Nutrition Services &
Early Years Health Promotion

Childhood Growth Monitoring

Guidance

June 2024

Alberta Health Services

Table of Contents

Table of Contents 2

Contact and Acknowledgements 3

Introduction 4

Background 5

Growth Measurement 5

Growth Charts 5

Procedure 8

When To Measure 8

Preparing to Measure 10

Weight Measurement 10

Length or Height Measurement 12

Head Circumference Measurement 15

Populating Measurements on a Growth Chart 16

Interpreting Growth Measurements 19

Discussing Growth with Families 24

Referrals 25

Contact and Acknowledgements

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This guidance document has been prepared by Nutrition Services and Early Years Health Promotion, Healthy Children and Families.

For more information on growth measurement and equipment specifications please contact Early Years Health Promotion at EYHP@ahs.ca

For more information on interpretation and discussion of growth, please contact Nutrition Services, Population and Public Health at PublicHealth.Nutrition@ahs.ca

Introduction

This Childhood Growth Monitoring Guidance document was developed for Alberta Health Services (AHS) staff and students involved in childhood growth monitoring in public health and clinical settings (inpatient and ambulatory).

The goal of this document is to optimize growth monitoring practices and therefore child health outcomes. Guidance in this document will address growth measurement procedures, plotting, interpretation, discussion, and follow-up actions for infants, children, and adolescents (birth to 19 years of age).

Background

Growth monitoring is an essential component of assessing the health and nutrition status of infants, children, and adolescents.[1] Serial measurements and interpretation of these measurements on an appropriate growth chart help monitor a child's growth and development and help with early identification of a potential nutrition or health problem.[1]

The collaborative statement from Dietitians of Canada, Canadian Paediatric Society, College of Family Physicians of Canada and Community Health Nurses of Canada Promoting Optimal Monitoring of Child Growth in Canada: Using the New WHO Growth Charts recommends growth monitoring as a routine part of health care for all Canadian children.[1]

Growth Measurement

Accurate and reliable measurements are fundamental to growth monitoring and making sound clinical judgements on the appropriateness of a child's pattern of growth.[1] They also allow for an ongoing, systematic process of collection, analysis, interpretation, and monitoring of growth. If measurements are in error, then the foundation of the growth assessment is also in error.[1]

Accurate measurements have three components:[2]

- Quality equipment which is regularly calibrated and accurate.
- Standardized measurement technique.
- Trained measurers who are reliable and precise in their technique.

Growth Charts

Growth charts are graphic presentations of body measurements of a population that aid in the assessment of body size, as well as the observation of growth patterns.[1] In Alberta, the World Health Organization (WHO) Set 2 are the standard growth charts.[1] The WHO Set 2 growth charts for birth to 24 months were developed from a multinational growth study of multiethnic infants in communities where economics were not likely to interfere with growth, and predominant human milk feeding occurred. As such, they can be considered to represent optimal growth of children from a variety of racial and ethnic backgrounds and cultural situations.[1] For school-aged children and adolescents, the WHO Set 2 for 5 to 19 years is considered the best available growth reference.[2] These charts were constructed based on data from the 1977 National Center for Health Statistics growth reference, and are intended to closer reflect optimal growth due to concerns about rising rates of obesity in the past several decades.[2]

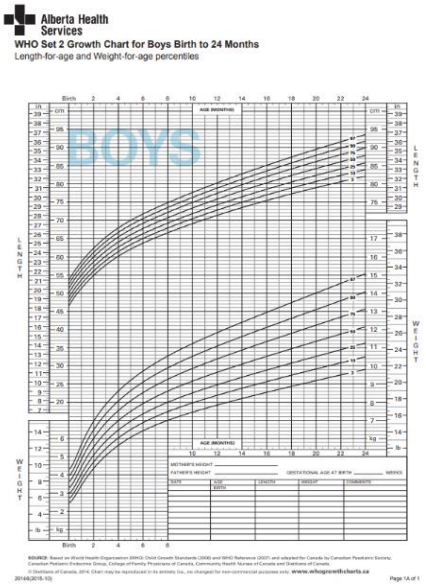
For preterm infants born less than 37 weeks, 0 days gestation, the Fenton 2013 preterm growth chart is the standard growth chart. Growth charts for infants with specific conditions can be used when appropriate, although sample sizes are limited, and caution is warranted when interpreting growth. It can be useful when using charts for specific conditions to also plot on the WHO Set 2 growth charts.

Percentiles

Percentile curves can be used to identify where a child plots relative to other children of the same age and sex. For example, if a child's weight is on the 75th percentile, it means that 75 of 100 children (75%) in the WHO growth studies weighed less and 25 (25%) weighed more. It is considered normal for children to measure between the 3rd and 97th percentiles.

All WHO Set 2 growth charts have the 3rd, 10th, 25th, 50th, 75th, 90th and 97th percentiles for weight and length/height. BMI and weight-for-length growth charts omit the 90th percentile and instead include the 85th and 99.9th percentiles.

Figure 1. WHO Growth Chart depicting percentile lines



Z-scores[3]

A z-score is a statistical measure (i.e., the number of standard deviations) that identifies how a child plots amongst other children of the same age and sex, whether it be above or below the median value. Z-score values of -2, 0, and +2 correspond to the 3rd, 50th, and 97th percentiles, respectively. Percentiles are adequate for assessing growth when anthropometric measurements fall within the 3rd to 97th percentiles (+2 or -2 standard deviations); however, in situations where growth measurements are less than 3rd or greater than the 97th percentile, percentiles are not able to quantify the severity of malnutrition.[4]

In public health, any measurements that are less than 3rd or greater than the 97th percentile would flag further assessment and/or referral. Z-scores therefore do not need to be used in a public health setting.

Z-scores are used in acute care settings for pediatric malnutrition screening. Z-score values less than -2.0 (for any growth measure) can indicate nutrition risk and should trigger further assessment by a registered dietitian or other designated health care provider. More information about using z-scores for malnutrition screening can be found at Canadian Malnutrition Task Force: P-INPAC.

Weight Bias and Stigma in Health Care

Weight bias and weight stigma exist in healthcare. This can be caused by provider bias, underlying assumptions about weight and health in research and clinical practice, practice environments (e.g., equipment, furniture and/or medical supplies that are not size inclusive), and systemic issues (e.g., societal pressures, weight-centric language and media).[5,6] Weight bias and stigma can impact the accuracy and quality of the growth monitoring process and relationships between the client and their families.

Weight bias and stigma are associated with adverse physical, behavioural, and psychological outcomes in those with higher body weights.[7] This includes avoidance of medical care, provider distrust, decreased physical activity, emotional distress, as well as self-devaluation and potential for triggering eating disorders in vulnerable children/adolescents.[5,8,9]

Practicing growth monitoring from a trauma-informed care approach can have a positive effect on care. Individuals who have previously experienced weight stigma may express physical, emotional or behavioural reactions when asked to be weighed or to discuss growth.[9] Client-centred care is enhanced by providing opportunities for families to collaborate on when, how, and if their child is measured, offer blind weights (where the client faces away from the numbers on the scale and declines to be informed of their weight), and asking how the individual or family feels about how growth is progressing and discussing growth in general.

Weight stigma is not the only form of stigma, and the effects may be increased in those who belong to single or multiple socially marginalized groups, who face identity-based stressors above and beyond the general population.[5] This Guidance provides information throughout on ways to reduce stigma related to culture, religion, and disability when performing growth monitoring.

