

# **MICHIGAN WIC ANTHROPOMETRIC MEASUREMENT PROCEDURES**

(Weight, Height, Head Circumference)

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# ANTHROPOMETRIC MEASUREMENTS

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Information in this handbook is for educational purposes only. Reference to commercial products or trade names does not imply endorsement by the Michigan Department of Health and Human Services WIC program or bias against those not mentioned.

# ANTHROPOMETRIC MEASUREMENTS

## INTRODUCTION

Measurements of height (length or stature) and weight are indicators of one's nutrient and food energy intake which impact health and well-being. These measurements are a key tool in assessing a client's growth and development, particularly in young children. For infants and children, body measurements plotted on growth charts can provide a clue to whether a child's growth is normal or delayed and how a child's weight compares to growth of other children based on standardized growth charts. By examining a child's weight and height over time, a picture of the child's growth pattern emerges. For adults, comparing height and weight indicates weight for height proportion, normal, under or overweight using the Body Mass Index (BMI).

Since height and weight measurements are important in identifying individuals who may be at risk for or already have a nutritional problem, it is essential that correct height and weight measuring procedures are employed. This manual describes the measurement methods and techniques used to produce WHO growth studies. Employing these techniques ensures accurate and uniform body measurements from one visit to the next.

Anthropometric measurements are collected to:

- 1) Provide objective health data to assess physical growth and development
- 2) Evaluate an individual's nutritional status
- 3) Identify health problems (overweight and underweight, or potential developmental or neurological disabilities)
- 4) Identify individuals at nutritional risk in need of treatment and follow-up care

Proper measuring techniques contribute to an accurate assessment of the growth pattern and/or nutritional status of those being measured. Measurements recorded are used for Michigan PNSS and PEDSS data.

**WIC ANTHROPOMETRIC RISK DETERMINATION  
POLICY 2.15**

Height and weight measurements must be obtained on all WIC Program applicants at each certification screening and infant and child health/nutrition evaluation (I-Eval, C-Eval). Head circumference measurements must be taken on all infants and children under age two (2) years. All measurements must be recorded and entered on the MI-WIC Anthro screen. For pregnant women, prenatal weight is also entered on the MI-WIC Anthro screen.

Accurate Birth Weight, Weeks Gestation, Last Menstrual Period (LMP) and/or Expected Delivery Date (EDD) must be entered in MI-WIC in order for accurate calculation of percentiles and system-generated plot points on the appropriate growth charts and prenatal grids. CPA's should confirm or use their clinical judgment and make the final determination of Weeks Gestation and EDD.

**SUPPLIES AND EQUIPMENT**

**Infants – C1**

Head circumference tape  
Pediatric beam-balance or digital scale  
Infant recumbent length board (infantometer)  
WHO growth charts  
VLBW charts (IHDP)  
Disposable sheets or scale papers  
Stable surface for equipment  
Recording Form

**C2- Adult**

Adult beam-balance or digital scale  
Stadiometer  
CDC growth charts  
Prenatal weight gain grid  
Paper Toweling  
Foot stool  
Recording Form

**Optional:**

Under scale mat or board to stabilize scale if area is carpeted  
Calibration Rod (recommended)  
Steel tapeline calibrated to 1/16 inch  
with right angle head board (if Stadiometer unavailable)  
Manual growth chart plotting - Ruler or Ross Lab Accuplot™  
or PrecisePlot plotting grid and paper growth charts

## SCREENING AREA

Anthropometric measurements should be taken in a non-traffic area. Ideally, a separate room or quiet area where all equipment needed is available for performing the required measurements. Infant equipment should be placed on sturdy table or counter. The infantometer should be placed so one person can ensure the infant's head touches the headpiece of the infantometer. The area should also have hand washing facilities for handwashing before and after measuring infants. Use of hand sanitizer is acceptable.

### EQUIPMENT SET UP

Best practice is to state the measurements aloud exactly as seen on the measuring device, obtain a confirming measurement, record measurements on the Anthro Recording form (pg 53) or LA clinic form exactly as seen on the measuring device, convert the measurements into MI-WIC format and enter the data onto the MI-WIC Anthro data screen as soon as possible.

#### **Infant - C1** Anthropometric Equipment:

- Pediatric scale
- Recumbent Length Board (infantometer)
- Head Circumference tape
- Disposable Diaper (medium)
- Disposable paper
- Calibration rod
- Recording form
- Hand washing facilities
- Hand sanitizer for use when measuring infants

Pediatric scale and infant recumbent length board need to be placed on a sturdy table and have enough space for two people to measure an infant's length and to operate the equipment efficiently. Recumbent length board should be positioned so the person holding the infant's head can stand directly behind the headboard for best position to ensure the infant's head is touching the headpiece.

## **C2 – Adult Anthropometric Equipment:**

Adult beam-balance or digital scale  
Stature board (stadiometer) with an installation calibration device  
Disposable paper  
Calibration rod  
Recording form

### **PROCEDURES FOR TAKING BODY MEASUREMENTS**

Weight: C2-Adult

Adult beam-balance or digital scale needs to be placed on uncarpeted flooring. If this is not possible, the scale must be placed on a piece of plywood or fiberboard (at least larger than scale platform) or an under scale mat. This action is necessary to maintain scale accuracy. Place disposable paper on scale platform.

Height: C2-Adult

A stature board (stadiometer) with an installation and calibration device is recommended for most accurate measurements and is included with the purchase of most stadiometers. Wall-mounted stadiometers rest on the installation calibration device when it is used and helps ensure accurate placement of stadiometer over time, as well as accurate measurements. If using a steel tapeline, it must be attached firmly to a flat surface with clear strapping tape, in a straight, plumb line. A permanent attachment is preferred. If the flat surface is a wall, it should not have an extending baseboard. The tape line must be attached with "0" at the floor level. A wall mounted stature measurement board with at least a 75 inch tape line and permanently attached headboard is acceptable equipment for measuring stature. The flat surface of the board should extend all the way to the floor if used to measure children. It is recommended to test with a calibration rod to be sure it is attached accurately. Be sure the tape or stature board is attached such that there is a flat surface for measurement down to the heels. The area where the client stands should be covered with a disposable paper. Some staff may have to use a footstool to see the measurement reading at eyelevel.

All equipment should be calibrated at least annually (keep a record for Management Evaluations). It is also recommended to check the calibration of length and stature boards periodically since they do have moving parts that can loosen over time. If the equipment is no longer accurate, adjust using the calibration rod as the guide and a Phillips screwdriver.

# PROCEDURES FOR TAKING BODY MEASUREMENTS

Wash hands before and after measuring infants. Use of hand sanitizer is acceptable.

## WEIGHT

### Birth to Two Years

Children from birth through 23 months of age are weighed on a pediatric beam-balance or digital scale. Weight is recorded to the nearest ounce and fraction of an ounce according to the units of the scale being used. A disposable sheet and medium diaper are placed on the scale to zero-balance the scale. Tare the scale according to scale manufacturer directions. A fresh disposable sheet is used for each client.

**NOTE: Best practice is to state the measurement out loud, record exactly in units used for measuring according to the precision of the equipment being used (recording form available pg 53). Convert to MI-WIC units, then enter into MI-WIC.**

### Two Years and Older

Individuals, age two (2) and older, are weighed on an adult beam-balance or digital scale and weights are recorded into MI-WIC. The adult scale must have sensitivity to the nearest one-fourth (1/4) pound for the beam-balance scale or 0.2 pounds for the digital scale. It is acceptable to weigh children over 2 years old on a pediatric scale if it accommodates their weight.

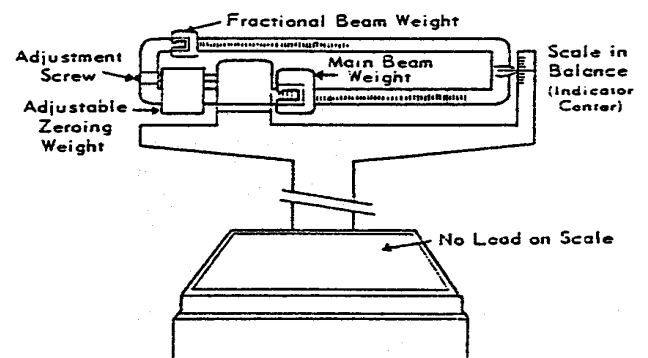
## BEAM-BALANCE SCALE PROCEDURES

### Equipment Preparation for Pediatric and Adult Beam-Balance Scales

The equipment should be checked each day before use for proper working order and horizontal balance. Check manufacturer's operating instructions.

The following instructions describe scale preparation for the pictured scale (Figure A).

1. Insure that the horizontal beam is operational (freely moveable when light pressure is placed on the scale and removed from the scale).





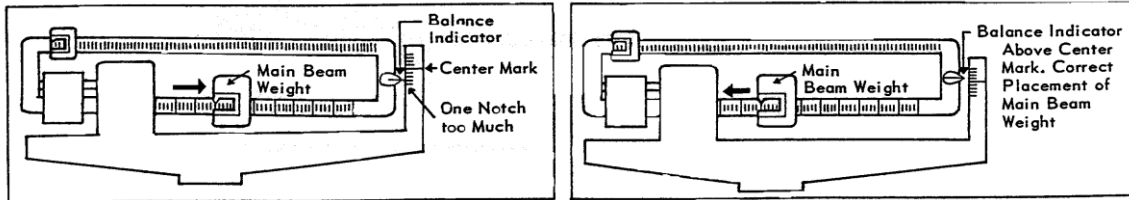
2. Zero balance the horizontal beam balance scale:
  - a. For the adult scale, nothing except a disposable paper towel should be on the platform.
  - b. For the pediatric scale, **zero the scale with a disposable sheet and a medium size dry diaper.**
  - c. Beam-balance scales must be zero balanced at least once daily, or more often if scale regularly goes out of zero balance. To confirm that the scale stays in zero balance, periodically a clinic will need to balance the scale several times during the day. [Please note that for digital scales it is possible to use the exact size diaper when zero balancing since digital scales require zero balancing with a sheet and dry diaper for each weighing.]
  - d. For the adult and pediatric balance beam scale, place the main and fractional sliding beam weights directly over the zero positions into the zero notch and check to see if scale is in balance. Make sure the main beam weight is exactly centered in the zero notch. If the fractional beam arm does not come to rest in the Indicator center of the scale, it is not in zero balance. Use the adjustment screw on the left of the arm to move the adjustment zeroing weight until the beam is in zero balance.
3. Adult beam-balance scale should be placed on an uncarpeted area. If this is not possible, the scale must be placed on a piece of plywood or fiberboard (at least larger than scale platform) or an under scale mat.

