Slide 1: A Preschool Nutrition Primer for Dietitians

Module 1: Pediatric Growth Assessment - Part One: The Principles

The Nutrition Resource Centre and NutriSTEP® present Pediatric Growth Assessment - Part One: The Principles. This training module is one of five topics to increase the knowledge, skills and competence of Registered Dietitians who work in a variety of care settings. The goal of these evidence-informed Primers is to increase your comfort level to provide quality nutrition services to your clientele and support team-based care of young children.

Slide 2: Learning Objectives for this presentation are to:

• Understand why to assess growth in the nutritional care of children.
• Learn about the challenges in doing growth assessment; the necessary measuring and plotting tools; and, how to interpret and use growth data ethically and effectively.
• Be aware of the current and proposed guidelines for assessing and monitoring the growth of Canadian children and youth and
• Know about the professional and parent resources to use in practice.

Slide 3: Presentation Outline will include the following topics:

• Growth process
• National Growth Monitoring Position
• Interpreting and assessing growth assessment data including BMI for Age
• Growth plotting and growth data interpretation exercises
• Resources to address growth concerns and
• Take home messages

Slide 4: Overview of Growth

There are three distinct stages of growth:
• infancy: during the early stages, infants have their rapid growth period
• toddler and school-age children: growth is relatively static and
• teenage years: experience another growth spurt
Module 1: Pediatric Growth Assessment – Part One

Slide 5: Overview of Growth

For Weight:
- birth weight is regained by 10-14 days of life after the initial 6-7% loss (due to diuresis)
- weight doubles by 4-5 months, triples by the first year, and quadruples by age 2

For Length:
- at birth length relates best to maternal size
- length increases by 50% by the first year of life
- length increases by 75% by age 2
- length reaches approximately half of adult height by age 2

Slide 6: Factors Affecting Growth are:
- Genetic constitution
- Normal endocrine function
- Adequate nutrition
- Absence of chronic disease and
- Nurturing environment

Additionally, fetal, infant, environmental and maternal factors can interact to impair intrauterine and postnatal growth.

Slide 7: Why Assess Growth?
- It is the best general index of health and nutritional status of an individual child and a population
- It is a form of screening for growth disorders or health concerns related to growth
- With regular serial measurements, it can be used as an early detection of malnutrition, neglect/abuse, or ill health
- Determine adequate nourishment
- And can be a reliable indicator of adult overweight and obesity

Slide 8: Desired Outcomes are to
- Improve nutrition
- Reduce the risk of inadequate nutrition
- Educate caregivers
- Early detection and referral for conditions of growth disorders
• Define health and nutrition status of populations for program planning and
• Assess the response to existing interventions

Slide 9: Growth Measurements

Basic measurements include:
• Recumbent length (from birth to 36 months) or standing height
• Weight and
• Head circumference (from birth to 36 months)

Derived indices include:
• Length for age, height for age, weight for age, weight for length and height, and body mass index
• Comparison of age and sex specific reference data

If the basic measurements are poorly done or incorrect, the derived indices will also be incorrect. This will hamper the interpretation of growth data as well as the nutritional care plan for the child. This can influence follow-up assessments and monitoring the effectiveness of the nutritional care plan.

Slide 10: Challenges in Assessing Growth are

• Failure to perform measurements
• Use of reliable, well-calibrated equipment
• Use of standard, accurate, measurement techniques
• Appropriate choice of growth charts
• Accurate plotting on growth charts
• Appropriate interpretation of growth indicators

Slide 11: National Growth Monitoring Position 2004

Due to the challenges in assessing growth, a national growth statement was developed and disseminated in 2004.