Procedure

When To Measure

Table 1 outlines the recommended minimum measurement frequency by age group and setting. Frequency will depend on age, clinical condition, degree of nutritional intervention, and if a potential growth concern has been identified. Weighing children more frequently than is needed may add to parental anxiety as growth is expected to fluctuate and minor or short-term deviations may cause unnecessary concern.[10]

Guidance may vary for children who are at higher risk of malnutrition and inadequate growth. In cases where growth needs to be monitored more frequently, weight velocity may be used in conjunction with interpretation on a growth chart. For more information about weight velocity, refer to Appendix A.

Table 1. Frequency of Weight Measurement in Public Health and Clinical Settings*

Age	Frequency of Measurement		
	Weight	Length/Height	Head circumference
Public Health Setting			
Birth–2 years	During the postnatal period as needed to monitor health concerns		
	Prioritized at all routine well-child visits according to the immunization schedule: 2, 4, 6, 12 and 18 months based on parent concerns and nursing judgement		
	During any follow-up visits as needed to monitor health concerns		
Two–four years	Prioritized at the routine well-child visit at four years of age based on parent concerns and nursing judgment		n/a
Clinical Setting–Inpatient[11,12]			
Preterm infants	At birth* or within 24 hours of admission as able		
	Daily until growth expectations are being met	Weekly until growth expectations are being met	Weekly until growth expectations are being met
Birth–2 years	At birth* or within 24 hours of admission as able		
	At least three times per week	Twice per month	Twice per month
Two–19 years	Within 24 hours of admission as able		n/a
	At least two times per week	Monthly	
Clinical Setting–Ambulatory Clinics[1]			
Birth–2 years	At each appointment or as per the clinic procedure		
Two–19 years	At each appointment or as per the clinic procedure		n/a

*Deviations from frequencies listed in this table should be based on clinical judgement. For example, measures at birth may be delayed for the clinical situation and care needs of the infant (e.g., skin-to-skin).

Preparing to Measure

Obtaining Consent

1. Explain to the parent/caregiver why and how measurements are taken and inquire if they agree to proceed. As developmentally appropriate, include the child/adolescent in the discussion and invitation for growth measurement.
2. Take measurements in a manner that respects their personal, religious, or cultural perspectives.
   - Provide privacy if parent/caregivers and/or the child/adolescent desire it.
   - See information on measuring a child with a cultural headpiece in Appendix E.
   - Offer a blind weight to the family/child/adolescent by asking if they prefer to be weighed backward or not know the number being recorded. For example, "Some people prefer to be weighed backward so they can't see their weight. Do you prefer to know or not know the number?"

Weight Measurement

Birth to 2 Years[13]

1. Select the appropriate scale. Refer to Appendix C for equipment specifications. Ensure the scale is placed on a level, firm, and stable surface.

Table 2. Scale Selection for Infants, Birth to 2 Years

Consideration	Equipment
Less than 20 kg	Electronic infant scale
Greater than 20 kg and can stand unassisted	Electronic child/adolescent scale
Greater than 20 kg and cannot stand unassisted	Held by parent/caregiver on a child/adolescent scale. The weight of the person holding the child is subtracted from their combined weight.
	A child who cannot be held may need to be weighed on a wheelchair scale or bed scale, as appropriate. Follow site protocols and manufacturer's instructions for bed scale use.

2. Undress the infant. Ask the parent/caregiver to assist, if able.

Table 3. Recommendations for the State of Undress for Weight Measurement

Setting	Age	Recommendation
Public Health	Birth to 2 months	Weigh nude.
	Two months to 2 years	Weigh in a clean, dry disposable diaper. Disposable diapers are recommended as cloth diapers are considerably heavier and vary in weight.
Clinical Settings	Birth to 2 years	Weigh nude. If unable, weigh in a clean, dry diaper and subtract the weight of the diaper to obtain a nude weight.

3. Place a paper barrier on the measuring pan of the scale and tare to zero.
4. Place the infant in the middle of the scale. For an infant with equipment such as a feeding tube or IV, hold the equipment off the infant during the measurement, if possible.[14] Ask the parent/caregiver to assist, if able.
5. Measure once the infant is still. Try to distract an active infant. If the infant is too active, weigh the infant being held by someone on a child and adolescent scale, with the weight of the person holding the child subtracted from their combined weight.
6. Record the weight.
   a. For birth to 2 months, record to the nearest 1 g (0.001 kg), as per area procedures.
   b. For 2 months to 2 years, record to the nearest 10 g (0.01 kg) or 1 g (0.001 kg), as per area procedures.
   c. If the infant is held by someone and measured on a child and adolescent scale, record to the nearest 0.1 kg.
7. Clean and disinfect equipment according to manufacturer or site procedures.

Two to 19 Years[13]

1. Use an electronic child/adolescent scale. Refer to Appendix C for equipment specifications.
2. Remove shoes, hats, coats/jackets, sweaters, and other bulky items. The child/adolescent can be asked to do this, or the parent/caregiver can be asked to assist, if able.
3. Place a paper barrier on the scale and tare to zero.
4. Ask the child/adolescent to stand in the middle of the scale platform. For a child/adolescent with equipment such as a feeding tube or IV, hold the equipment off the child/adolescent during the measurement, if possible.[14]
5. Record the weight in kilograms to the nearest 0.1 kg.

Length or Height Measurement

Birth to 2 Years[13,15,16]

1. Measure infants and toddlers up to 2 years lying down (recumbent) on an infant-length board. Refer to Appendix C for equipment specifications. If recumbent length is not possible, measure height and adjust the measurement by adding 0.7 cm for an approximate length.[16]
2. The child should be measured wearing light clothing and/or a diaper. Remove shoes, hats, and bulky clothing such as coats/jackets and sweaters. Remove or undo hairstyles and accessories that may impact the measurement. The parent/caregiver can be asked to do this, if available.
3. If available, place a paper barrier on the length board.
4. Two people are needed to get an accurate measurement. Ask the parent/caregiver or another staff member to place the infant on their back in the centre of the length board, with the infant's head against the headboard, compressing the hair.
5. Have the parent/caregiver or a second measurer gently cup the infant's ears while holding the face, so it is pointed upward, and the head is firmly but gently held in position. Make sure the infant's chin is not tucked in against the chest or stretched too far back. Staff can help position the head so that the infant is looking vertically upward, with the crown of the head in contact with the headpiece in the Frankfort Horizontal Plane (Figure 2).

Figure 2. Positioning an infant's head for length measurement in the Frankfort Horizontal Plane

6. Standing on the side of the board where the measurement markings can be seen, align the infant's trunk and legs, then gently extend both legs, with one hand on the infant's knees to maintain full extensions of the legs (Figure 3). Both legs must be fully extended for an accurate length measurement.
7. Move the footboard so that it is firmly against the heels with feet against the footboard. The infant's toes should be pointed upward.