### Steps in Obtaining Weight Measurements Using Beam- Balance Scales

1. Confirm that the sliding weights on the horizontal beam are at the zero position and that the scale is in balance. Note that this step must be done at least once daily, or more often if scale regularly goes out of zero balance. Place a paper towel on the scale platform for sanitation.
2. Pediatric Beam-Balance scale (Birth to two (2) years of age or older)
  - a. Remove the dry diaper used for zero balancing and place the child in the middle of the weighing surface on the disposable sheet.
  - b. Weigh the child with ONE DRY diaper and light clothing such as a thin undershirt while lying or sitting.
3. Adult Beam-Balance scale (Two (2) years and older)
  - a. Direct the individual to stand in the middle of the weighing surface covered with a paper towel or disposable sheet.
  - b. Individuals are weighed WITHOUT shoes and wearing only light indoor clothing.

Sweaters, jackets, coats, hats, scarves, and shoulder bags must be removed. Remove small toys, rocks, etc. in children's pockets.

- Actual weight measurement is taken by moving the main beam weight away from the zero position into the notch, which first shows that too much weight has been added. This places the balance indicator below the center mark (Figure B). Move the main beam weight back one



notch. This will raise the balance indicator above the center mark (Figure C).

FIGURE B

- Move the fractional beam weight until the balance indicator is on the center mark (Figure D). This may require several back-and-forth adjustments of the fractional weight. This shows that the individual and the weights are in balance with each other. See Figure E for enlargement of fractional beam arm.

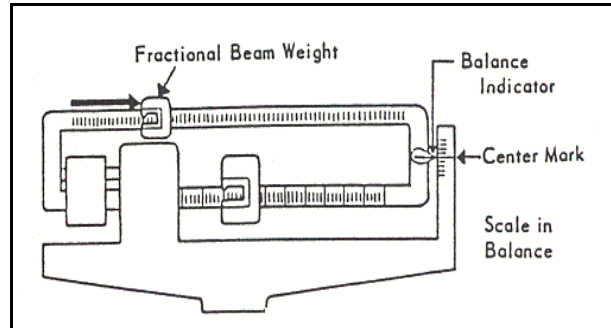
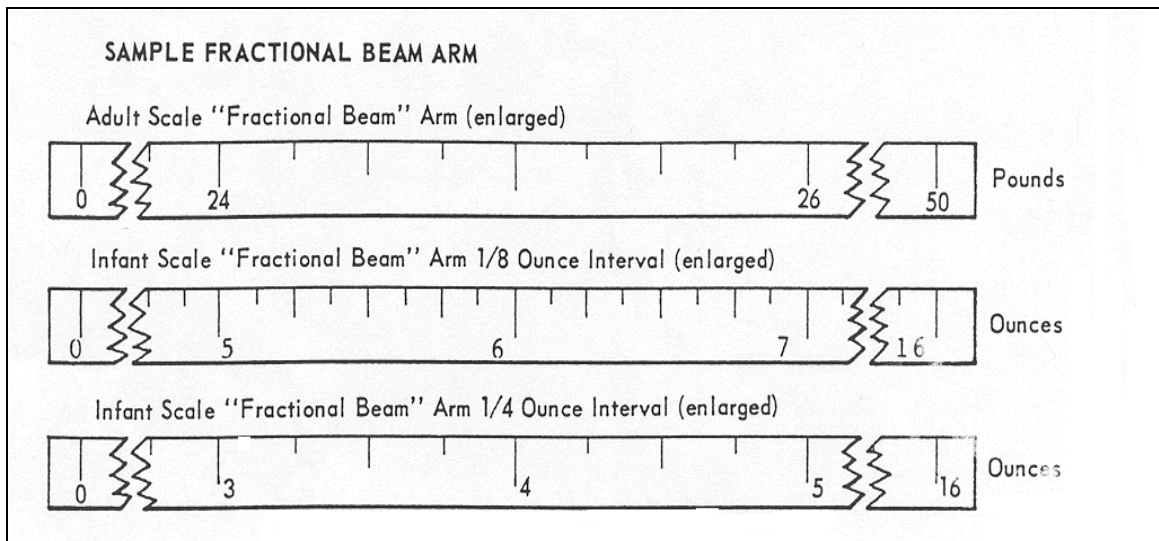


FIGURE E



6. Read aloud the weight measurement and write the measurement value on the recording form.
  - a. Pediatric Beam-Balance                      read the measurement to the nearest 1/8 ounce, 1/4 ounce, or 1 ounce according to the precision of scale.
  - b. Adult Beam-Balance                         read the measurement to the nearest 1/4 pound.
7. Return beam weights to zero position.
  - a. Keep infant or child on the pediatric scale.
  - b. Keep the child or adult on the adult scale.
8. Repeat steps 3 through 6 until a confirming measurement is obtained.
9. **Confirm the measurement:** compare the measurement with the previous one. Re-measure until two (2) readings agree within one ounce (or 1 ounce for scales with 1 ounce precision) for pediatric scales and one-quarter (1/4) pound for adult scales.
10. Record the confirming measurement value **IMMEDIATELY**. (Confirming measurement is the last measurement that agrees with a previous measurement according to allowable differences.)
11. MI-WIC plots the weight measurement on the Growth Chart of the corresponding with client's category. If the child's birth weight is < 1500 grams, the measurements will also be plotted on the VLBW Charts, used for educational purposes. Examples of these charts are found in Appendix G.

**NOTE: If children are very active on the scale, it may be necessary to zero balance a beam balance scale between readings.**

**Note for MI-WIC:** The "Unk" check box in the Anthropometric grid is checked if a measurement is not known or cannot be taken. Double-click in the Comment field to enter the reason for not being able to obtain a measurement.

**Note for MI-WIC:** The "?" check box is used if the measurement could not be taken using outlined measurement procedures (i.e. cast, uncooperative child, missing limbs, braces, etc.) or if a 24 month through 36 month old child's height is measured recumbently instead of a stature measurement. Check the "?" on the Anthropometric grid, make a note on that row explaining the reason the measurement was not taken according to outlined procedures. MI-WIC will plot the measurements, however, risk will not be assigned based on that measurement.

## DIGITAL SCALE PROCEDURES

### Equipment Preparation for Pediatric and Adult Digital Scales

1. Pediatric scale needs to be placed on a sturdy table to operate the equipment efficiently.
2. The digital scale should be checked each day according to manufacturer's operating instructions before use to insure accuracy of display.
3. Zero balancing digital scales
  - a. Some digital scales require zero balancing at each weighing. Some digital scales have a reweigh function allowing the person to remain on the scale for the confirming measurement.
  - b. Be sure the digital scale is set for pounds rather than metric weights.
4. The adult digital scale should be placed on an uncarpeted area. If this is not possible, the scale must be placed on a piece of plywood or fiberboard (at least larger than scale platform) or an under scale mat, unless the scale has new special balancing features allowing accurate measurement on a carpeted surface.
5. Either a disposable sheet for infant scales or paper toweling for adult scales is placed over the area where the client touches the scale for sanitation purposes.

### Steps in Obtaining Weight Measurements Using Digital Scales

Please note that there are many types of digital scales. Be sure the digital scales used have been approved for use for WIC measurements.

1. Adult/toddler digital scale should be placed on an uncarpeted area. If this is impossible, place scale on a piece of plywood or fiberboard larger than scale platform or an underscale mat. Infant scales should be on a stable surface.
2. Zero balance the digital scale with a paper towel or disposable sheet on the platform before each weight measurement is taken. If the scale has a re-weigh function, zero balance the scale before each child; however, it is not necessary to remove the client for the confirming weight.

**Infant Digital Scale (Birth to two (2) years of age):** Before zero balancing the scale, place a disposable sheet and medium size dry diaper on the digital scale so zero balance is done with the sheet and diaper on the scale. Be sure the scale is set to measure pounds and ounces.

- a. Remove the dry diaper and place the child in the middle of the weighing surface.
- b. Weigh the child with ONE DRY diaper and light clothing such as a thin undershirt while lying or sitting.

**Adult Digital Scales (Two (2) years and older):** Turn on the scale and allow the self check and zero balance to occur before the individual steps on the scale. Make sure the scale is set to measure in units of pounds.

- a. Direct the individual to stand in the middle of the weighing surface covered with a paper towel or disposable sheet.
  - b. Individuals are weighed WITHOUT shoes and wearing only light indoor clothing. Sweaters, jackets, coats, hats, scarves, and shoulder bags must be removed. Remove small toys in children's pockets.
3. Allow the digital scale to lock into the measurement value. The digital scale may beep or otherwise indicate the measurement is locked.
  4. Read aloud the weight measurement and write the measurement value on the recording form exactly as it appears on the digital scale display.
  5. If the scale does not have a reweigh function, remove the infant from the pediatric scale and place the diaper back on the scale. Zero balance the digital scale before taking a confirming measurement.

For clients two (2) years and older, ask the individual to step off the adult scale. Zero balance the digital scale before taking a confirming measurement.