• Collaborators include: Dietitians of Canada, Canadian Pediatric Society, College of Family Physicians of Canada, and the Community Health Nurses Association of Canada
• Target Audience include: Health care professionals and parents
• The purposes are:
Module 1: Pediatric Growth Assessment – Part One

- To facilitate understanding of the growth process and importance of accurate measurement and plotting of anthropometrics and
- To guide in selection and interpretation of growth charts

Dietitians should be aware of this pending statement but as of June 2007, practitioners are still using the CDC growth charts and the following slides will cover the current guidelines. It is anticipated that the WHO growth standards will be adopted for use in Canada and some information has been provided on the proposed WHO standards. Once the revised growth statement has been publicly released, updated information will be shared with practitioners.

**Slide 12: National Recommendations 2004 suggest**

- The use of the Centre of Disease Control clinical growth chart set number 2 (3rd to 97th percentile)
- From birth to 36 months: measure length, weight, head circumference, and weight for length
- From 2-20 years of age: measure height, weight, and body mass index for Age

The Centre for Disease Control criteria: BMI reference data using five US national health examination surveys from 1963 to 1994 and five supplementary data sources. The CDC gender- and age-specific BMI references define overweight in children as BMI above the 95th percentile while children between the 85th and 95th percentile are considered to be at risk for overweight. The CDC BMI reference data and cut-off points are recommended for Canadian children except the labels for the weight categories are different; a BMI between the 85th and 95th percentiles indicates a child is “overweight” while a BMI above the 95th percentile indicates that a child is “obese”. It is also recommended that the CDC charts are recommended for use in clinical and community settings.

**Slide 13: National Recommendations 2004**

Body Mass Index for Age is measured by:

- Weight (in kilograms) divided by Height (in metres squared)
- The use of the CDC growth curves (from age 2-20 years) in clinical & community settings
- The use of International Obesity Task Force criteria (from age 2-18 years) for population comparisons
Frequency Guidelines for measurements are:
- Within 1-2 weeks of birth and
- At 1, 2, 4, 6, 9, 12, 18, and 24 months of age
- Between 4-6 years, and annually for older children & teens

The International Obesity Task Force or Cole criteria: BMI references using data from six countries. Cole et al drew percentile curves that at age 18 years passed through the cut-off points of 25 and 30 kg/m² for adult overweight and obesity. Children with a BMI of 25 or 30 at the extrapolated age of 18 were classified as overweight or obese, respectively.

Slide 14: National Recommendations 2004
- Children with Special Needs to
  - Use the CDC with consideration of conditions affecting growth
- Breastfed Infants
  - Can use CDC with caution due to risk of misinterpretation
  - Growth rates differ where infants appear leaner after 3-4 months of age on the growth curves
- Preterm Infants
  - Use gestation adjusted age until 24-36 months and
  - Use the CDC or IHDP charts with very low birth weight and low birth weight based on the purpose of growth tracking

Slide 15: World Health Organization Growth Standards
The World Health Organization has published new infant growth charts, which use breastfed babies as the optimum size, replacing 40-year-old growth charts, which were based largely on formula fed babies.

This is great news for health professionals wanting to support breastfeeding, as it no longer means that the typical formula fed baby is seen as the norm. Because breastfed babies are typically lean, the shape of the growth curve in the new WHO Child Growth Standards differs from the existing one, particularly during the first six months of life when growth is rapid.

The new WHO growth charts are based on a study of more than 8,000 children around the world raised in environments that promote healthy growth, such as breastfeeding, healthy diets and adequate healthcare.
Their mothers did not smoke before or after pregnancy. The study has shown that given the optimum start in life, children from different regions of the world all have the potential to grow and develop within a similar range. So for the first time, the charts will give a prescriptive definition of optimum growth for all children, rather than simply describing average growth.