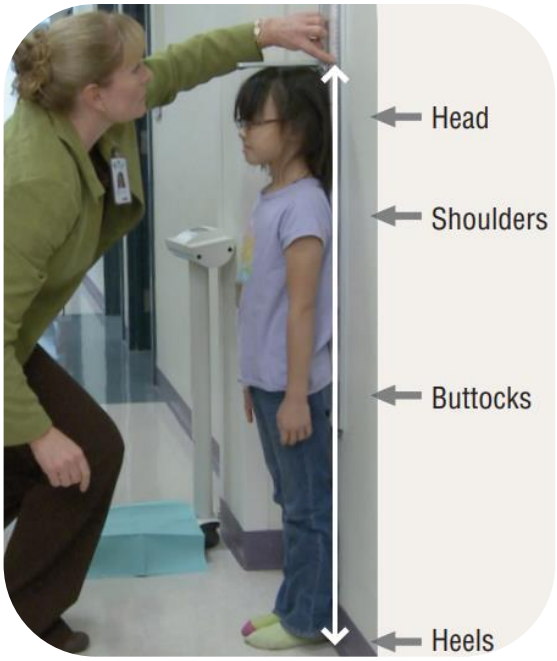
Figure 3: Positioning an infant's feet against the footboard of a length board

8. Record the length in centimetres to the nearest 0.1 cm.
9. Clean and disinfect equipment according to manufacturer or site procedures.

Two to 19 Years[13,16]

1. Measure children and adolescents 2 to 19 years who can stand unassisted on a stadiometer. If the child cannot stand unassisted, measure lying down (recumbent) length on an infant length board (infantometer) or recumbent child length board and adjust the measurements by subtracting 0.7 cm.[16] Refer to Appendix E for more information on special circumstances. Refer to Appendix C for equipment specifications.
2. Shoes, hats, coats/jackets, sweaters, and other bulky items should be removed. The child/adolescent can be asked to do this, or the parent/ caregiver can be asked to assist, if able.
3. Ask the child/adolescent to stand against the stadiometer, with heels together, legs straight, arms at sides, and shoulders relaxed.
4. Ensure the child/adolescent is standing with heels, buttocks, shoulders, and head touching a flat upright surface. Ask the child/adolescent to look straight ahead (Figure 4).
5. Bring the perpendicular headpiece down to touch the crown of the head with enough pressure to compress the hair.
6. Ensure your eyes are parallel with the headpiece in the Frankfort Horizontal Plane to read the measurement.
7. Record the height in centimetres to the nearest 0.1 cm.
8. Clean and disinfect equipment according to manufacturer or site procedures.

Figure 4. Positioning for a child or adolescent against a stadiometer for height measurement



Head Circumference Measurement

Birth to 2 Years[13,16]

1. Measure using head circumference tape. Refer to Appendix C for equipment specifications.
2. Remove or undo hairstyles and accessories that may impact the measurement. Ask the parent/caregiver to assist, if able.
3. Sit the child on a flat surface or the parent/caregiver's lap. The child may be more comfortable in the arms of a parent/caregiver.
4. Position the head circumference tape just above the eyebrows (over the supraorbital ridges), above the ears and around the prominent part on the back of the head (occiput) (Figure 5).

Figure 5: Positioning a head circumference tape for head circumference measurement

5. Pull the tape snugly to compress the hair.
6. Record the measurement in centimetres to the nearest 0.1 cm.
7. Clean and disinfect equipment according to manufacturer or site procedures.

Populating Measurements on a Growth Chart

Select the appropriate growth chart according to a child's age (taking into consideration the need for chronological or corrected age) and sex (Table 4). Electronic charting systems may select a default growth chart and plot measurements automatically. Check that the appropriate growth chart and/or if applicable, that the correction for prematurity is selected. For information about populating growth measurements in Connect Care, refer to the Growth Charts Quick Start Guide (AHS internal use only).

Table 4. Growth Chart Selection

Consideration	Recommended Growth Chart	Comments
Term infants, children, and adolescents	WHO Set 2 growth charts	

Consideration	Recommended Growth Chart	Comments
Preterm infants (infants born **less than** 37 weeks, 0 days)	Fenton preterm growth charts up until 0 weeks corrected age (40 weeks postmenstrual age)	For infants in the neonatal or pediatric intensive care unit, health professionals may choose to continue plotting on the Fenton preterm growth chart until 50 weeks postmenstrual age to capture smaller changes in growth when monitoring more frequently. The Hypoglycemia in the newborn with risk factors: Identification and management guide for newborn less than 5 days of age references the Fenton growth chart to assess for small for gestational age and large for gestational age, regardless if they are preterm or term. It is not intended for ongoing growth monitoring of term infants. Note that postmenstrual age is denoted as gestational age on the Fenton growth chart.
	WHO Set 2 growth charts greater than 0 weeks corrected age (greater than 40 weeks postmenstrual age)	Corrected age may be plotted up until 24 months of age, and postnatal/ chronological age used after 24 months of age, such as when plotting low on the growth chart. In some clinical situations, preterm infants may be corrected up to 36 months.
Infants, children, and adolescents with intellectual, developmental, genetic or other conditions (e.g., Down syndrome, cerebral palsy, Turner syndrome)	WHO Set 2 growth charts	Specific growth curves are also available for some other conditions[17–20] but have limitations. These may be used in conjunction with the standard growth chart to provide further information in the overall growth assessment.[2,17,21]

Using Body Mass Index (BMI)

To assess weight status, BMI-for-age (and not weight-for-age) should be determined for all children ages two years and older.[1] BMI-for-age should be used to assess weight relative to height and to screen for possible wasting, overweight and obesity.[1] The World Health Organization recommends against the use of weight-for-age after 10 years of age, as "it does not distinguish between height and body mass in an age period when many children are experiencing their pubertal growth spurt".[1] In certain circumstances, short-term weight changes may impact linear growth and reflect disease activity. To understand the full growth picture, clinicians may choose to track weight-for-age and height-for-age as complementary measures along with BMI-for-age over age 10.[2] Consider factors that may impact the interpretation of BMI including health conditions, family history, level of physical activity, and frame size.[22] For example, children and adolescents who have high fat-free mass may have a high BMI and, as a result, be incorrectly classified as overweight or having obesity.[2]

Plotting

Review all plotted growth measurements that are available from the child's record. If a plotted point on a growth chart seems unreasonable (i.e., an infant's length is shorter than at the previous visit) or is inconsistent with previous visits, check measurements, age parameters (e.g., prematurity correction) and growth chart selection, and if necessary repeat the measurement in question and compare.[13,16]

An acceptable standard for differences between repeat measurements is as follows:[13]

- Weight is within 0.01 kg (10 g) for children birth to 24 months of age.
- Weight is within 0.1 kg (100 g) for children 2 to 19 years of age.
- Length/height is within 0.5 cm.
- Head circumference is within 0.2 cm.
- If measurements are not within the above ranges, consider all factors affecting growth (refer to Interpreting Growth Measurements below) and if necessary, measure a third time.

Plotted points can be described as being on a specific percentile line (e.g., on the 75th percentile), between 2 percentile lines (e.g., between the 50th and the 75th percentile) or just above or below a percentile line (e.g., just above the 75th percentile). The 50th percentile is not the goal for each child as children can have the genetic potential to be taller, shorter, lighter, or heavier than average.[2] The pattern of serial measurements is more important than a one-time measurement or the percentile the child follows.

Interpreting Growth Measurements

As part of growth assessment and discussion, providers should review the core growth messages with families and consider additional factors that may be impacting growth patterns. Core growth messages and standard points of discussion are outlined below to aid the interpretation and understanding of growth patterns.