6. **Confirm the measurement:** The confirming measurement is the last measurement that agrees with a previous measurement according to allowable differences. Repeat steps 3 through 6. Compare the measurement with the previous one. Re-measure until two (2) readings agree within one (1) ounce for infant scale and one-quarter (1/4) pound or 2 tenths (0.2) of a pound for adult scale.
7. When a confirming measurement is obtained, convert the measurement into MI-WIC units and enter on the Anthro screen **IMMEDIATELY** to avoid mistakes. **Note:** If the adult digital scale measures in tenths of a pound, this measurement may be entered directly into the weight field on the MI-WIC Anthro grid.
8. The weight measurement will be plotted in MI-WIC on the WHO or CDC Growth Chart. The VLBW (IHDP) Chart is used if the birth weight is < 1500 grams; the information is considered to be for educational purposes, rather than standardized.

Examples of these charts are found in Appendix G.

NOTE: At times, it may be impossible to obtain an accurate weight of a child (C2-C4) or infant without being held by an adult. A gross determination of weight may be obtained by weighing an infant or child held by an adult. Digital scales have a tare function which subtracts the weight of the adult. Weigh the adult first, then using the tare function, weigh the adult and infant or child. The tare function will subtract the weight of the adult. Enter the data into the Anthro grid, check the “?” and enter the reason the measurement was not performed according to the outlined procedure. MI-WIC will plot the data as a red asterisk but risk will not be assigned. Sensitivity of an adult scale is to the .2 lb or 1/4lb. The sensitivity of the infant pediatric scale is to the ounce. To get an accurate picture of an infant’s growth, it will be important to obtain a weight using outlined procedures the next visit.

**At times, children between two and three years of age are unwilling to be measured standing. If this is the case, take a recumbent measurement, check the ‘?’ box and record a comment stating the measurement was taken recumbently. The measurement will plot as a red asterisk but risk will not be assigned based on this measurement.**

## LENGTH

Wash hands before and after measuring infants. Use of hand sanitizer is acceptable.

### Birth to Two Years

Children from birth to two years must have their height measured as length (recumbent heel-to-crown). The device for measuring length is called an infant recumbent length board (infantometer). Taking recumbent length requires **TWO PERSONS**, one to hold the child's head in contact with the fixed headboard, and the other to hold the knees down and slide the footboard until it touches the heels of both feet. The child being measured should not wear shoes and feet need to be bare or with thin socks. Recumbent length is recorded to the nearest one-sixteenth (1/16) or one-eighth (1/8) inch.

### Equipment Preparation

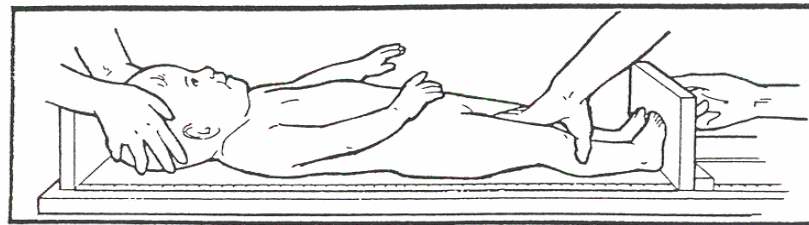
Each day before the recumbent length board is used, it should be checked for proper working order. Check for missing or loose screws and to see that the footboard (the end that slides) slides easily and is not worn, loose, or broken.

## Steps in Obtaining Length Measurement

1. Wash hands before and after measuring infants. Use of hand sanitizer is acceptable.
  - 1.
2. Place a disposable sheet on recumbent length board.
3. Ask caregiver to remove child's shoes, other footwear, and outdoor wear.
4. Place the child in the middle of the board.
  - a. First person: holds the child's head with **GENTLE BUT FIRM** traction, so that the crown of the head is in contact with the fixed headboard and the line of sight is directly upward until the measuring is completed. This person should be directly behind the headboard and not to the side, so as to position the child properly.
  - b. Second person: using the heel of one hand, holds the child's knees together and gently pushes the knees down against the recumbent length board. This will fully extend the child. With the other hand, slide the footboard to the child's feet until the heels of both feet touch the footboard. See Figure F below.

**Figure F**

Recumbent Length Position



4. Read the measurement to the nearest one-sixteenth ( $1/16$ ) inch or nearest one-eighth ( $1/8$ ) inch and record it on the recording form.
5. **For Confirming Measurement:** Keep the child in the middle of the board and slide the foot board away from the feet. Repeat steps 4 and 5 until two (2) readings agree within two-sixteenth ( $2/16$ ) or one-eighth ( $1/8$ ) inch. Record the confirming measurement on the recording form **IMMEDIATELY**, convert to MI-WIC units ( $16^{\text{th}}$ ) and enter that unit into the MI-WIC Anthro grid. See **Appendix C DATA ENTRY SYSTEM: MI-WIC**.
6. The length measurement will be plotted in MI-WIC on the WHO Growth Chart. The VLBW (IHDP) Chart is used if the birth weight is  $< 1500$  grams; the information is considered to be for educational purposes, rather than standardized.

Examples of these charts are found in Appendix G.

## STATURE

### Two Years and Older

Stature/height measurement should be performed on an uncarpeted area using an 84" steel tapeline attached to a true vertical flat surface, such as a wall without a baseboard or door jamb and a right angle head board. A wall mounted stature measurement board with at least a 75 inch tape line and permanently attached head board is acceptable equipment for measuring stature. The individual being measured should **NOT** wear shoes. A foot stool needs to be available for the staff person who is shorter than the individual being measured.

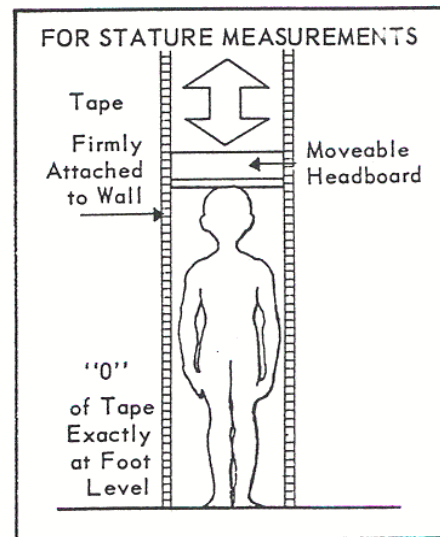
Stature measurement is recorded to the nearest one-sixteenth ( $1/16$ ) or one-eighth ( $1/8$ ) inch.

**NOTE: Height measuring rods which are affixed to balance beam scales are not acceptable. The scale does not have a stable surface for standing. The headpiece may not maintain a right angle position and the rod may not be accurately calibrated. Also, they are often calibrated in one-fourth ( $1/4$ ) inch increments.**

### Equipment Preparation

1. Check to see if the tape line is securely attached to a rigid vertical surface (door jam, wall without a baseboard, etc.).
2. Verify that the "0" mark on the tape is at the level of the foot sole. The steel tape line needs to be installed (see Figure G) above a carpet-free area.
3. Confirm that tapeline or mounted board is calibrated at 36 inches using an independent measurement (i.e., calibration rod or carpenter's tape measure).
4. Confirm the soundness of the right angle headboard.
5. Make certain the stature board and the foot board are mounted so that a small child can stand straight with heels and buttocks aligned vertically. It is recommended to use an Installation Calibration Device (ICD) to insure the stature board is mounted correctly and to provide the necessary alignment to obtain an accurate height for small children.

FIGURE G





## Steps in Obtaining Stature Measurement

1. Have the individual to remove shoes.  
If not wearing socks, place paper towel or disposable sheet to step on.
2. Ask the individual to stand "straight and tall" and look straight ahead.  
(Keep head straight and chin parallel to the floor)
3. The feet must be flat on the floor, slightly apart, legs and back straight, and arms at sides.
4. Place the body so that the shoulder blades, buttocks, and heels are touching the wall or vertical flat surface of the measuring device.

### FRONT VIEW

### SIDE VIEW

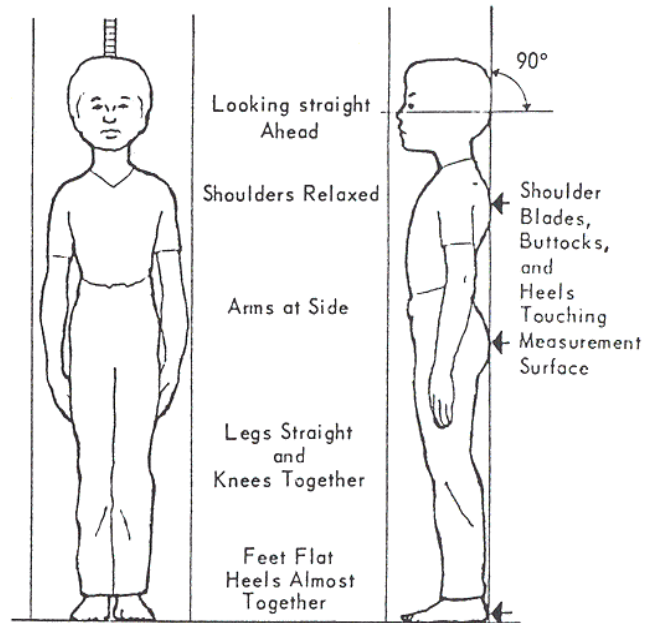
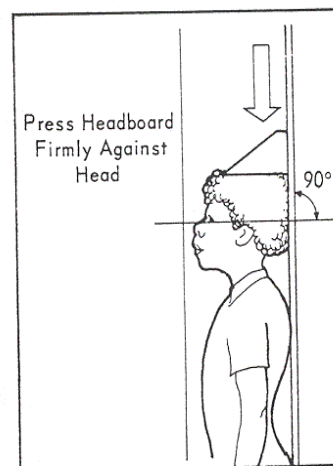


FIGURE I

5. The shoulders must be relaxed and in contact with the measurement surface. (Figure I)
6. The head often is not in contact with the measurement surface. The line of sight is horizontal.
7. Do not have the person lean on the steel tape line.
8. Check to see that knees are not flexed and that heels are not lifted from the floor. For young children who tend to stand on their toes, ask caregiver to assist by holding feet in proper position.
9. Lower a moveable headboard or plane (such as a block, squared at right angles against the wall) until it gently, but firmly, touches the crown of the head. Do not allow the hairstyle to prevent the board from touching the crown of the head.(Figure J)



10. If an unattached right angle head board is used, the measurement should be read while head board is properly in place. If the person needs to be moved to take the reading, the measurer's thumb needs to secure the head board against the wall to prevent slippage.
11. Read aloud the stature measurement to the nearest one-sixteenth (1/16) inch and record it on the clinic recording form.
12. Recheck to see that the child's knees are not flexed and that heels are not lifted from the floor.
13. **For Confirming Measurement:** Repeat the adjustment of the headboard and re-measure until two readings agree within two-sixteenths (2/16) inch. The measurer reads aloud the confirming measurement and records it **IMMEDIATELY** onto the recording form, convert into MI-WIC units and transfer data into MI-WIC.
14. MI-WIC plots stature measurements on the appropriate Growth Charts.

