Objectives:

• Describe the importance of using growth parameters and serial measurements to assess infant and child growth
• Briefly describe the development and reference population of the WHO growth charts
• Identify the strengths and limitations of the WHO growth charts
• Describe the considerations undertaken to adapt and recommend the WHO growth charts for Canadian use
• Describe the different WHO Growth Charts for Canada
1. True or False. The World Health Organization developed 2 sets of growth monitoring charts in 2006 and 2007 respectively. They were the growth standards of 0-5 years of age and growth reference for 5-19 year of age.

2. True or False. Serial measurements of a child’s weight, height/length and head circumference are necessary for monitoring a child’s growth and determining if a child is on a healthy growth trajectory.

3. The World Health Organization growth standards were based on:
   a) Longitudinal data – children were measured a number of times
   b) Cross-sectional data – children were chosen and measured once

4. True or False. One of the strengths of the WHO’s growth charts is that they are based on a primarily formula fed sample population which is ideal for growth as per current nutrition recommendations.

2. **TRUE.** Serial measurements are necessary for monitoring a child’s growth over time and to identify any possible deviations from the child’s usual growth trajectory.

3. **The correct answer is (a).** The WHO growth standards data set was based on children who were measured over time, rather than just being measured once over the course of the study.

4. **FALSE.** The WHO growth charts are based on a primarily breastfed population. Breastfeeding is the normative and natural way to feed a baby for optimal growth.
Why monitor growth?

• Provide a platform for **reinforcing healthy** infant and child growth patterns and acknowledge what is going well
• Provide a **tool** for nutrition and health evaluation
• Initiate **further assessment** to rule out health concerns in case of unusual growth patterns
• Create ‘**teachable moments**’ with caregivers – how nutrition, physical activity, genetics and illness can affect growth pattern and motivate necessary changes to a healthier lifestyle
• Provide a **context for regular contact** for child and caregivers with primary health care services and public health
Child growth

- Maturity at birth
- Weight
- Height / Length
- BMI (Body Mass Index)
- Head circumference
- Developmental milestones
- Rourke Baby Record
  (www.Rourkebabyrecord.ca)

Corrected age vs. chronological age
The Canadian Paediatric Society recommends that infants be weighed and measured (length/height and head circumference):

- within one to two weeks of birth
  (preferably within 48 hours of hospital discharge)
Child Growth Monitoring

Children 2-19 years of age:
• Once a year

Other times:
• Acute or emergent clinic and hospital visits
REFLECTION:

Serial measurements tracked over time are necessary to assess a child’s growth. Why would that be the case over any measurements at a single point in time?
Growth Monitoring – Main Activities

Assess
• Measure weight, length / height and head circumference
• Plot measurements on appropriate growth charts

Analyze
• Interpret the growth pattern
• Discuss growth pattern with caregivers; seek agreement on action needed

Advise
• Monitor and follow-up

(Ashworth A, Shrimpton R, Jamil K. 2008)
Overview of the WHO Growth Monitoring

WHO Growth Monitoring

2006 Growth Standards (birth – 5yr)

2007 Growth References (5 – 19yr)
WHO Growth Standards (Birth to 5 yr)

- Based on the WHO’s MGRS (Multicenter Growth Reference Study) 1997 - 2003
- Portrays how a child SHOULD grow
- World-wide applicability
Which one of the following is NOT a consideration in the Multicentre Growth Reference Study used to develop the WHO Growth Standards?

a. socioeconomic conditions favourable for growth
b. environmental conditions favourable for growth
c. breastfeeding practice
d. none of the above
The correct answer is (d).