- It is considered the Gold Standard or a target for all children to achieve
- It corrects the existing inconsistency between current nutrition recommendations and growth monitoring practices
- The Canadian Collaborative Group evaluated the impact of using the new WHO growth charts
- And the new Canadian guidelines were released on February 8, 2010

**Slide 16: Canadian Guidelines 2010**

- Children birth to five years to use the 2006 WHO Child Growth Standards
- Children and adolescents to use the 2007 WHO Growth Reference

Reasons for using the above guidelines include:
- Growth references vs growth standards
- Promotion of breastfeeding as the norm
- Cross-sectional vs longitudinal growth monitoring
- Addressing the obesity epidemic
- International sample population
- Validation with subjective assessments by health professionals and
- Transitioning charts as the child ages

**Slide 17: Canadian Guidelines 2010**

The differences between the CDC and WHO growth curves are:
- Appearance and age ranges
- Breastfed vs formula fed growth patterns
- Increased emphasis on the use of BMI-for-age over the age of 2 years
- Use of z scores
- Weight-for-age
- Cut-off points and terminology and messages to parents and children
• Crossing percentiles and norm percentile “also called surfing” and
• The prevalence of under and over-nutrition

**Slide 18: Canadian Guidelines 2010 include**

- Children with Special Needs
- Pre-term infants
- Children of different ethnicities and
- Canadian First Nations, Inuit and Métis

Growth monitoring frequencies are:
• Within 1-2 weeks after birth
• At 2, 4, 6, 9, 12, 18, and 24 months of age
• Annually after age 2 through adolescence and
• Should occur at all well-health and acute care visits

**Slide 19: Canadian Guidelines 2010**

Additional References and Resources include the:
- Collaborative Statement
- Executive Summary
- Current Issues: The Inside Story (Q and A for Health Professionals) (DC members’ side only)
- Health Professional’s Guide for using the new WHO growth charts and
- Is My Child Growing Well? Q and A for Parents

**Slide 20: Growth Charts**

- The CDC charts are a set of growth references that describes a sample with no health claims
- The WHO charts are growth standards or a “healthy” sample, in which a model or target to achieve
- It assesses general nutritional status of a population in diverse settings
- It acts as a Tool with cut-points to screen for health and nutritional disorders
- The CDC growth charts are considered references while the WHO growth charts for children birth to age five are considered growth standards.
Slide 21: Growth Charts are

- An educational resource to promote improved child health care by families
- Single measurement assesses current size
- Serial measurements assess growth and
- Only part of the picture and not a diagnostic tool

Slide 22: Considerations for Growth Charts and Measurements

Population vs. individual data
- There is variability in individual growth and body compositions (For example: 5% of healthy children are below the 5th percentile for stature)
- Therefore, the direction of measurements is more important than the actual percentile

Shifting percentiles
- Normal percentile shift “such as regression towards the mean at the 50th percentile” in the first 2-3 years of age & at puberty
- Crossing percentiles could be a sign of growth disturbance (for example: greater than or equal to 2 percentiles down suggests growth failure).

Slide 23: Considerations for Growth Charts and Measurements

Normal versus optimal growth
- Growth charts can’t evaluate growth patterns as optimal or sub-optimal
- It doesn’t distinguish normal variability and a mild pathological problem
- Maximal growth is not necessarily optimal growth
- However, optimal growth may be used as a term with the WHO growth charts as they are considered standards.

Short versus long-term growth
- Growth spurts and periods of stasis which can be difficult to detect due to measurement errors and measurement intervals
- Seasonal fluctuations can occur, where greatest velocity occur in spring and lowest in the winter
Slide 24: Considerations for Growth Charts and Measurements

Heredity versus environment
- The environment is modifiable such as diet, activity level, disease state, and social factors
- Heritable factors are resistant such as bone density, body density, BMI, skin fold thickness, stature, muscularity, and body proportions

Sexual and skeletal maturation
- Over or under nutrition affects sexual and skeletal maturation

Slide 25: Considerations for Growth Charts and Measurements

Catch-up growth
- Understanding is limited as
- Growth deficit can be partially recovered but tends to be incomplete
- Net growth loss are affected by severity and length of growth impairment, and the age at which it occurs
- It is less likely to be fully compensated if it occurs over age 2
- Weight deficits improve first and then height
- Those who are wasted but not stunted catch-up faster