Examples of these growth charts are found in Appendix G.

**NOTE: If an individual has protruding buttocks, have only the buttocks in contact with the wall. The other usual contact areas (shoulder blades and heels) should be equal distances from the wall.**

**NOTE: At times, children between two and three years of age are unwilling to be measured standing. If this is the case, take a recumbent measurement, select '?' and record a comment stating the measurement was taken recumbently. The measurement will plot as a red asterisk but risk will not be assigned based on this measurement.**

## HEAD CIRCUMFERENCE

### Birth to 24 Months

Children from birth to twenty-four (24) months of age, must have their head circumference measured. This measurement is used for screening non-nutrition related abnormalities (micro and acrocephaly). While in the United States, head circumference is not considered a sensitive measure of nutritional status when a child's age, length and weight are known, it may provide information important for referral purposes...

### Steps in Obtaining Head Circumference

1. Take the measurement when the infant is lying on his/her back or sitting. If the child is restless, it may be necessary to hold the infant's head while taking the measurement.

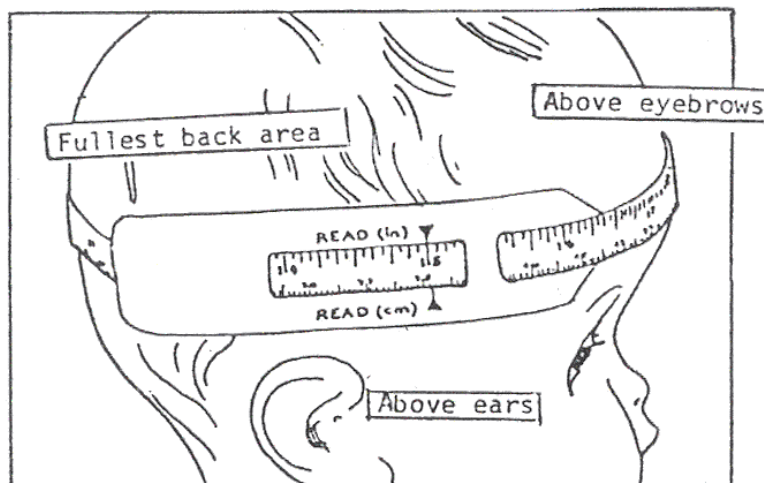
2. Firmly but gently apply an insertion tape or disposable paper tape to the head just above the eyebrows (Figure K) and around the most prominent posterior (back) portion of the head.
3. Read aloud the head circumference to the nearest one-sixteenth ( $1/16$ ) inch and record it.
4. **For Confirming Measurement:** Repeat the adjustment of the head circumference tape and re-measure until two (2) readings agree within two-sixteenths ( $2/16$ ) inch.
5. Read aloud the confirming measurement and record it on the recording form, convert into MI-WIC units, then record **IMMEDIATELY into MI-WIC**.
6. The head circumference measurement will be plotted in MI-WIC on the WHO Growth Chart. If the child's birth weight is  $< 1500$  grams, the measurements will also be plotted on the VLBW Charts, used for educational purposes.

Examples of these charts are found in Appendix G.

FIGURE K.

**NOTE: Cloth and plastic tape measures are not acceptable because they stretch and become inaccurate. Paper tapes should be used only once.**

**NOTE: Do not place the head circumference tape over ribbons, barrettes, pony tails or braids. If infant's hair-do prevents an accurate measurement, (i.e., corn-row braids) take the measurement and record it on the MI-WIC Anthro grid in the note field and check the '?' box indicating an inaccurate measure was taken. Enter the explanation why the measurement did not follow outlined procedures in the note field.**



## QUALITY CONTROL

### MEASURING TECHNIQUE RELIABILITY CHECK

**It is recommended to cross- check body measurement technique of staff monthly.**

1. At least two individuals should weigh and measure the same subject using the recommended procedures for taking body measurements.
2. Compare results. The two or more sets of measurement readings should agree within the following limits:

#### CONFIRMING MEASUREMENTS:

length within - 2/16 inch or 1/8 inch

stature within - 2/16 inch or 1/8 inch

weight within - one (1) ounce for pediatric scale

weight within - one-quarter (1/4) pound or 2 tenths (0.2) of a pound for adult scale

### EQUIPMENT CARE

Equipment should be checked on a regular basis to determine its operational wholeness and ensure accuracy. Equipment is to be cleaned daily.

1. Scales
  - a. Located on an uncarpeted area.
  - b. Zero the horizontal beam of the scale daily. If the scale is used heavily, zero-in scale at frequent intervals during the day.
  - c. Checked for accuracy with calibrated or standard weights at least once a year.
2. Recumbent length board
  - a. Check for loose screws. Also check with measured board (about 24 inches) to see that board is measuring accurately.
  - b. Check for proper working condition (e.g., footboard slides with ease, measuring tape securely fastened).

- c. Check head board alignment. It should be at right angle to recumbent length board.
3. Steel tapeline measure or stature board
  - a. Installed above a carpet-free area.
  - b. Verify that the "0" mark on the tape is at foot level. Check tapeline calibration at the 36 inch mark.
  - c. Located on a flat vertical surface (make sure heels aligned vertically with board and that there is a flat vertical surface where a small child needs to be touching the board).
  - d. Mounted securely with a "see-through" tape.
4. Right angle headboard
  - a. Check alignment of headboard. Should be at right angle to measuring tape.

### **SCALE MAINTENANCE**

Scales must be annually inspected, calibrated, cleaned and repaired by authorized repair service personnel. Proof of calibration must be available upon request. Pediatric beam-balance scales acceptable tolerance allowance is one (1) ounce depending on the precision of the scale. The acceptable tolerance allowance for the adult beam-balance is one-fourth (1/4) pound. Digital scale tolerance is also related to the precision of the scale. Acceptable precision for digital pediatric scales is one ounce. Acceptable precision for digital adult scales is two tenths (0.2) or one-fourth (1/4) pound.

Scales need to be tested for accuracy at least once a year. This is done by weighing a number of standard weights on each scale. Since scale accuracy may change as weight is added or removed, it is suggested that the scale be tested with a number of different standard weights. A beam-balance scale should be equally accurate with a 10 pound or 100 pound load.

### **RELOCATING A SCALE**

Before moving a scale from one area to another, move the two (2) beam weights to their maximum weight positions and secure the horizontal beam with rubber bands. This helps to maintain the accuracy of the beam-balance and prevent unusual wear and tear on the equipment.

## **PLACEMENT OF BEAM WEIGHTS**

When adult beam-balance scale is not being used, place both the fractional and main sliding beam weights directly over the maximum weight positions (50 to 300 pounds). This action will prevent the horizontal beam from bouncing up and down. It will help maintain accuracy of the beam-balance and prevent unusual wear and tear on the equipment.

## **CLEANING EQUIPMENT**

Scales, recumbent length board, moveable headboard, and insertion tape should be regularly cleaned with a cleansing solution daily. If an infant urinates or defecates while being measured, the equipment must be cleaned immediately with antiseptic solution.

## COMMON MEASUREMENT ERRORS

Inaccurate measurements are usually the result of inadequate or improper use of weighing and measuring equipment, and careless technique including the reading and recording of errors.

### TYPES OF ERRORS

1. Equipment-Related
  - a. Use of improper and inadequate equipment, such as bathroom and other spring scales, yardsticks and stretchable tapes, and steel tapeline not properly attached to flat vertical surface.
  - b. Incorrect use of proper equipment (e.g., failure to periodically check the zero balance on scales).
  - c. Inadequate maintenance of proper equipment, such as the use of worn, loose, or broken sliding headboards and footboards.
  - d. Use of wrong growth chart to record and plot body measurements.
  - e. Incorrect use of units for measurement if digital scales are used (e.g., units set on kilograms instead of pounds).
2. Technique-Related
  - a. Improperly positioned or poorly extended children.
  - b. Measuring infants unassisted, or those who are unmanageable.
  - c. Failure to obtain confirming measurement.
  - d. Failure to record measurements immediately and accurately.
  - e. Transposing of measurement values.
  - f. Calculating age incorrectly.
  - g. Failure to recognize the need for precision and accuracy.
  - h. Lack of attention to measurement procedural details.
3. Data Entry
  - a. Failure to convert to MI-WIC convention.
  - b. Transposing numbers

## IMPACT OF ERRORS

Various measurement errors, such as over or under measurement of an individual and transposing numbers, can lead to: 1) inaccurate information about a child's growth pattern which can cause an inappropriate referral for health care, and 2) misrepresentation of the gross nutritional status of the population being screened. An example of a common error which can misrepresent a population occurs when a clinic makes many length measurement errors (measuring young children too short) but weighs those children accurately. In this situation, an artificially high proportion of children are reported as being overweight for their length. Errors that mask retarded growth can delay needed medical evaluation and errors that suggest the presence of a growth abnormality can cause needless concern and may lead to unnecessary diagnostic procedures. Every effort needs to be made to assure that proper equipment is available and the correct technique is followed.

## WHO, CDC AND VLBW GROWTH CHARTS

Growth charts show how a child's height (length or stature) and weight compare with those of other children. They are tools that help the health provider identify children who are outside the average range of weight or height for age and sex.