Table 5. Core Growth Messages and Discussion Points

Core Growth Messages
• Growth assessment is a health **screening** tool • Growth is one sign of **general health** • Growth should be considered **along with other factors** (e.g., genetic conditions, gestational age, birth weight, acute or chronic illness, food intake and activity level) to determine overall health • Growth patterns are assessed for the **individual** • Growth may reflect **family** growth patterns • Growth pattern **over time** is more important than one single measurement

<table>
<tr><th colspan="2">Discussion Points
Within patient and family-centred care, discussion will be based on parent questions/concerns and/or clinical judgement</th></tr>
<tr><td>0–2 Years
Breastfeeding and/or human milk feeding and/or formula feeding
Age-appropriate solid food intake</td><td>2–19 Years
Variety of foods from Canada's food guide
Body image concerns
Disordered eating pattern</td></tr>
<tr><td colspan="2">Age-appropriate milk and/or plant-based beverages
Feeding relationship and family meals
Availability/access to healthy food
Intake of juice and/or sweetened beverages
Child's overall health
Voiding and stooling
Presence of, or recent history of, acute or chronic illness
Stress or change in child's life
Family growth patterns
Age-appropriate physical activity
Screen time/sedentary behaviours
Sleep patterns</td></tr>
</table>

Growth Assessment

Growth assessment alone is not a diagnostic tool and should always be used in conjunction with other information.

When looking at growth:

- Growth should be considered along with other factors when determining a child's overall health. A child's size and growth rate are influenced by factors such as parental stature and genetic conditions (e.g., Down syndrome, cerebral palsy), as well as by gestational age, birth weight, acute or chronic illness, food intake and activity level. In most children, height and weight measurements follow consistently along a 'channel', on or between the same percentile line(s). Some shifts in a child's growth pattern may be expected in the first two years of life and during puberty.
- Considering all measures (length/height, weight, weight-for-length/BMI, head circumference) collectively will allow for a more complete picture of growth.[23]
- Growth patterns over time are more important than one single measurement.[23] One-time measurements only describe a child's size and do not provide adequate information to assess a child's growth pattern. A series of weight and length/height measurements over time are required to reflect a child's growth pattern.

Identifying Growth Concerns

A growth pattern that follows consistently on or between the same percentile line(s) is considered a normal growth pattern.

Growth patterns that can be considered for further assessment and/or referral include:

- A growth pattern that remains flat is usually a growth concern and requires further assessment.[23]
- An incline or decline from a child's previously established growth pattern can signal a growth concern and require further assessment. This is especially the case if the change is nearing a cut-off point (refer to Tables 6 and 7) or is a sharp change.[23]
    - This **may** be a normal growth pattern. However, it signals a need for further assessment and/or referral.
    - After the first few months of life, formula-fed infants may show an upward shift in growth.[2,18,19] A child's growth pattern, familial sizes, and whether they are fed breastmilk/human milk or formula should be considered before suggesting any changes in feeding.[2]
- Cut-off points (refer to Tables 6 and 7) guide further assessment, monitoring, and referral.[1] Cut-off points should **not** be used as diagnostic criteria.[1]
- Weight velocity refers to weight change over a specific period (e.g., grams/week).[1] It is not a standard assessment tool, however, it may help to identify growth problems earlier where changes on growth charts are difficult to detect.[1] If using weight velocity in conjunction with the growth chart, refer to Appendix A.

Table 6. Cut-off Points and Messages for Families (Birth to 24 Months)[16,24]

Indicator	Percentile cut-off point	Z-score (for clinical settings)	Growth concern (for health professional reference only)	Message for families
Weight-for-age	Less than 3	Less than -2	Possibly underweight	Weight may be low
Length-for-age	Less than 3	Less than -2	Possibly stunted	Length may be low
Weight-for-length	Less than 3	Less than -2	Possibly wasted	Weight may be low
	Greater than 97	+2	Possibly overweight	Weight may be ahead of length
	Greater than 99.9	+4	Possibly obese	
Head circumference-for-age	Less than 3	-2	Microcephaly	Head circumference is small
	Greater than 97	+2	Macrocephaly	Head circumference is large

Table 7. Cut-off Points and Messages for Families (2 to 19 years)[16,24]

Indicator	Percentile cut-off point		Growth concern (for health professional reference only)	Message for families
	2–5** years	5–19 years		
Weight-for-age*	Less than 3		Possibly underweight	Weight may be low
Height-for-age	Less than 3		Possibly stunted	Height may be low
BMI-for-age	Less than 3		Possibly wasted	Weight may be low
	Greater than 97	Greater than 85	Possibly overweight	Weight may be ahead of height
	Greater than 99.9	Greater than 97	Possibly obese	
	n/a	Greater than 99.9	Possibly severely obese	

*There are no cut-offs for interpretation of weight-for-age after 10 years of age; BMI-for-age cut-offs can be used as a guide to assist with the assessment of growth.[1]

** Up to but not including 5 years of age[2]

The **Growth Monitoring Summary Sheet** (Figure 6) summarizes the interpretation of growth measurements and indicates corresponding messages for families and follow-up actions.

Figure 6. Growth Monitoring Summary Sheet

Complete and document age-appropriate growth measurements and view on the appropriate growth chart.
Review all plotted growth measurements on client's record. If the current measurement is outside of expected parameters or an unexpected shift in growth has occurred, check age parameters and growth chart selection, and if necessary, re-measure.

↓

Assess family's receptiveness to discussing growth.
Provide Core Growth Messages and review Standard Discussion Points appropriate for child's age.
Consider all factors that might be currently affecting growth.

↓

Growth measurements are consistent with previous growth pattern.	**Shift** in growth pattern: • sharp incline/decline • movement across percentiles, nearing a cut-off point • growth line is flat	Below 3rd percentile:		Above 97th percentile:	Above 85th percentile:	Head circumference-for-age (birth to 24 months):
		Birth to 24 months weight-for-length weight-for-age length-for-age	**2 to 19 years** BMI-for-age weight-for-age height-for-age	**0 to 2 years** weight-for-length **2 to 5 years*** BMI-for-age	**5 to 19 years** BMI-for-age	**Below 3rd percentile** and growing slowly or **Above 97th percentile** and growing rapidly

↓

This may be a normal growth pattern. Consider if further assessment and monitoring is needed.
Use the messages below if the growth pattern indicates potential growth concern.

Message for Families				
"Growth pattern appears normal"	"Growth pattern may be changing"	"Weight may be low" "Length/height may be low"	"Weight may be ahead of length/height"	"Head circumference is small" or "large"

↓

Consider a follow-up visit to track growth sooner than the next scheduled routine appointment.

Determine if a referral to another health professional is needed:

- Physician should be notified** if the growth line is flat, if this is the first time the child has plotted outside of expected parameters and/or professional judgment indicates. Follow-up with physician may be recommended.
- Offer/recommend a referral** to a dietitian if individualized nutrition guidance is indicated.
- Refer** to a lactation consultant or other pediatric specialist if indicated.
- Offer appropriate resources and discuss relevant community programs.

*Up to but not including 5 years of age,
**Obtain consent, notify or refer as per site process.

Discussing Growth with Families

Begin by assessing how receptive the family/client is to discussing growth, explaining growth monitoring practices and core growth messages, exploring each client's individual growth pattern, and providing client-centred care and support.

Use the Growth Monitoring Summary Sheet (Figure 6) and Pediatric Growth Discussions: A Tool for Health Professionals to guide discussions with families at all visits. Table 8 summarizes the key steps for discussing growth with families.