Slide 26: Growth of Aboriginal Children

The Canadian Pediatric Society First Nations and Inuit Health Committee
- Questions the need for special growth charts
- Current recommendations are to use the CDC growth curves
- This population may have growth patterns that differ from normal standards
- The Canadian reference population lacked sufficient number of specific racial and ethnic groups to consider separate charts

Keep in mind the current revision statement from the National Growth Monitoring Position

Slide 27: Growth of Children with Special Needs

There is an increased risk of malnutrition and inappropriate growth patterns due to:
- Decreased oral intakes, activity levels and repeated medical setbacks
- They often have growth curves different from reference curves
• It is difficult to measure due to musculoskeletal deformities, spasms, splints, braces; non-ambulatory and overweight stature
• Alternative measures can include:
  o crown-rump length, sitting height
  o body segment lengths (such as upper arm lengths, lower leg length) or total length (such as arm, arm or “wing” span) and
  o skin-fold measures

Slide 28: Growth Charts for Children with Special Needs

The recommendations are to:
• Use normal reference charts as it is the best evaluation tool
• However, limitations of specialized growth charts are
  o very small sample sizes
  o old data that may not reflect newer treatments
  o cross-sectional data vs. longitudinal measures and
  o may mask existing nutrition problem
• Specialized charts can be used with careful consideration of the limitations
• Or can be used as additional information in the overall nutritional assessment

Slide 29: Growth in Preterm Infants

• The growth in low birth weight and very low birth weight pre-term infants differ from term infants born at an appropriate weight.
• They have a shorter gestational age and a lower birth weight and do not catch up to term infants despite using adjusted or corrected age.
• Catch-up growth may be attained at 18 months for head circumference, 24 months for weight and 40 months for height.
• Some very low birth weight preemies may not catch-up for weight and length until early school age (at approximately 8 years of age).

While assessing the preschooler, dietitians will not be using premature growth charts or correcting for gestational age, it is important to understand the short and long term impact of prematurity on the growth potential of these children. This will enable you to assess their growth appropriately and set realistic goals for the child and their family to work towards.
Slide 30:  Growth in Preterm Infants

- Very low birth weight status with weight and length below the 10th percentile at age 2 will likely stay below at age 5 and 8 years
- There is a high risk for growth failure which is associated with poorer developmental outcomes
- Optimal growth is not definitively established, therefore we need to
- Compare growth with other pre-term infants of similar birth weight
- Corrected age should be used until 36 months of age for growth assessment

Slide 31:  Growth in Preterm Infants

- Older postnatal growth charts developed when neonatal care, including nutritional care were not optimal and no data from infants less than 29 weeks' gestation.
- Newer postnatal growth charts reflect changes in growth related to better neonatal care but have limitations and may not reflect ideal growth of preemies.
- Current intrauterine growth charts reflect cross-sectional data and not longitudinal; from small samples of infants including subjective global assessments and they are not gender specific.

Slide 32:  2001 IHDP Growth Charts for Preemies

To assess preemies, there are two choices and your decision will be based on the purpose of growth monitoring. The following references provide more background on this topic.

The IHDP charts are based on a US national collaborative randomized clinical trial with data from 867 pre-term low birth weight infants from term to 36 months corrected age. These charts include:

- Weight, length, and head circumference at 4 month intervals for the first year and every 6 months for the 2nd and 3rd years
- Gender and birth weight for very low birth weight (less than 1500g) and low birth weight (between 1500 and 2500g) at birth
- Percentiles for length, head circumference and weight for length

The charts exclude triplets/quadruplets, infants on oxygen for more than 90 days, hospitalized more than 60 days post term, specific birth defects, and chromosome anomalies. These growth charts may not depict ideal
growth and it may be more appropriate to use corrected age until 36 months on the CDC growth charts. Growth expectations should be modified based on clinical course of each infant.