- The Multicentre Growth Reference Study (MGRS) considered all of these factors - socioeconomic and environmental conditions favourable for growth and breastfeeding practices.
WHO Growth Standards (Birth to 5 yr) – MGRS

- 8440 affluent children with different ethnic backgrounds and cultural settings
- Study sites – socioeconomic and environmental conditions favourable to growth
- Extensive breastfeeding support program

WHO Growth Standards (Birth to 5 yr) – MGRS
Important finding:

Although children were from different racial and ethnic background → minimal differences in rates of linear growth
## Strengths of WHO vs the CDC (Birth to 5 yr)

<table>
<thead>
<tr>
<th>WHO</th>
<th>CDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal data; children sampled 21 times between birth and 24 mo</td>
<td>Cross-sectional data; children sampled once</td>
</tr>
<tr>
<td>Based on a predominantly breastfed population:</td>
<td>Based on a predominantly non-breastfed population:</td>
</tr>
<tr>
<td>• 75% exclusively or predominantly breastfed ≥4mo</td>
<td>• Only 50% breastfed at all</td>
</tr>
<tr>
<td>• 68% partially breastfed ≥12mo</td>
<td>• ~30% breastfed ≥3mo</td>
</tr>
<tr>
<td>• 16% continued to breastfeed at 24 mo</td>
<td></td>
</tr>
<tr>
<td>• Mean breastfeeding duration = 17.8 mo</td>
<td></td>
</tr>
</tbody>
</table>
## Strengths of WHO vs the CDC (Birth to 5 yr)

<table>
<thead>
<tr>
<th>WHO</th>
<th>CDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 developed and developing nations</td>
<td>Single country’s growth pattern</td>
</tr>
<tr>
<td>Excluded data points</td>
<td>Removed most current weight data for ≥ 6yr, but not &lt;6yr</td>
</tr>
<tr>
<td>&gt;99.9th %ile for birth – 2yr and</td>
<td></td>
</tr>
<tr>
<td>&gt; 97th %ile for 2 – 5 yr</td>
<td></td>
</tr>
<tr>
<td>Prescriptive</td>
<td>Descriptive</td>
</tr>
</tbody>
</table>
WHO Growth Reference 2007 (5 – 19 yr)

Rationale for new charts

• evidence-informed practice throughout the child years
• motivated by 2006 WHO Growth Standards
• address global surge in childhood obesity
• reconstructed based on best available historical data
WHO Growth Reference 2007 (5-19 yr)

Address obesity epidemic:

- Chose NCHS (1963-1974) rather than CDC charts to precede increasing rates of obesity
- Smooth transitioning at 5 years between the WHO growth standards (birth – 5yr) and the WHO growth references (5 – 19 yr) and at 19 years with adult BMI cut-offs
Why did Canada adopt the WHO growth charts?

- Strengths of the WHO charts
- Multicultural nature of Canada
- No national Canadian database of anthropometrics for <2 yr
Recommended for use for Canadian children and endorsed by:

- The College of Family Physicians of Canada
- Le Collège des Médecins de Famille du Canada
- Dietitians of Canada
- Community Health Nurses of Canada
- Infirmières et infirmiers en santé communautaire du Canada
- National Aboriginal Health Organization (NAHO)
- Canadian Pediatric Endocrine Group
- Canadian Paediatric Society
Adaptations Made for Canadian Charts

- Visually made to look similar to what Canadian practitioners have been familiar with
- From landscape to portrait layout
- Included the 0.1st and 99.9th percentiles
- The measurements and where they fall on the growth chart are the ones recommended by the WHO
Applicable to Aboriginal people (Métis, Inuit and First Nations)

CPS First Nations, Inuit and Metis Health Committee provided feedback at consultation: applicable to Aboriginal populations (Métis, Inuit and First Nations)

Caution:
• larger number of children will be ‘moved up’
• may cause problems with the diagnosis of Fetal Alcohol Syndrome Disorder
Further Adaptations of the Canadian Growth Charts in 2014

• Shading used on the 2010 colour charts was removed and a blue icon added to the Boys charts and a pink icon on the Girls charts.

• The 0.1st percentile was removed from all charts as it is a cut-off for severe wasting/underweight.

• The 99.9th percentile remains on the charts with a dotted line. It indicates the cut-off for obesity on the 0-2 years Weight for Length chart and BMI for Age chart (2-5 years).