Six sets of growth charts are used to record height and weight measurements. Separate charts are available for boys and girls from Birth to 24 Months of Age (WHO) and for boys and girls 2 to 5 Years of Age (CDC). VLBW Charts are also used for educational purposes only for Birth to 36 Months of Age for boys and girls when a child is born less than 1500 grams.

Exhibits of the growth charts are found in Appendix G. Michigan Department of Community Health obtained permission from CDC to reproduce them.

The WHO Birth to 24 Months of Age Growth Charts and VLBW Charts should only be used to plot length measurements taken in the recumbent (laying down) position. A 2-5 year old child's height is measured in the standing position and plots on the CDC 2 to 5 Years of Age Growth Charts. The data source used to prepare the WHO Birth to 24 Months of Age Growth Charts was based on length measurements taken in the supine position. If a child's height measurement is taken in the recumbent position and is over the age of 2, the data are plots on the CDC 2-5 Years of Age Growth Chart, incorrect information about this child's growth pattern is obtained. There can be as much as one inch difference between length and stature measurements.

Growth data plots on the WHO growth grids when a client is 40 weeks gestation. If a client is preterm, data will not plot on the WHO growth grid until he or she reaches the gestation adjusted age of 40 weeks. Adjustment for preterm birth occurs until the chronological age of 2 years. Measurement data will then plot on the CDC 2 to 5 years Growth Chart.

Even though VLBW infants have a distinctly different pattern of growth, the WHO Growth Charts, adjusted for preterm birth, will be used for risk codes. Currently, CDC recommends using the Infant



Health Development Program (IHDP) VLBW Charts. Growth patterns shown on the IHDP VLBW charts are for educational purposes only to give a relative idea of that child's growth.

**PERCENTILE CURVES**

Growth charts can tell how each child's measurements compare with a sample of 100 children of the same sex and age. WHO growth charts have 2 additional sets of curves, nine percentile lines total, with the numbers 2, 5, 10, 25, 50, 75, 90, 95 and 98 printed along the right hand side. The CDC 2 to 5 charts continue to use 5, 10, 25, 50, 75, 90 and 95 percentile lines but the BMI-for-Age has the addition of the 85<sup>th</sup> percentile line. These are called percentile curves. Each one shows the percentage of boys and girls in the U.S. population who are below or above that measurement. For example, if a 4 year old boy weighs 38 pounds, his weight-for-age is at the 75<sup>th</sup> percentile. This means that 75 percent of the boys weigh less and 25 percent weigh more.

**GROWTH CHART CHARACTERISTICS**

Listed below are the plotting unit intervals for the CDC-based Growth Charts.

**PLOTTING UNIT INTERVALS**

<b>Growth Charts</b>	<b>Age Interval</b>	<b>Length/ Stature For Age</b>	<b>Weight For Age</b>	<b>Head Circumference</b>	<b>Weight for Length BMI-for-age</b>
Birth to 24 Months	1 month (1/2 month hatch mark)	1/2 inch	1 pound	1/2 inch	Weight: 1 pound Length: 1 inch
VLBW	1 month Gestation- Adjusted Age	2 cm	1/2 kg	1 cm	Weight: 1/2 kg. Length: 2 cm
2 to 5 Years	2 month (1 months hatch mark)	1/4 inch	1 pound	-----	Age: 1/2 year (3 mos. hatch mark) BMI: .2 BMI unit

## CALCULATING BODY MASS INDEX (BMI)

Body Mass Index (BMI) is an anthropometric index of weight and height that is defined as body weight in pounds divided by height in inches squared multiplied by 703. BMI is the commonly accepted index for classifying adiposity in adults and it is recommended for use with children and adolescents.

To calculate BMI, take the confirming values for weight and height on the BMI-for-age chart and convert fractions to the decimal equivalent. (Refer to Appendix F on converting fractions to decimals.)

Put the numbers in the formula below (using decimal fractions):

$$\text{BMI} = [\text{Weight (lbs.)} \text{ \_\_\_\_\_\_ } \div \text{stature (in.)} \text{ \_\_\_\_\_\_ } \div \text{stature (in.)} \text{ \_\_\_\_\_\_ } ] \times 703$$

## MANUALLY PLOTTING MEASUREMENTS

Use a hand calculator to calculate and record the BMI value (rounded to the nearest tenth) on the growth chart data box for BMI.

### STEPS IN MANUALLY PLOTTING MEASUREMENTS ON THE CHILD'S GROWTH CHART

1. Calculate individual's age.
  - a. Ask the birth date of the individual.
  - b. Use the following formula to obtain the age:

Write down the date (year, month and day) that the measurements were taken. Subtract the year, month and day that the person was born.

#### DATE OF MEASUREMENT - PERSON'S BIRTH DATE = PERSON'S AGE

- c. Start calculation by figuring days, then months, and then years.

For example:

	Year	Month	Day
Date of Measurement	2013	4	15
MINUS Birth date	- 2011	- 3	- 10
Person's Age =	2 Years	1 Months	5 Days

When it becomes necessary to "borrow" in the subtraction, make certain 30 days are borrowed from the month column and 12 months are borrowed from the year column, as in the following example:

	Year	Month	Day
		18	45
		(6 + 12)	(15 + 30)
Date of Measurement	13	6	
	2014	7	15
MINUS birth date	<u>- 2012</u>	<u>- 10</u>	<u>- 28</u>
Person's Age =	1 Years	8 Months	17 Days

Step 1: Subtract 30 days (1 month) from 7 months to make 6 months.

Step 2: Add the 30 days (subtracted from the month column) to 15 days to make 45 days (30 + 15).

Step 3: Subtract 28 days from 45 days = 17 days.

Step 4: Subtract 12 months (1 year) from 2014 to make 18 months (7 mo. - 1 mo. = 6 mo. and 6 mo. + 12 mo. = 18 mo.)

Step 5: Subtract 10 months from 18 months = 8 months.

Step 6: Subtract 2012 from 2013 = 1 years (2013 - 1 = 2012)

This child is 1 year, 8 months, and 17 days of age.

Age calculation is an area where many errors are often made. Age errors are as serious as measurement errors. CHECK YOUR CALCULATIONS CAREFULLY.

2. Select appropriate sex and age specific growth chart.

**NOTE: The Birth to 24 Months of Age WHO Growth Charts or VLBW Charts can only be used to plot recumbent length measurements. These charts are based on a population measured in the recumbent position. When a child's height is measured in the standing position, the 2 to 5 Year of Age CDC-based Growth Chart must be used.**

**NOTE: The same growth chart should be used in subsequent certifications or until height measurement procedure changes from length to stature.**

3. Complete the growth chart information at top and in the data boxes

**Birth to 24 Months of Age Growth Chart record:**

- name
- birth date
- date of measurement
- age (round age in days to nearest 1/2 month). Instructions for rounding age are found in Appendix I.
- recumbent length\*
- weight\*
- head circumference\*

**2 to 5 Years of Age Growth Chart record:**

- name
- birth date
- date of measurement
- age (round age in days to nearest year and month). Instructions for rounding age are found in Appendix I.
- stature\*
- weight\*
- BMI (calculated from stature and weight)

**\* Record confirming measurement. If measurement values are rounded off, place them in brackets next to the confirming ones on the growth chart. Often, the rounded off values are used to plot the measurement on the growth grid. See Appendix D for guidelines to rounding off fractions and ounces.**

4. If using the 2 to 5 CDC Growth Chart, calculate BMI and plot on BMI-for-age chart. Refer to previous section for BMI calculation method.
5. Plot height, weight, and head circumference or BMI values on appropriate CDC or VLBW Growth Charts (used for educational purposes). Appendix H contains a summary table highlighting plotting unit intervals.

If a ruler is used:

- a. Locate the vertical age line on length/stature-for-age, weight-for-age, and head circumference-for-age grids. Draw the vertical age line with a ruler. See Appendix I for directions on how to round age to nearest month or year and month.
- b. Locate the horizontal length/stature measurement line on the length/stature-for-age grid and draw the line with ruler. Place a dot or “x” where the vertical age line

intersects the horizontal measurement line.

- c. Locate the vertical length/stature measurement line on the weight-for-length/stature grid and draw the line with ruler.
- d. Locate the horizontal weight measurement line on both the weight-for-age and weight-for-length/stature grids. Draw horizontal lines with ruler. Place a dot or “x” where the horizontal weight line intersects the vertical age and weight-for-length/stature lines.
- e. Locate the horizontal head circumference measurement line on the head circumference-for-age grid and draw the line with ruler. Place a dot or “x” where the horizontal measurement line intersects the vertical age line. If PrecisePlot™ or Accuplot™ Plotting Aid is used:

#### GROWTH CHARTS:

- a. Length/Stature-for-Age
  - 1) Locate child's age on growth chart; mark spot with a small "x" along axis line (the age line).
  - 2) Locate child's measurement on growth chart; mark spot with a small “x” along axis line (the length/stature line).
  - 3) Place PrecisePlot™ or Accuplot™ vertical and horizontal lines to match-up with “x” markings for age and measurement.
  - 4) Mark the growth chart through the hole at the intersection of the PrecisePlot's™ or Accuplot's™ vertical and horizontal lines.
- b. Weight-for-Age  
Use the same directions as those for plotting length/stature for age.
- c. Head Circumference-for-Age  
Use the same directions as those for plotting length/stature for age.
- d. Weight-for-Length/BMI-for-Age
  - 1) Locate child's length/BMI measurement on growth grid; mark spot with a small “x” along axis line (the length/BMI line).
  - 2) Locate child's weight measurement/age on growth chart; mark spot with a small “x” along axis line (the weight/age line).
  - 3) Place PrecisePlot™ or Accuplot™ vertical and horizontal lines to match-up with “x” markings for length/BMI and weight/age.

- 4) Mark the weight-for-length/BMI-for-age chart through the hole at the intersection of the PrecisePlot's™ or Accuplot's™ vertical and horizontal lines.