Table 8. Steps for Discussing Growth with Families

	Sample dialogue (from Pediatric Growth Discussions: A tool for Health Professionals)
Step 1: Assess It is important to assess how receptive a family is to discussing growth.	"Has a health professional ever discussed your child's growth with you or provided you with information about growth charts?" "Would it be OK if you and I talked about your child's growth today with your child here?"
Step 2: Explain Health professionals can describe general healthy growth patterns and explain how growth charts are used to help enhance a family's understanding of their child's growth.	"Growth is one sign of a child's general health. Over time, growth measurements plotted on a growth chart show a child's own growth pattern. A child's growth pattern shows if they are growing well or if they are moving in a direction that may signal a possible growth concern." "Your child's weight has been plotting high on the growth chart. This may be normal for your child based on what you've told me about the height and build of your family."
Step 3: Explore When considering a child's individual growth pattern, it is important to explore all factors that may influence growth, along with barriers, facilitators, and readiness to make change.	"Have there been any recent illnesses or stresses in your child's life?" "Growth patterns can signal us to take a look at family routines such as eating, physical activity and sleep. If you like, we can talk about these routines and discuss what is going well and any areas where you may wish to make changes." "What has your child's activity level been like lately?"

	Sample dialogue (from Pediatric Growth Discussions: A tool for Health Professionals)
Step 4: Facilitate goal setting and provide support Health professionals can assist families by applying a family-centred approach and by offering support, whether there is a growth concern or not. Health professionals can reinforce positive family practices, facilitate goal-setting for possible areas of change, offer education/resources and arrange for follow-up or referral.	"Given what we have talked about, what do you think would work for you and your family as a next step?" "I understand how hard this must be for you. There are programs in your community that can help support your family with some of the challenges you are facing right now. Would you like to talk about them?" "Small changes that improve the health of your family are much easier to make and maintain than drastic ones. Too many big changes at once can be overwhelming."

Education Resources

The following education resources can support growth discussions with families:

- For nutrition resources, refer to Nutrition Education (ahs.ca/NutritionHandouts) and search for:
  - When Your Child's Weight Measures Low
  - When Your Child's Weight is Ahead of Height
- For child growth and development information for infants and young children, visit Healthy Parents, Healthy Children.

Referrals

If a referral to another health care provider or program is indicated, refer as appropriate according to zone or site referral processes.

For a referral form for provincial weight management programs (2–17 years), refer to Provincial Pediatric Weight Management Referral in the Alberta Referral Directory (switch to desired location) or via Connect Care.

Resources

Health Care Provider Resources

- For more information on discussing growth with families, refer to Pediatric Growth Discussions: A Tool for Health Professionals
- For a recording template for calibration activities, refer to Childhood Growth Measurement Calibration Recording template
- To further explore weight bias in healthcare settings, search “Exploring bias around overweight and obesity” on Insite (for AHS staff only)

Appendix A: Weight Velocity

Weight velocity refers to weight change over a specific time (e.g., grams/week).[1] It is not a standard assessment tool, however, it may help to identify growth problems earlier where changes on growth charts are difficult to detect.[1] In particular, weight velocity can be helpful in the early weeks after birth, as growth charts do not account for infant postnatal weight loss.[25]

Other points to consider with weight velocity include:

- Weight velocity and the use of growth charts may be challenging for term infants in the first two weeks of life as neonatal losses are not reflected.[25] Losses of up to 10% of birthweight are normal in the first days after birth and it is normal for it to take two weeks to return to birthweight, with some infants taking three weeks or longer.[26,27] If infants have not reached birthweight by two weeks, further assessment should occur to determine if there are any concerns such as feeding abilities or parent challenges.[10]
- Weight velocity can fluctuate and be influenced by several factors, therefore use should be limited to the investigation of growth concerns and interpretation alongside the growth chart and recent medical history should be considered.[28] For example, a low weight velocity may be expected if a child was growing at a higher percentile and the rate of weight gain then slows as the child settles into their unique pattern of growth. A higher weight velocity may reflect recovery after an illness.[3]
- Weight velocity is less relevant after 6 months of age when a child's growth typically slows. At this time, the lower end of the approximate weekly weight gain ranges may be too low to be a sensitive indicator for potential growth concerns, therefore, growth charts are the preferred tool.

The WHO Weight Velocity Standards can be used to assess the weight velocity of term infants up until 24 months of age. Table 9 was adapted from these standards for use in weekly follow-up appointments. Further assessment may be warranted when repeated or successive measures are below the approximate weekly weight gain.[28] The table is for health professional reference only and should **not** be distributed to clients.

Table 9. Approximate Weekly Weight Gain for Healthy Term Infants (Birth–6 Months) (For Health Professional Reference Only)

	Approximate weekly weight gain (grams)*[10]		Typical growth	Indications for further assessment
	Girls	Boys		
Birth–14 days	Because of normal weight loss after birth and weight fluctuations, weekly weight gain values cannot be provided.		It is normal for infants to lose weight for the first few days after birth and to take 2 weeks or longer to return to birth weight.[10]	If an infant has lost more than 10% of birth weight or has **not returned** to birth weight by 2 weeks of age, further assessment should occur.[10]
15–28 days**	Weekly weight gain is generally 150 g **or more.**	Weekly weight gain is generally 175 g **or more.**	After returning to birth weight, infants should continue to gain weight.[27]	Weight gain **lower than** the values to the left may signal a growth concern; further assessment should occur.
1–2 months	130–360 g weekly	165–420 g weekly	The values to the left represent approximate weekly weight gain for healthy, term infants. In a given week, infants may gain above or below these values and be experiencing normal, healthy growth.	Repeated or successive measures **below the lower end** of the ranges to the left may signal a growth concern; further assessment should occur.
2–4 months	90–235 g weekly	100–250 g weekly		
4–6 months	50–170 g weekly	50–180 g weekly		

*Conversion – to convert grams to ounces, divide by 28.
**There is not enough evidence to identify upper cutoffs for excessive or rapid weight gain.
Adapted from: WHO Growth Velocity Standards[10]

Further assessment and support may include:

- Further exploration of all factors impacting growth
- Breastfeeding and/or human milk feeding support and/or referral to another health professional (PHN or lactation consultant [IBCLC or CLC])
- Information on appropriate infant formula and preparation as appropriate
- Follow-up weight checks
- Referral to a physician to investigate any potential medical causes
- Referral to a registered dietitian

The WHO weight velocity standards were designed for use with healthy term infants and do not specifically address preterm infants or infants with intellectual, developmental, genetic, or other conditions (e.g. cerebral palsy, Down syndrome, Turner syndrome, etc.).

Appendix B: Plotting by Hand

Plotting by hand may be required as a downtime procedure for electronic charting systems.

Note: A slight shift in an individual child's growth pattern may be observed when switching between paper and electronic plotting due to the ability for increased accuracy with electronic plotting. If the growth pattern for a child who was previously plotted electronically, and is now being plotted on paper, appears to have shifted slightly, consider plotting the recorded lengths and weights from the previous visit(s) into a new record.

Calculating Age

Incorrect calculation of age can be a source of error in plotting and can result in an incorrect assessment of the growth of a child.[13,29]

Term infants, Children, and Adolescents

Age can be calculated using a calendar. Use the day of the month that the child was born, and count the completed calendar months, weeks, and days.

Example:
A child born on 27/Jan/2023 will be 8 calendar months old on 27/Sept/2023 and 9 months old on 27/Oct/2023.

If today's date were 13/Oct/2023, the child born on 27/Jan/2023 would be 8 months, 2 weeks and 2 days old.

Preterm Infants

Corrected age can be calculated using the equations below.

Step 1: # of weeks preterm = 40 weeks – gestational age at birth (completed weeks)

Step 2: Corrected age = postnatal/chronological age (completed months and weeks) – # of weeks preterm
Note: Although a month contains an average of 4.33 weeks, for the purpose of this calculation, approximate that a month is equal to four weeks.