**Slide 33: Population Level Body Mass Index for Age - Overweight and Obesity Rates**

Should we be concerned about the preschooler population and their growth pattern?

We now have actual growth data on preschoolers as well as older children. It can be seen that across Canada and in Ontario, more than 20% of preschoolers are overweight or obese. While rates of overweight and obesity are somewhat higher with older children, one in five preschoolers could be developing a growth pattern that could have negative effects on their overall growth and development. It is also expected that using the WHO growth charts, these rates will be even higher adding additional concern for the need for early intervention.

**Slide 34: Using Body Mass Index to Screen for Pediatric Obesity**

- Weight is a poor indicator of fatness or obesity.
- It is recommended to use body mass index to screen at over the age of 2 years.
- Weight for stature is not the same as Body Mass Index for age.
- Stature doesn’t adjust for age during periods when body fat differs substantially (such as short toddlers or tall infants).
- Body mass index for age is safe, simple and inexpensive.
- There is a significant correlation to direct measures of fat as well as subcutaneous measures.

Both CDC and WHO growth charts include BMI percentiles. But the WHO charts include BMI from birth while CDC charts start at age 2. The use of BMI before age 2 using the WHO charts will need to be reviewed using the updated growth statement once it is released.

**Slide 35: Advantages of Body Mass Index are**

- It is Reproducible and non-invasive
- It is Validated against measures of body fat
- It is Consistent with adult standards and can be used over the age of 2 to track childhood overweight into adulthood
- It is a reference for adolescents beyond puberty
- It relates to health risks, such as:
  - It correlates with clinical risk factors for cardiovascular diseases such as hyperlipidemia, hyperinsulinemia, and hypertension
  - During pubescence, it is related to lipid levels and high blood pressure during middle age

**Slide 36: Interpreting the Body Mass Index for Age**

Points to keep in mind:
- Age
- Body mass index pattern
- Adiposity rebound after age 5½ years
- Gender
- Muscle mass versus fat mass
- Stage of sexual maturation and
- Ethnic differences

**Slide 37: Adiposity Rebound**

Adiposity increases during a child’s first year, and after about one year of age BMI-for-age begins to decline. It continues falling during the preschool years until it reaches a minimum around 4 to 6 years of age. After 4 to 6 years of age, BMI-for-age begins a gradual increase through adolescence and most of adulthood. The rebound or increase in BMI that occurs after it reaches its lowest point is referred to as “adiposity” rebound. This is a normal pattern of growth that occurs in all children.

Recent research has shown that the age when the “adiposity” rebound occurs may be a critical period in childhood for the development of obesity as an adult. An early “adiposity” rebound, occurring before ages 4 to 6, is associated with obesity in adulthood. However, studies have yet to determine whether the higher BMI in childhood is truly adipose tissue versus lean body mass or bone. Additional research is needed to further understand the impact of early adiposity rebound on adult obesity.

**Slide 38: Using the Body Mass Index with Children**

- Track changes in body mass index over time
- If there are increases of greater than or equal to 2 units per year, it may reflect excessive increase in body fat
• The degree of change that indicates risk is not known
• If demonstrating crossing percentiles or abnormal trend, then review weight for age and stature for age

**Slide 39: Limitations of Body Mass Index**

- It is not reliable in disease states associated with abnormal growth, body composition, and the timing of puberty
- It is not appropriate for children with deformities confounding measurement of stature
- It lacks science and experience to assess underweight and therefore more research is needed

**Slide 40: Body Mass Index - One Piece of the Puzzle**

- Body mass index is a derived value based on population data
- Every child is their own reference
- There is normal variability in individual growth and body composition (For example: 5% of healthy children grow below the 5th percentile and above the 95th percentile – similar to the bell curve distribution)
- Single measurements are insufficient and needs to be tracked over time for trends

