight of 20 kg in 10g increments and easily “zeroed” and recently calibrated.

#### Measuring Infant Length:
- Use calibrated length board with fixed headpiece and movable footpiece which is perpendicular to the surface of the table.
- Two trained people are needed to get an accurate measurement.
- Measure infant without shoes and wearing light underclothing or diaper.
- The infant should be placed on its back in the centre of the board lying flat against the surface. Eyes should be looking up. Both legs should be fully extended and toes should be pointing upward with feet flat against the foot piece.
- Measure length to nearest 0.1 cm.

#### Measuring Head Circumference:
- Position the tape just above the eyebrow, above the ears and around the biggest part on the back of the head.
- Use a flexible, non-stretchable tape.
- Measure to nearest 0.1 cm.

---

*Measuring infant length. Used with permission from reference 8.*

*Measuring head circumference. Used with permission from reference 8.*
Weighing Children and Adolescents:

- A child older than 24 to 36 months is weighed standing on a beam-balance or digital scale, provided they can stand on their own. Child is weighed wearing light undergarments or lightweight outer clothing
- Weight is recorded to the nearest 0.1 kg

Note: Children unable to stand unsupported may need to be weighed held by someone, with the weight of the person holding the child subtracted from their combined weight. A larger child with special needs may need to be weighed on sit-down or wheelchair scales.

Measuring Stature in Children and Adolescents:

Young children from 24 to 36 months may have either length or stature measured. The appropriate chart (length or stature for age) should be used for plotting the results. Children with physical disabilities (unable to stand) may require length measured using a recumbent board or may require the usage of other segment length measurements.2,6,7

- Measure stature for children over 24 months who can stand unassisted.
- A stadiometer for stature measurements requires:
  - a wall mounted vertical board with an attached metric rule
  - a horizontal headpiece that can be brought into contact with the superior part of the head
- Child or adolescent stands against the stadiometer without shoes, with heels together, legs straight, arms at sides, shoulders relaxed
- Ensure that the child is looking straight ahead
- Bring perpendicular headpiece down to touch the crown of the head
- Measurer’s eyes are parallel with the headpiece
- Measure to the nearest 0.1 cm

Note: Alternative measurements like segmental lengths, girths and skinfolds require special skills and equipment. They are performed at some paediatric centres for monitoring growth in children with special health needs.2,7

For more information about the assessment of growth refer to the following references and resources:


NOTE: The PARENT FACT SHEET Is My Child Growing Well? should be used in addition to the HEALTH PROFESSIONAL FACT SHEET. Both fact sheets can be accessed by searching the key words “growth charts” at http://www.dietitians.ca/resources/resourcesearch.asp


Dietitians of Canada gratefully acknowledges authors Janet Schlenker RDN (DCPNN) and Shefali Raja RDN (DCPNN) for development of this fact sheet and DC Paediatric Nutrition Network (DCPNN) for financial support.

© 2004. Dietitians of Canada and Canadian Paediatric Society. All rights reserved. Permission to reprint in its entirety for non-commercial use only.