Example:
A baby was born preterm at 34 weeks and is now 6 months 3 weeks old (postnatal/chronological age).

Step 1: # of weeks preterm = 40 weeks – 34 weeks = 6 weeks preterm

Step 2: Corrected age = (6 months 3 weeks) – 6 weeks = 5 months, 1 week

Calculating BMI

A child's BMI **value** needs to be determined before plotting on the 2 to 19 year body BMI-for-age growth chart.

BMI can be calculated as follows using a standard calculator:

- BMI = weight (kg) ÷ height (cm) ÷ height (cm) x 10 000
  (This equation can be found on the growth charts.)

The BMI value should be rounded to one decimal place.[30]

Example:
A child's weight is 12.7 kg and height is 97.8 cm.

BMI = 12.7 kg ÷ 97.8 cm ÷ 97.8 cm x 10 000 BMI = 13.277

BMI = 13.3

Plotting

- Plot the recorded measurements for the current visit on the appropriate growth chart (Refer to Table 4). If you do not have paper copies available at your site, they may be printed from the AHS Growth Charts webpage. It is only possible to assess trends when points are plotted for two or more visits.[23]
- On the horizontal axis: find the child's age or length, depending on the growth chart being used.
- On the vertical axis: find the child's weight, length/height, BMI or head circumference, depending on the growth chart being used.
- Use a straight-edge ruler or right-angle triangle to follow the child's age/measurements from the horizontal and vertical axis' to find the point on the growth chart where they intersect (See Figure 7).
- Draw a small dot at the intersecting point.

Figure 7. Plotting using a right-angle triangle

Appendix C: Equipment Specifications

There are many options for growth measurement equipment that offer high-quality and reliable measurements. An equipment specification checklist is provided below. Consult with your purchasing department to determine which products are currently available for purchase. Equipment recommendations are for both stationary and portable equipment.

General Specifications

Equipment should have contact surfaces that are smooth and easy to clean with AHS-approved disinfectants. Equipment with many complex surfaces or with unsealed joints and crevices cannot be cleaned and are not acceptable.

Scale Specifications[13]

Scales should be durable, accurate, and safe. Common bathroom scales are not acceptable and can be inaccurate.

Wheelchair Scales

Providing accessible weighing scales can improve the quality of care provided to those with mobility and/or activity limitations. The most common type of accessible scale is a wheelchair scale. These can be used for wheelchair users, those with limited stability, and those needing to sit on a chair while being weighed. These types of scales include folding portable, stationary, and platform (portable and in-ground).

Scale specifications are described in Table 10.

Table 10. Scale Specification Checklist

Infant scale (birth to 2 years)	Child and adolescent scale (2 to 19 years)	Wheelchair scale
☐ High-quality electronic digital scale. Beam balance is an acceptable alternative. ☐ Weighs in 0.001kg or 0.01 kg increments. Refer to site-specific requirements. ☐ Weighs to 20 kg ☐ Tray large enough to support the infant ☐ Can be tared to zero ☐ Can be calibrated Desirable features: ☐ Motion detector and stabilizer ☐ 'Average weight' feature with the ability for weight to be 'locked' in	☐ High-quality electronic digital scale. Beam balance is an acceptable alternative. ☐ Weighs in 0.1 kg increments ☐ Weighs from 5 kg to 105 kg ☐ Stable weighing platform ☐ Weight can be 'locked' in ☐ Can be read at eye level of measurer ☐ Can be tared to zero ☐ Can be calibrated ☐ No height device attached	In addition to the child and adolescent scale specifications, the wheelchair scale has: ☐ Sturdy handrails ☐ Wide platform for power wheelchairs ☐ Slip-resistant platform ☐ Large digital display
Equipment examples: Seca 727 Electronic Baby Scale with damping system, Seca 334 Mobile Electronic Portable Infant Scale	Equipment examples: Seca 703, Seca 876 (portable)	Equipment example: Scaletronix wheelchair scale model 6002 supplied by Global Medical Products

Length Board and Stadiometer Specifications[13,15]

Length boards

Length boards allow for accurate length measurements. They should be durable, accurate, and safe for the infant or child being measured. Rulers or tapes on examination tables are not accurate. Inappropriate equipment used for measuring tends to measure 'short'. Length attachments for infant scales are not recommended unless they meet the same specifications as a length board.

Stadiometers

Stadiometers can be portable or permanently fixed to a wall. A common failing of the portable stadiometer is a base that is too small, which leaves the stadiometer unstable and not entirely perpendicular to the floor. Devices attached to scales do not have a firm platform and can be sharp. Other examples of inaccurate and unacceptable devices for measuring height include tapes, yardsticks or graphics attached to the wall.

Length board and stadiometer specifications are described in Table 11.

Table 11. Length Board and Stadiometer Specification Checklist

Length board	Stadiometer
☐ A firm, flat horizontal surface ☐ Measuring range of 40 to 99 cm for infants from birth to 24 months of age, or up to at least 180 cm for children/adolescents ☐ Measures in 0.1 cm (1 mm) increments ☐ Fixed tape that is easy to read ☐ An immovable headpiece at a right angle to the tape ☐ Moveable foot piece, perpendicular to the tape	☐ A vertical board with an attached metric rule ☐ Height range of at least 70 cm to 205 cm ☐ Measures in 0.1 cm (1 mm) increments ☐ Moveable horizontal headpiece that can be brought into contact with the most superior part of the head ☐ Wide and stable platform or uncarpeted floor as a base ☐ Firmly mounted on a stable wall (if applicable)
Equipment examples: Perspective Enterprises PE-RILB-BRG2, Seca 417 Measuring Board (portable), O'Leary Adult Recumbent Board Model REC LB-6X supplied by Ellard Instrumentation (non-ambulatory children/adolescents)	Equipment examples: Seca 222, Seca 213 (portable)

Head circumference tape measure specifications[13]

Insertion tapes are recommended, as they provide a more accurate view of the measurement than that obtained by overlapping the edges of a tape measure.

Head circumference tape specifications are described in Table 12.

Table 12. Head Circumference Tape Specification Checklist

Head Circumference Tape
☐ Flexible, non-stretchable tape ☐ Measures in 0.1 cm (1 mm) increments ☐ Plasticized insertion tape is desirable
Equipment examples: Plasticized Head Circumference Reusable Insertion Tape Measure, Abbott Laboratories Co 20037907 (Oracle #402651)

Appendix D: Maintenance and Calibration

The purpose of this appendix is to provide maintenance and calibration recommendations that can be used to ensure the accuracy and reliability of childhood growth measurement equipment.

Regular calibration and maintenance help ensure that growth measurement equipment produces accurate and reliable measurements when proper measurement techniques are followed.

Equipment which is regularly calibrated and accurate is one of three components essential to achieving accurate measurements.

Care of Measurement Equipment

- Follow AHS Infection Prevention & Control (IPC) Procedures for hand hygiene, cleaning and disinfecting of measuring equipment (non-critical multi-use medical equipment/devices) and cleaning/transporting of portable equipment.
- Store equipment at normal indoor temperature, protected from humidity and wetness.

Maintenance and Calibration

A suggested calibration testing schedule for growth measurement equipment is outlined below. Follow site procedures and/or manufacturer's calibration guidelines.