### PLOTTING GROWTH CHARTS FOR PRETERM INFANTS

The measurement values for preterm infants are to be plotted on appropriate sex and age-specific CDC and VLBW Growth Charts (used for educational purposes). When a preterm infant's length and weight measurements are plotted on an age-specific growth chart, the graphing marks often fall significantly below the 5th percentile curve. To correctly interpret a preterm infant's physical growth, it is necessary to take into account the number of weeks the infant is preterm and adjust the infant's age for plotting length and weight measurements on the growth chart. Use adjusted age for preterm infants, not actual age, when determining risk codes for WIC certification.

Pregnancy usually lasts about 40 weeks. If the infant is born before 37 weeks, (less than 37 weeks) the infant is preterm.

#### STEPS TO FIND ADJUSTED AGE FOR PLOTTING PRETERM INFANT MEASUREMENTS

1. Find number of weeks preterm.
  - a. 40 weeks (full-term) minus number weeks of gestation at birth equals weeks preterm.
  - b. Example:
 
$$\begin{array}{r} 40 \text{ weeks (full-term)} \\ - 33 \text{ weeks (gestational age)} \\ \hline 7 \text{ weeks preterm (Adjustment for preterm birth)} \end{array}$$
  
2. Find number of months preterm, rounding to the half month
  - a. Weeks preterm divided by 4 equal number of months preterm.
  - b. Round fraction to the half month:
    - If fraction of month is  $\frac{1}{4}$  - round down to whole month
    - If fraction of month is  $\frac{1}{2}$  -  $\frac{1}{2}$  month
    - If fraction of month is  $\frac{3}{4}$  - round down to  $\frac{1}{2}$  month
  - c. Example:  $\frac{7 \text{ weeks preterm}}{4} = 1 \frac{3}{4}$ , then round to  $1 \frac{1}{2}$  (months preterm.)
  
3. Determine Gestation Adjusted Age (GAA)
  - a. Actual age minus number months preterm equals Gestation Adjusted Age.
  - b. Example:
 
$$\begin{array}{r} 4 \text{ months actual age} \\ - 1 \frac{1}{2} \text{ months preterm.} \\ \hline 2 \frac{1}{2} \text{ months Gestation Adjusted Age} \end{array}$$

Normal, healthy preterm infants grow rapidly after birth. While preterm infants who are Low Birth Weight (LBW) have slightly different growth patterns, they will still be plotted on the WHO Birth to 24 Month Growth Chart. Even though VLBW infants have a distinctly different pattern of growth, the WHO Growth Charts, adjusted for preterm birth, will be used for risk codes. Currently, CDC recommends using the Infant Health Development Program (IHDP) VLBW Charts. They can be used for educational purposes to give a relative idea of that child's growth. Adjustment for preterm birth occurs until the chronological age of 2 years. Measurement data will then plot on the CDC 2 to 5 years Growth Chart.

Reference: Moore, W.M. & Roche, A.F.: Pediatric Anthropometry, 2nd edition. Ross Laboratories, Columbus, OH 1983.

<b>PRENATAL WEIGHT GAIN GRID</b>
----------------------------------

The Prenatal Weight Gain Grid shows how a woman is gaining weight compared to the expectations for her pregravid weight category (normal weight, underweight, overweight or obese). It is a tool to help identify women who are gaining insufficient or excessive weight during pregnancy. An exhibit of the grid is found in Appendix J.

### **WEIGHT GAIN CURVE**

The Prenatal Weight Gain Grid can show how the pregnant woman's weight compares with the expected increase. The highlighted area on the graph identifies the desired pattern and rate of weight gain for each weight gain category A-D (BMI <18.5, BMI 18.5-24.9, BMI 25-29.9 or BMI >30) of pregravid weight women. It is expected that women with low pre-pregnancy weight-for-height may gain at a faster rate (up to one pound per week) and overweight women may gain at a slower rate (1/2 pound per week). However, they all should follow the pattern of weight gain.

### **PRENATAL GRID CHARACTERISTICS**

The grid is made up of vertical and horizontal lines representing weeks of gestation and number of pounds of weight gained or lost from the pregravid weight. The heaviest printed horizontal line represents the woman's pregravid weight. The lighter printed horizontal lines represent one pound of weight gained or lost. If the woman's weight line is above the pregravid weight line this represents weight gained. If, on the other hand, her weight line is below the pregravid weight line, this represents weight lost from the pregravid weight reference point.

The highlighted area within the heavy diagonal lines represent the desired pregnancy weight gain pattern for each weight gain category pregravid weight woman. The lines start in the early weeks, from the pregravid weight line, rising gradually from early to the ending weeks of gestation.

## **HOW TO USE THE PRENATAL WEIGHT GAIN GRID**

The proper use and interpretation of the Prenatal Weight Gain Grid requires using the following instructions:

1. Obtain and record the pregravid weight on Grid's after the question in blue on the Anthro screen. This is the weight just before conception. If the pregravid weight is unknown, check the Unk box. Click 'Save'.
2. Measure the height (without shoes) and record in the appropriate column on the Anthro grid.
3. Weigh with normal indoor clothing and without shoes and record in the appropriate column on the Anthro grid.
4. MI-WIC calculates the weeks of gestation based on the Expected Date of Delivery (EDD) entered on the Cert Action screen. Gestational wheels may be obtained from pharmaceutical companies or the American College of Nurse-Midwives. (See Appendix K).
5. Use the pregravid weight as the baseline for the women's present prenatal weight.
6. At each prenatal visit, record the weight gained or lost. MI-WIC plots each weight to establish a pattern that can be compared with the shaded weight gain curve for the client's pre-natal BMI weight gain category.



**RECORDING MEASUREMENTS**

All measurements must be recorded. For the WIC Program, the results of height (length/stature), weight and head circumference measurements must be recorded on the MI-WIC Anthro Screens.

**REFERRAL CRITERIA FOR NUTRITION RISK**

Any infant or one year old whose height, weight and/or head circumference are above the 98th percentile or below the 3th percentile is at risk. Any two to five year old whose height or BMI for age is below the 5<sup>th</sup> percentile or above the 95<sup>th</sup> percentile is at risk. Further investigation should be made to determine if these percentiles represent unusual or abnormal findings. The occasionally encountered sharp deviations or the more gradual but continuing shifts from one percentile position to another call for further investigation as to their causes.

Measures of physical growth are interpreted in relation to some expected value considered normal or usual for a child of the age, sex and genetic potential of the one being measured. The most fruitful interpretations of children's growth are made from several observations made over a period of time rather than measures at a single point in time. Two sets of measurements permit calculation of growth during a defined period of time; while a single set of measurements gives only size. Also, the larger the time span during which accurate, serial observations are made, the surer will be the judgment as to whether a given child's measurements are normal or abnormal. There are no data which easily shows whether a deviation represents an abnormality or is merely unusual.

**CHILDREN - BIRTH TO 5 YEARS\***

**Suggested Registered Dietitian Referral Criteria**

<b>Growth Chart</b>	<b>WHO Birth to 24 Mos.</b>	<b>CDC 2 Yrs. to 5 Yrs.</b>
Weight-for-length or BMI-for-age	below 2.3th percentile <b>or</b> above 97.7th percentile	below 5th percentile <b>or</b> above 95th percentile
Head circumference-for-age	below 2.3th percentile <b>or</b> above 97.7th percentile	_____

\* Refer to MI-WIC Policy 2.13A (**Nutrition Risk Criteria**) for additional information regarding abnormal growth patterns in children.

A child, who meets the criteria for Risk Code 113+, High Risk Overweight, should be assessed by the WIC program RD to determine the nature of the nutritional problem for this child. Part of the assessment will include learning how the child and caregiver think and feel about the child being overweight. Interested families should be referred for nutrition education or for nutrition counseling, as appropriate. In some instances, where family system dynamics indicate a dysfunctional interaction pattern, referral to a community mental health service may be desirable.

A child who is low weight-for-age (below 5th percentile) could be experiencing growth retardation and may need to be referred for an assessment to determine growth and nutritional status.

## **WOMEN - PRENATAL AND POSTPARTUM**

Prenatal women who have a low rate of weight gain below their shaded category on the Prenatal Weight Gain Grid or a low maternal weight gain during the second and third trimesters are indicators associated with fetal growth problems. Low maternal weight gain is a determinant of fetal growth and is associated with smaller average birth weights and an increased risk of delivery of an infant with fetal growth restriction.

Weight loss during pregnancy may indicate underlying dietary or health practices, or health or social conditions associated with poor pregnancy outcomes.

Pregnant women with large gestational weight gains are at increased risk for delivering high birth weight infants, which secondarily lead to complications such as: dysfunctional and prolonged labor, midforceps delivery, cesarean delivery, meconium aspiration, asphyxia.

Postpartum women with extremely high weight gain during pregnancy may be at increased risk of subsequent obesity leading to other chronic health conditions.

Refer to MI-WIC Policy 2.13A for additional information concerning prenatal and postpartum weight loss and excessive weight loss.

## **ASSESSING GROWTH**

Growth in childhood is mainly linear. Yet, each normal, healthy child grows at a genetically predetermined rate and has his/her own physical growth pattern. This growth pattern is one of the most useful criteria for judging nutritional status; because growth is sensitive to nutrient intake. Growth can be compromised or accelerated by undernutrition, imbalanced nutrient intake, or overnutrition.

Assessing a child's growth pattern requires accuracy and precision in obtaining body measurements and in plotting these data on growth charts. These activities provide information as to whether the child is expressing his/her genetic potential for growth and how the child compares with other

children of the same age and sex. They also identify the child's growth channel which serves as a guide to appraise health and nutritional status.

Whenever possible, a pattern of growth should be determined for each child based on a series of measurements made over time. It is the health professional's responsibility to establish what is normal for the individual or recommend evaluation by a physician. Any outlying measurement may be normal for a particular individual; but the more extreme an outlying measurement is, the greater the likelihood it is not normal. When determining what normal growth for a child is, the following factors should be taken into account:

- previous weight and length/stature measurements, such as low birth weight which may account for small size (length/stature or weight or both) up to age 7;
- history of illness;
- parental body build and physical stature;
- emetic disorders.