**Slide 41: Body Mass Index - One Piece of the Puzzle (continued)**

- Errors in measurement can lead to incorrect data and interpretation. A 1.9 centimetre height variation is equivalent to 1 BMI percentile
- It is not diagnostic
- Further assessment is required such as: skin-fold thickness, co-morbidity, family history, recent health history, and a physical exam
- Health risks can involve: eating habits, physical activity patterns, genetic predisposition, and other risk factors

**Slide 42: CDC Body Mass Index for Age Cut-offs**

- Those who plot greater than or equal to the 95th percentile are classified as Overweight (but Obese under Canadian definitions)
- Those who plot between the 85th to less than the 95th percentile are at Risk of overweight (but are classified as overweight under Canadian definitions)
- Those who plot between the 5th to less than the 85th percentile are classified as Normal weight
Those who plot less than the 5th percentile are classified as Underweight.

The Canadian terminology differs from the CDC terms for overweight and obese categories. Again, this will likely change with the WHO charts and categories used with those charts.

**Slide 43: WHO Body Mass Index for Age Cut-offs 5 to 19 years**

- Those who plot greater than or equal to the 99th percentile are classified as severely obese
- Those who plot greater than the 97th percentile are classified as obese
- Those who plot greater than the 85th percentile are classified as overweight
- Those who plot less than the 3rd percentile are classified as wasted
- Those who plot less than 0.1 percentile are classified as severely wasted

**Slide 44: Is this Patient at Risk?**

- This boy is 3 years and 3 weeks old.
- What is his BMI-for-age?
- Is he at risk for being overweight?

It is becoming more difficult to visually assess children and potential growth concerns since many children who are growing along the 50th percentile for weight and height actually appear ‘thin’ compared to their age and sex-related peers. This example helps illustrate the importance of accurate growth data collection and assessment.

**Slide 45: Plotted Body Mass Index for Age as illustrated on the CDC BMI curves**

This patient is plotted on a boys’ curve aged 2 to 20 years. His current measurements as follows:

- Age: 3 years and 3 wks
- Height: 100.8 cm
- Weight: 18.6 kg
- Body mass index: 18.3
- Body mass index-for-age is plotted on the 95th percentile, and he is classified as obese
Note that using the CDC growth charts, this child is classified as obese. Using the WHO charts, this child will also be classified as obese.

**Slide 46: Is this Patient at Risk?**

- This girl is 4 years old
- What is her BMI for Age?
- Is she at risk for being overweight?

**Slide 47: Plotted body Mass Index for Age as illustrated on the CDC BMI curves**

This patient is plotted on a girls’ curve aged 2 to 20 years. Her current measurements as follows:

- **Age:** 4 years
- **Height:** 99.2 cm
- **Weight:** 17.55 kg
- **Body mass index:** 17.8
- **Body mass index-for-age** is plotted on the 90th to 95th percentile, and she is classified as overweight

Note that this child is classified as overweight using the CDC growth charts; she will likely be classified as obese using the WHO charts.

**Slide 48: Putting it Together**

- Take weight and height measurement
- Plot on the appropriate growth chart
- Interpret growth data findings
- Consider message to parents
- Points to discuss with parents such as Background on assessing and discussing nutritional intake, activity and growth
- Provide Suggested Handouts
- and consider further Actions and Referrals

**Slide 49: Core Messages for Parents**

- Growth pattern over time is more important than a single measurement
- Weight & height or height measurements are health screening tools
- Growth is one sign of general health
- Many things affect a child’s growth and
- Growth reflects family growth patterns
Slide 50: Core Messages for Parents

- Focus on healthy eating & lifestyle habits rather than physical appearance
- Focus on positive lifestyle habits and feeding or eating relationship and
- Parents should model positive body image and respect child’s individuality

Growth assessment should be considered a tool to assess readiness for information and need to explore things further.

Slide 51

This is the end of the presentation. There are practice questions that can be completed on your own time, and are not part of the audio presentation. The questions and correct answers are located in the separate link titled Modules 1-5: Case Study Questions and Answers.