Table 13. Growth Measurement Equipment Calibration Testing Schedule

Equipment	Frequency of calibration testing	Responsible	Calibration equipment used
Stationary equipment			
Infant scales	Check calibration upon installation and monthly thereafter	End user	Calibration weights
Length boards (infantometer) and stadiometer	Check calibration upon installation and monthly thereafter	End user	Calibration rod
Wheelchair scale for non-ambulatory children	Upon installation and yearly thereafter	Professional calibration	Professional calibration

Equipment	Frequency of calibration testing	Responsible	Calibration equipment used
Child/adolescent scale	Upon installation and yearly thereafter	Professional calibration	Professional calibration
Recumbent length board for non ambulatory children	Check calibration upon installation and monthly thereafter	End user	Calibration rod
Portable equipment			
Infant scales	Once per day if used daily or before each use, if used less frequently	End user	Calibration weights
Length board (pediatric) and stadiometers	Once per day if used daily or before each use, if used less frequently	End user	Calibration rod
Child/adolescent scale	Upon installation and yearly thereafter	Professional calibration	Professional calibration

Maintenance and calibration of an infant scale

1. Check for damage. Equipment that shows evidence of damage and/or cannot be cleaned adequately should be repaired or replaced.
2. Check calibration:
    i. Zero the scale.
    ii. Gently place the calibration weight (e.g., 5.000 kg) in the centre of the scale. To ensure an accurate measurement reading, the weight(s) should be placed evenly over the center area of the scale.
    iii. Record the measurement to the nearest 0.001 kg (i.e., gram).
    iv. Repeat the above steps a second time. (e.g., weigh the calibration weight a total of two times).
    v. The measurement reading should be exactly the same as the known weight of the calibration weight each time (e.g., a 5.000 kg calibration weight should read 5.000 kg on the scale).
    vi. An acceptable tolerance range is +/- 0.01 kg over or under the weight of a known calibration weight (e.g., a scale with a 5.000 kg weight on it should read between 4.990–5.010 kg).

vii. Record the outcome on the 'Calibration Record' and indicate any action taken if needed.

viii. If the scale reads outside the acceptable tolerance range (e.g., 5.020 kg), calibrate the scale following the calibration guidelines for the piece of measurement equipment (calibration guidelines are available from the manufacturer for each model).

ix. If the scale was not successfully calibrated and the error is consistent, adjust measurements accordingly, until the scale can be properly repaired (e.g., If after an attempted calibration of the scale, a measurement is consistently showing an error of 0.020 kg, adjust the measurement by subtracting or adding 0.020 kg, as appropriate). Document that an adjustment was made.

3. Professional calibration should be conducted if a scale is found to be weighing inaccurately when checked with standard weights, and the site is unable to calibrate it 'in-house' following the manufacturer's directions. Professional calibration is recommended yearly (or according to the manufacturer's direction if different) for infant scales that are not checked with standard weights according to the schedule outlined in Table 13.

Maintenance and calibration of length boards

1. Check for damage. Equipment that shows evidence of damage and/or cannot be cleaned adequately should be repaired or replaced.
2. Ensure that the joints of the length board are tight and straight.
3. Check that the measuring tape can be read. If it is too worn to be read, it should be replaced.
4. Check calibration:
   i. Place one end of the calibration rod directly on the base with one end firmly against the headboard.
   ii. Bring the footboard to rest firmly against the other end of the calibration rod.
   iii. Read the measurement to the last completed mm. The measurement reading should be exactly the same as the known height/length of the calibration rod (e.g., a 95.0 cm calibration rod should be measured as 95.0 cm with the length board).
   iv. An acceptable tolerance range is 1.0 cm over or under the length or a known calibration rod (e.g., a length board being checked with a 95.0 cm rod should read between 94.0 and 96.0 cm).
   v. Record the outcome on the 'Calibration Record' and if needed, indicate any action taken.

vi. If the length board reads outside the acceptable tolerance range (e.g., 97.0 cm), try to calibrate the length board following the calibration guidelines for the piece of measurement equipment (calibration guidelines are available from the manufacturer for each model).

vii. If the length board was not successfully calibrated and the error is consistent, adjust measurements accordingly, until the length board is calibrated or replaced (e.g., If after an attempted calibration of the tool, a measurement is consistently showing an error of 2.0 cm, adjust the measurement by subtracting or adding 2.0 cm, as appropriate). Document that an adjustment was made.

viii. If measurements are showing an error of variable amounts, or the equipment cannot be calibrated, notify your manager and follow local procedures for professional calibration.

5. Professional calibration should be conducted if the infant length board is found to be measuring inaccurately and the site is unable to calibrate it 'in-house' following the manufacturer's directions. Professional calibration is recommended yearly (or according to the manufacturer's direction if different) for infant-length boards that are not checked with standard rods according to the Growth Measurement Equipment Calibration Testing Schedule.

Maintenance and calibration of a stadiometer[16]

1. Check for damage. Check that the joints of the stadiometer are tight and straight. If not, tighten or straighten them.
2. Check that the measuring tape can be read. If it is too worn to be read, it should be replaced.
3. Equipment that shows evidence of damage and/or cannot be cleaned adequately should be repaired or replaced.
4. Check calibration:
   i. Place one end of the calibration rod on the stadiometer base.
   ii. Lower the stadiometer headpiece to rest firmly against the top end of the calibration rod.
   iii. Ensure that the rod stands perpendicular to the base.
   iv. Read the measurement to the last completed mm.
   v. Record the outcome on the 'Calibration Record' and indicate any action taken if needed.
   vi. The measurement reading should be exactly the same as the known height/length of the calibration rod (e.g., a 95 cm calibration rod should be measured as 95 cm).

vii. If the measurement is not consistent with the length of the calibration rod, adjust according to the manufacturer's instructions.

viii. If the stadiometer cannot be calibrated and the error is consistent, adjust measurements accordingly until the stadiometer can be calibrated or replaced (e.g., If after an attempted calibration of the tool, a measurement is consistently showing an error of 2.0 cm, adjust the measurement by subtracting or adding 2.0 cm, as appropriate). Document that an adjustment was made.

5. Professional calibration should be conducted if the stadiometer is found to be measuring inaccurately and the site is unable to calibrate it 'in-house' following the manufacturer's directions, professional calibration should be conducted. Professional calibration is recommended yearly (or according to the manufacturer's direction if different) for stadiometers that are not checked with standard rods according to the Growth Measurement Equipment Calibration Testing Schedule (Table 13).

Maintenance and calibration of a child/adolescent scale

1. Check for damage. Equipment that shows evidence of damage and/or cannot be cleaned adequately should be repaired or replaced.
2. Professional calibration is recommended yearly (or according to the manufacturer's direction if different) for child/adolescent scales.
3. Record the outcome of calibration in the "Calibration Record".

Appendix E: Special Considerations for Length/Height Measurement

When it is difficult to measure a child in a vertical plane[15]

If the child cannot easily place their head, scapulae, buttocks, and heels in one vertical plane, (e.g., a child with a larger body) a minimum of two contact points (the back of the head and buttocks, or the heels and buttocks) should be in contact with the wall or vertical surface of the measuring device with the trunk vertical and balanced over the waist. Record the points of contact.

Measuring a child with leg length asymmetry[15]

If the child has leg length asymmetry, the child should stand on the longer leg with the shorter leg supported by a block or wedge of suitable height until the pelvis is level and both knees are fully extended. When measuring length, keep the legs together and measure to the heel of the longest leg. Record the presence of leg length asymmetry.