• On the 5-19 year charts it is the cut-off for severe obesity.
REFLECTION:

How familiar are you with the set of WHO Growth Charts for Canada?
Pop Quiz

Which of the following is not a WHO Growth Chart for Canada?

a. Length-for-age and Weight-for-age (0-24 months)
b. Body Mass Index-for-age (0-24 months)
c. Head circumference and Weight-for height (0-24 months)
d. Body Mass Index-for-age (2-19 years)
The correct answer is (b).

BMI-for-age is not plotted for infants between 0-24 months of age.
WHO Charts for Canada Public Health and Primary Care setting

For each of the 2 genders

<table>
<thead>
<tr>
<th>0-24months</th>
<th>2-19 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length-for-age and Weight-for-age</td>
<td>Height-for-age and Weight-for-age</td>
</tr>
<tr>
<td>Head circumference and Weight-for-length</td>
<td>Body Mass Index-for-age</td>
</tr>
</tbody>
</table>
Sample Birth – 24 Months Charts (BOYS)
Sample Charts 2-19 yr (GIRLS)
Percentiles on the WHO Growth Charts for Canada (Set 1)

<table>
<thead>
<tr>
<th>Percentiles Set 1</th>
<th>SDS or Z-scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>- 2</td>
</tr>
<tr>
<td>15&lt;sup&gt;th&lt;/sup&gt;</td>
<td>- 1</td>
</tr>
<tr>
<td>50&lt;sup&gt;th&lt;/sup&gt;</td>
<td>0</td>
</tr>
<tr>
<td>85&lt;sup&gt;th&lt;/sup&gt;</td>
<td>+ 1</td>
</tr>
<tr>
<td>97&lt;sup&gt;th&lt;/sup&gt;</td>
<td>+ 2</td>
</tr>
<tr>
<td>99.9&lt;sup&gt;th&lt;/sup&gt;</td>
<td>+ 3</td>
</tr>
</tbody>
</table>
Percentiles on the WHO growth charts for Canada (Set 2)

*NOTE: The 99.9th percentile is included on the Weight-for Length chart (Birth – 24 months) and the BMI for Age chart (2-19 years)
Summary – Key Practice Points

• Monitoring growth provides a platform for reinforcing healthy child growth and appropriate identification of growth concerns.

• Serial measurements are important for monitoring growth pattern whereas a single measurement may be used as a ‘red flag’ for identifying the need for further assessment.

• The WHO growth charts were developed using data from 6 developing and developed countries with the children growing under optimal growth conditions.
Summary – Key Practice Points

• Despite different racial and ethnic background, children showed minimal differences in rates of linear growth, therefore attesting to the worldwide applicability of the WHO growth charts.

• There are two sets of WHO Growth Charts for Canada - practitioners may choose to use the set based on their professional preference.

• BMI-for Age rather than Weight for Age is considered by the WHO to be best indicator for monitoring a child’s weight beyond age 10. However, if a practitioner chooses to plot and monitor Weight for Age beyond 10 years of age, these results should be considered in conjunction with BMI-for-Age.
Module 1: Post Test

1. The WHO Growth Standards were based on a study which sampled children from:
   a) 6 developed nations
   b) 6 developing nations
   c) A single nation
   d) 6 developed and developing nations

2. True or False. One of the key findings from the WHO’s Multicentre Growth Reference Study (MGRS) was that despite differences in racial and ethnic background, there were minimal differences in rates of linear growth among the 6 nations sampled.

3. True or False. One of the strengths of the WHO’s growth charts is that they are based on a primarily breastfed population which is ideal for growth as per current nutrition recommendations.
1. The correct answer is (d). The WHO growth standards were based on the Multicentre Growth Reference Study which sampled children from 6 developed and developing nations.

2. The correct answer is TRUE. One of the key findings from the MGRS was that despite differences in racial and ethnic background, there were minimal differences in rates of linear growth among the 6 nations sampled - thus, speaking to the world-wide applicability of the WHO Growth Standards.

3. The correct answer is TRUE. The WHO growth charts are based on a primarily breastfed population. Breastfeeding is the normative way to feed a child and is ideal for growth as per current nutrition recommendations.
Acknowledgements

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Members of the National Reference Groups