A pregnant woman's weight gain pattern can be an indicator of the fetus's growth. Inadequate weight gain in the mother may be indicative that she is not getting a sufficient intake of calories and other nutrients; thus the fetus will not have the proper amount or type of nutrients available for growth and development. Excessive maternal weight gain can leave the mother with larger than needed calorie stores or fat that she will need to remove after pregnancy.

When determining what normal weight gain is for a pregnant woman, the following factors should be taken into account:

- pregravid weight status;
- stage of adolescence;
- number of fetuses;
- weight gain or loss in the earlier trimesters of the pregnancy.

## **INTERPRETING ANTHROPOMETRIC INDICATORS**

Body measurements plotted on the appropriate WHO or CDC-based growth chart can identify the child who is at nutritional risk. The criteria for identifying individuals with potential problems are:

1. Low length or stature-for-age: length or stature-for-age less than the WHO 2.3<sup>rd</sup> percentile or CDC 5th percentile. This should be assessed to determine if the short stature is due to heredity or inadequate nutrition and poor health.

2. Low weight-for-age: weight-for-age less than the WHO 2.3<sup>rd</sup> percentile or CDC 5th percentile. This suggests the child is at risk of chronic or recurrent underweight. (This is not a criterion for WIC weight eligibility.)
3. Low weight-for-length or BMI-for-age: weight-for-length or BMI-for-age less than the WHO 2.3<sup>rd</sup> percentile or CDC 5th percentile. This suggests that child is at risk of recent undernutrition.
4. High BMI-for-age or weight-for-length for children 2-5 years: weight-for-length or BMI-for-age greater than the WHO 97.7th percentile or CDC 95<sup>th</sup> percentile. This suggests the child is high risk overweight.
5. High BMI-for-age for children 2-5 years: BMI-for-age greater than the 85th and below the 95th percentile. This suggests the child is at risk of becoming overweight.
6. A decrease of 25 percentiles or more in length-for-age. This suggests that the child's length or stature has recently become at risk for stunting.
7. A decrease of 25 percentiles or more in weight-for-length. This suggests that the child has recently become at risk for underweight.

The two measurements that are considered the most important in nutrition screening for overweight, underweight and delayed growth are length or stature-for-age and weight-for-length or BMI-for-age.

Length or stature-for-age growth chart reflects past nutritional history. It is the best indicator of long-term undernutrition. Length or stature-for-age below the WHO 2.3<sup>rd</sup> percentile or CDC 5th percentile suggests the possibility of linear growth retardation due to long-term illness, nutritional deficiency, or genetic factors.

Weight-for-length or BMI-for-age growth chart reflects recent undernutrition or overnutrition. It is an indicator of current nutritional status. Weight-for-length or BMI-for-age below the WHO 2.3<sup>rd</sup> percentile or CDC 5th percentile suggests underweight and above the WHO 97.7 percentile or CDC 95th percentile suggests the possibility of overweight.

**NOTE: Weight-for-age growth chart does not distinguish between skeletal and soft tissues and it is not as useful as an indicator of nutritional status. However, it is a good indicator when following a child over time. Weight-for-age below the 5th percentile suggests chronic or recurrent underweight and above the 95th percentile suggests chronic or recurrent overweight.**

**NOTE: Helpful clues for interpreting body measurements are the parent's height and weight and the child's ethnic or racial background. For example, Hispanic children tend to be shorter than other children. If a Hispanic child is found to be much shorter than other children his/her age, this does not necessarily mean growth is delayed.**

Head circumference is an important screening measurement for identification of micro or macrocephaly due to non-nutritional abnormalities. Head circumference-for-age on or below the

2.3<sup>rd</sup> percentile suggests microcephaly and on or above the 97.7th percentile suggests macrocephaly. Referral to a physician for further assessment is warranted.

#### HOW TO TELL IF A CHILD IS OVERWEIGHT

If a child's weight-for-length or BMI-for-age is at or above the 97.7th percentile and 95<sup>th</sup> percentile, respectively, or if weight-for-length or BMI-for-age has moved upward over time crossing into higher percentiles, the child may be at risk for overweight. The child should be referred for assessment and counseling.\*

The child whose BMI-for-age falls between the 85th and the 95th percentile is considered to be at risk of becoming overweight and his or her weight should be monitored. Children in this range have a higher chance of becoming overweight as an adult and they have increased risk of weight-related health conditions.

#### HOW TO TELL IF A CHILD IS UNDERWEIGHT

If a child's weight-for-length or BMI-for-age is at or below the WHO 2.3<sup>rd</sup> percentile or if the present weight-for-length or BMI-for-age is at a lower percentile than previous measurements, the child may be at risk for underweight. The child should be referred for assessment and counseling.\*

The child's whose weight-for-length or BMI-for-age falls between the WHO 2.3<sup>rd</sup> and 5<sup>th</sup> percentiles or CDC 5th and at the 10th percentile is considered at risk for becoming underweight and his or her weight should be monitored. This child may be potentially at risk.

#### HOW TO TELL IF A CHILD'S GROWTH IS DELAYED

If a child's length or stature-for-age is below the WHO 5<sup>th</sup> percentile or CDC 10th percentile or if the present length or stature-for-age is at a lower percentile than previous measurements, the child's growth may be delayed.\* The child's diet and certain medical problems may be causing delayed growth. A medical history and examination, as well as dietary habits and feeding practices, should be evaluated carefully. The child may need to be referred to his or her medical provider for additional tests to determine why he or she is growing too slowly.

\* Check for age calculation, measurement and growth chart plotting errors before referring a child for counseling. When errors are made, a child can be mistakenly identified as having a nutrition problem when there really is none or vice versa.

## **DETERMINATION OF ANTHROPOMETRIC RISK**

Anthropometric measurements are used to screen children for risk of poor growth and pregnant women for adequate weight gain during pregnancy. Measurements are used to establish a growth pattern, requiring a series of plot points on growth charts. From two or more plot points, it is possible to judge whether there has been Adequate or Slow/Faltering Growth Pattern, as studies have determined a range of healthy or recommended growth curve pattern. Anthropometric risks are designated 100 series risks (see Policy Exhibit 2.13A). Risk codes followed by the plus (+) sign are state-designated nutritional high risk codes as shown in Policy Exhibit 2.13B Michigan-Designated Nutritional High Risk Conditions by PBNIC Status. See Appendix M for Minimum Expected Weight Gain tables.

### **SLOW/FALTERING GROWTH (Risk Code 135+)**

Growth faltering is defined as a growth rate below that which is appropriate for an infant's age and sex. It can effect length, weight, and head circumferences resulting in values lower than expected. Growth faltering may include weight faltering (a drop in weight-for-age) or slowed growth where both weight and length growth are slower than expected. An example of weight faltering is a drop in weight after a minor illness or a measurement/plotting error.

Growth in infants is steady and predictable. It is a reflection of health and nutritional status and the overwhelming majority of infants have no growth problems. Normal growth is also pulsatile, with periods of rapid growth or growth spurts followed by periods of slower or no measurable growth. Catch-up and catch-down growth during early childhood are normal phenomena that affect large numbers of children, particularly during infancy, and may merely be an adjustment to the genetic potential for growth (9). Growth is also seasonal, with length velocities (the change in growth over time) increased during the spring and summer months and stagnant other months. Weight may vary depending on the time of day and infant feeding schedule. Growth may be increased or slowed by a variety of conditions, with changes in growth as the first sign of a pathological condition. Such conditions include: undernutrition, hypothyroidism, iron deficiency, human immunodeficiency virus (HIV), inborn errors of metabolism, lead toxicity, zinc deficiency, immune deficiency, failure of a major organ system such as the gastrointestinal digestive system, renal, cardiovascular, and pulmonary. Infants that do not follow a steady predictable pattern, such as those with short stature or decreased growth rate, should be the focus of concern.

The timely detection of poor growth in early life is a way to identify infants who may be at risk for growth faltering, and intervene before undernutrition has detrimental health outcomes, such as growth retardation, when incurred early are irreversible. It can help prevent short stature and adverse functional and deleterious long term consequences, such as poor cognition and educational performance, low adult wages, lost productivity, and when accompanied by weight gain later in childhood, an increased risk of nutrition-related chronic diseases.

### **Excessive Weight Loss After Birth**

Infant weight loss in the early postpartum period is physiologically normal, and nearly universal but the amount of weight loss varies. Weight loss of 5% and 7% of birth weight is not unusual for formula-fed or breastfed infants, respectively. Healthy infants are expected to regain their birth weight within 8-10 days after birth. However, if a breastfed infant loses 7% of birth weight in the first 72 hours after birth, an evaluation and review of the mother-infant dyad is needed and any problems resolved immediately. Risk of dehydration and failure to thrive in breastfed newborns can be mitigated by early screening and providing lactation support in the early postpartum period.

A weight loss of up to 10% of birth weight is the maximum acceptable weight loss for newborn infants, with any additional loss a potential emergency. Contributing factors include:

- Hospital practices like epidurals, pacifier use, low or non-nutritive feedings, or strict feeding schedules.
- Maternal factors such as retained placenta, parity, anxiety, and poor maternal knowledge.
- Infant factors such as birth weight, gestational age, gender, and feeding method.
- Breastfed infants with poor positioning, latch and/or milk transfer.

WIC staff should identify and address any potential underlying feeding issues causing newborn weight loss. An infant with a weight loss of greater or equal to seven percent signals the need for careful evaluation and intervention, infants with a weight loss of ten percent or more is a marker for a medical referral.

### **Any Weight Loss 2 Weeks to 6 Months**

While the 2006 CDC/WHO growth charts show slower growth from 3 – 18 months of age as a normal growth pattern, weight loss is not expected beyond the first two weeks of life and requires follow-up. After birth, growth faltering is caused by inadequate caloric intake, normal caloric intake in an environment of excessive loss or malabsorption; or increased metabolic needs. In cases of dehydration or acute illnesses like gastroenteritis, fluid loss that exceeds fluid intake may also lead to significant weight loss. Weight loss in young infants is commonly caused by acute infections, feeding problems, allergy to milk protein, lead poisoning, HIV, malnutrition, pyloric stenosis, gastrointestinal reflux, celiac disease, cystic fibrosis, neglect, growth failure, congenital heart disease, and inborn errors of metabolism.