Measuring a child wearing a cultural headpiece

If the head covering does not fit close to the head, such as a turban, choose an alternative means of measuring height, such as upper arm length (see below). In children with religious topknots, the measuring arm of the stadiometer can be placed on one side of the topknot to obtain a reading. Record the method used to obtain height measurement.

Measuring height in children with physical variations or disabilities[15,16]

If the measurement of the standing height of a child with a physical variation or disability is not possible, the following methods are recommended:

- In children without contractures but who are non-ambulatory, use full body recumbent (supine) length. The child should be positioned on an infant length board (infantometer) or a recumbent length board made for this purpose. A tape measure should not be used to measure the length of infants or children due to poor reliability. Measure to the nearest 0.1 cm, subtract 0.7 cm to convert to height and record.
- If recumbent length is measured in a child with spasticity, contractures, and/or other musculoskeletal variations, measure the side of the body that is unaffected or less affected and that can be extended to the fullest. Record the side measured and the presence of spasticity, joint contractures, and/or other musculoskeletal variations.
- If the child has severe contractures, spasticity or scoliosis, or is too heavy to be lifted from a wheelchair, a segmental measure such as upper arm length may be used to track growth in height over time. Refer to the method below. This measurement should be taken by a trained individual to help minimize error.

Estimating height in children with lower leg variations

Several measures can be used to estimate height in children who have significant lower leg variations or have their knee, hip or ankle at a 90-degree angle and therefore cannot be measured in a recumbent position. It is important to document the type of segmental measure completed. In electronic charting systems, all measurements that are taken are populated on the selected growth chart and BMI is automatically calculated from the measure. Be aware when interpreting measurements that they may utilize different segmental measurements and estimation equations, and BMI is an estimation and should be interpreted with caution.

Procedures for measuring knee height, tibial length, and arm span and corresponding equations for estimating height are available in the Growth Assessment chapter of Pediatric Nutrition for Dietitians via Knowledge Resource Services (AHS internal only).[31]

Measuring upper arm length (UAL)[32,33]

- The child should face away from the measurer.
- The right arm should be bent at a 90-degree angle at the elbow with the right palm facing up.
- Mark the measurement site: Locate the end of the spine of the right scapula by following the scapula out to the arm until it makes a sharp V-turn to the front of the body. Using a cosmetic pencil, make a horizontal line on the uppermost edge of the posterior border of the spine extending from the acromion process.

Figure 8. Marking spine extending from acromion process

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- Hold the zero end of the measuring tape at this mark and extend the tape down the posterior surface of the arm to the tip of the olecranon process, the bony part of the mid-elbow. Immediately record the length to the nearest 0.1 cm.

Figure 9.

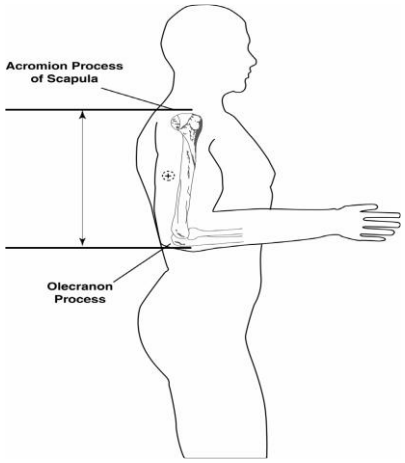

Figure 10. Correct tape placement for UAL

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- To plot the child on a growth chart, use the following equation to convert upper arm length to height:

standing height = (4.35 x UAL in cm) + 21.8

Appendix F: Definitions

Accurate: the nearness of the measure to the 'true' value.

Blind weight: client stands backward on the scale with the display covered or turned away so it is not visible to the patient.[34]

Body mass index (BMI): an index of weight and height; is defined as body weight in kilograms divided by height in meters squared.[2]

BMI-for-age: refers to the plotting of BMI according to age on sex-specific charts. This is done because adiposity varies with age and gender during childhood and adolescence. BMI-for-age is used continuously from age two to adulthood as a predictor of health risks.[2]

Calibrate: to check, adjust, or determine by comparison with a standard.

Calibration: a comparison or validation of the height or length or weight of an object with a known value.

Calibration weight: a standard weight used to check the calibration of stationery and portable equipment that measures length/height.

Calibration rod: a rod of known and fixed length is used to calibrate the stadiometer and infant length board.

Chronological age: See postnatal age.

Completed months/weeks: used in corrected age calculations. It is calculated by determining how many "full" or "complete" months or weeks of age a child has completed.

Corrected age: for preterm infants (less than 37 weeks, 0 days gestation), the age of the infant from birth minus the number of weeks born before 40 weeks of gestation.[1]

Frankfort Horizontal Plane: an imaginary horizontal line extending from the most inferior point of the orbital margin to the left tragion. The tragion is the deepest point in the notch superior to the tragus of the auricle.[13]

Gestational age: used to describe the age of a fetus or newborn infant.[35] It is calculated according to the time elapsed between the first day of the last normal menstrual period and the day of delivery.[35]

Growth monitoring: the serial weighing and measuring of the length/height (and head circumference if less than or equal to 24 months old) of a child and graphing the measurements on a growth chart.[1]

Head circumference: the measure of the largest circumference of the head, around the back of the head (occiput) and just above the eyebrows (supraorbital ridges).[13] It reflects brain size and is used for screening for potential health, nutrition or developmental problems.[2]

Height: the measure from the crown of the head (the superior point) to the bottom of the feet. Height is always measured standing.[13]

Height-for-age: reflects a child's height compared to their age.

Length: the measure from the crown of the head (superior point) to the bottom of the feet with the subject lying horizontally in a supine position. Length is always measured recumbent.[13]

Length-for-age: reflects a child's length compared to their age.

Macrocephaly: refers to a large head size and is commonly defined as a head circumference more than two standard deviations above the mean.[36] The causes are numerous and include normal familial growth patterns, hydrocephalus, malformations, and genetic, metabolic, and other disorders.[36]

Microcephaly: refers to a small head size and is most often defined as a head circumference more than two standard deviations below the mean.[36] Microcephaly may be due to chromosomal abnormalities, prenatal exposure to toxins, maternal infections and chemical agents, or an infection, trauma, metabolic disorder or anoxia during infancy.[37]

Plotted point: the plotted point on a graph where a line extended from a measurement on the horizontal axis (e.g. age) intersects with a line extended from a measurement on the vertical axis (e.g. weight).[23]

Postmenstrual age: used to describe the age of an infant; it is equivalent to gestational age plus postnatal (chronological) age.[35]

Postnatal age: (also known as chronological age) is used to describe a child's age after birth. It is calculated according to the time elapsed after birth.[35]

Postnatal period: the period from birth up to 8 weeks.

Reliable: how close repeated measures are to each other.[13]

Tare: to set the weight of the scale at 'zero' when a weight (person or paper barrier) is on the scale. Another person, such as an infant, can then be added and the weight of the infant read directly from the scale.[13]

Tolerance of a measure: the difference between two measures that are accepted as reasonable accuracy.

Weight bias is the negative weight-related attitudes, beliefs, assumptions, and judgements toward individuals with larger bodies.[6]

Weight-for-age: reflects body weight compared to a child's age.[23]

Weight-for-length: reflects a child's weight in proportion to attained growth in length.[23]

Weight stigma and discrimination: occur when attitudes and beliefs are shown through stereotypes, rejection, and devaluation toward individuals who do not comply with prevailing social norms of adequate body weight and shape.[38]

Zeroed: ensuring nothing is being weighed when a scale registers zero.[13]

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