The primary goal of the intervention is to enhance infant health outcomes by addressing causes of slowed growth and keeping vulnerable infants tracking along growth percentiles established in infancy. In some cases, it may be important to intervene quickly, while in other cases a period of frequent growth monitoring would be more appropriate to prevent too rapid refeeding and subsequent increased risk of type 2 diabetes, obesity, and cardiovascular disease later in life.

If faltering growth is suspected, maternal neglect and inadequate caloric intake due to inappropriate formula mixing, breastfeeding problems, early introduction of solid food, maternal depression, and emotional deprivation, must be ruled out and addressed. Growth monitoring should occur on a monthly basis – utilizing two separate weight measurements taken at least eight weeks apart as data markers. It is imperative that WIC staff involved in measuring infant growth use standardized equipment and receive adequate training prior to conducting infant measurements to increase reliability between measures. If the participant does not respond to nutritional management (i.e. weight continues to falter) or if other markers falter (such as length for age or stagnant head circumference), then the infant should be referred to their health care provider for assessment.

## **Normal Growth Patterns**

Understanding normal growth patterns in infants is important. The pattern of weight gain during infancy varies depending on the method of feeding. Compared to formula-fed infants, breastfed infants gain weight rapidly in the first three to four months of life and relatively slowly thereafter. Although the weights of formula-fed and breastfed infants are similar by one to two years of age, the typical pattern of slowed weight gain after three to four months among breastfed infants may lead to unnecessary early introduction of solid foods or cessation of breastfeeding if the slowed weight gain is perceived as lactational inadequacy.



## **SPECIAL SCREENING SITUATION CONSIDERATIONS**

During the screening process, circumstances may arise that require special attention or deviation from normal procedures. The following is a list of some of the most common “special situations” that may occur.

### **IF MEASURING PROCEDURES CANNOT BE FOLLOWED**

If an infant or young child is uncooperative and a measurement cannot be taken, check the ‘Unk’ check box and enter a comment in the ‘Comments’ box. If the child is between two and three years of age and is unwilling to be measured standing, but is willing to be measured lying down, take measurement recumbently, mark the ‘?’ checkbox. The measurement will plot as a red asterisk on the Birth to 24 Months growth chart but risks will not be assigned. Be sure to document the actual measurement and enter procedure used in ‘Comments’ in Anthro grid.

### **IF MEASURING INDIVIDUALS OUTSIDE OF RECOMMENDED PROCEDURES**

Sometimes the standard measurements cannot be used because the individual is wearing a cast, missing a limb, or is physically disabled. Use the appropriate procedure listed below for each situation.

#### **INDIVIDUALS WEARING A CAST**

If the individual is wearing a cast that prevents the standing height measurement being obtained, document it in ‘Comments’ on Anthro grid. Omit the height measurement until the cast is removed and the height can be measured accurately. If an individual is wearing a cast that does not prevent his/her height from being obtained, complete the measurement using standard procedures, and document the fact that a cast was being worn in ‘Comments’. In addition, enter measurements and document the reason for not being able to obtain an accurate measurement (Check the ‘UNK’ or ‘?’ as appropriate and enter explanation in the ‘Comments’ field).

An individual wearing a cast can usually be weighed using standard procedures. Check the ‘?’ and presence of a cast should be documented in ‘Comments’ on the Anthro grid. Remember that overweight risk factors may not be used for WIC certification in this situation, and plot point on the growth charts will reflect weight with cast to be considered the next weight without the cast.

#### **CHILDREN UNABLE TO STAND**

Children over two years old who cannot stand without support should be measured lying down. If the child is longer than the recumbent board, use a steel measuring tape attached to a table, desk-top or floor. Check the ‘?’ on the Anthropometric grid. The measurement will be plotted on the CDC 2-5 year growth chart for children two to three years old as a red asterisk but no risk will be assigned.

For children older than three, the measurement will plot on the growth chart for children 2 to 5 years of age as a red asterisk but no risk will be assigned. Care should be taken when interpreting the growth chart for children 2 to 5 years of age of a child measured lying down. The child will plot taller on the growth chart because of being measured in the recumbent position. The percentile obtained in this case can only be used to assess the child's growth over time. Interpretation should therefore be limited to assessment of the child's own growth curve and should not be evaluated in relationship to the reference population.

Document the actual measurement obtained, check '?' and enter 'Comments' in Anthro grid.

#### CHILDREN OVER 2 UNABLE TO STAND

Children over 2 years of age who cannot stand on the adult scale may be weighed using a special procedure.

An adult may hold the child and the total weight for both persons can be recorded. The adult can then be weighed alone and his/her weight can be subtracted from the combined weight. The remaining weight represents the child's weight. This procedure is called 'taring'.

Record the measurement, check the '?' and enter "Comments" as to measuring procedure used.

#### PHYSICALLY DISABLED ADULTS

If an adult has a physical handicap that prevents her/him from being measured, check 'Unk' and enter a comment in the 'Comments' in the Anthro grid.

#### LEG SHORTER THAN THE OTHER

If a child is less than two years of age and one leg is shorter than the other, the child should be measured lying down. Both legs should be fully extended. Record the measurement with the longer leg, check the '?' and enter a note in 'Comments'.

A child over two years of age or a woman can be measured in a standing position by having him/her stand on his/her longest leg. Place a check in the '?' checkbox and enter a note in the 'Comments'.

#### AMPUTEE/MISSING LIMBS

Infants or young children who are missing arms or legs may be weighed using the standard procedure. If the client is over 2 or an adult who can stand alone, they should be weighed on the adult scale using the standard procedure. Document the physical problem and weight in all appropriate sections in MI-WIC and document in the 'Comments'. Even though a risk factors for underweight will not be assigned for WIC certification in this situation, a record of the weight will be useful going forward for monitoring future weight. If an older child or adult cannot stand to be weighed and cannot be held by a caretaker to be weighed, the 'Unk' checkbox should be checked and document in 'Comments'.

If an individual is missing limbs that prevent the recumbent length from being measured, this

measurement should be omitted, the 'UNK' check box marked and reason should be documented in 'Comments'. If the handicap does not prevent the measurements from being obtained, complete them using the standard procedures.

It is important to note that the growth percentile for weight for height or length will not be accurate because of missing limbs. However, plotting the individual's weight gain over time will still be useful in assessing growth.

### CONGENITAL/METABOLIC DISORDERS

The pattern of growth of an individual with a congenital or metabolic disorder may be different than that of standardized growth charts. However, plotting the individual's personal growth curve over a period of time may be very helpful in assessing their growth rate and providing appropriate nutrition counseling.

### IMPACT OF IMPROPER MEASUREMENT ERRORS

Various measurement errors, such as over or under-measurement of an individual and transposing numbers, can lead to:

- 1) Inaccurate information about a child's growth pattern prompting an inappropriate referral for health care
- 2) Misrepresentation of the gross nutritional status of the person being screened.

Every effort needs to be made to assure that proper equipment is available and correct technique is followed. An example of a common error which can misrepresent a population occurs when a clinic makes many length measurement errors; e.g., measuring young children too short but weighs those children accurately. In this situation, an artificially high proportion of children are reported as being overweight for their length.

<b>MANUAL PLOTTING OF MEASUREMENTS</b>
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MI-WIC automatically plots measurements based on data entry. The following section details methods used to hand plot measurements.

**STEPS IN MANUAL PLOTTING MEASUREMENTS ON GROWTH CHARTS**

1. Calculate individual's age.
  - a. Ask the birth date of the individual.
  - b. Use the following formula to obtain the age:

Write down the date (year, month and day) that the measurements were taken. Subtract the year, month and day that the person was born.

**DATE OF MEASUREMENT - PERSON’S BIRTH DATE = PERSON’S AGE**

- c. Start calculation by figuring days, then months, and then years.

For example:

	Year	Month	Day
Date of Measurement	2013	4	15
MINUS Birth date	<u>- 2011</u>	<u>- 3</u>	<u>- 10</u>
Person's Age =	2 Years	1 Months	5 Days

When it becomes necessary to "borrow" in the subtraction, make certain 30 days are borrowed from the month column and 12 months are borrowed from the year column, as in the following example:

	Year	Month	Day
		18	45
		(6 + 12)	(15 + 30)
	13	6	
Date of Measurement	2014	7	15
MINUS birth date	<u>- 2012</u>	<u>- 10</u>	<u>- 28</u>
Person's Age =	1 Years	8 Months	17 Days

- Step 1: Subtract 30 days (1 month) from 7 months to make 6 months.
- Step 2: Add the 30 days (subtracted from the month column) to 15 days to make 45 days (30 + 15).

Step 3: Subtract 28 days from 45 days = 17 days.

Step 4: Subtract 12 months (1 year) from 2014 to make 18 months  
(7 mo. - 1 mo. = 6 mo. and 6 mo. + 12 mo. = 18 mo.)

Step 5: Subtract 10 months from 18 months = 8 months.

Step 6: Subtract 2012 from 2013 = 1 years (2013 - 1 = 2012)

This child is 1 year, 8 months, and 17 days of age.

Age calculation is an area where many errors are often made. Age errors are as serious as measurement errors. CHECK YOUR CALCULATIONS CAREFULLY.

2. Select appropriate sex and age specific growth chart.

**NOTE: The Birth to 24 Months of Age WHO Growth Charts or VLBW Charts can only be used to plot recumbent length measurements. These charts are based on a population measured in the recumbent position. When a child's height is measured in the standing position, the 2 to 5 Year of Age CDC-based Growth Chart must be used.**

**NOTE: The same growth chart should be used in subsequent certifications or until height measurement procedure changes from length to stature.**

3. Complete the growth chart information at top and in the data boxes

**Birth to 24 Months of Age Growth Chart record:**

- name
- birth date
- date of measurement
- Age (round age in days to nearest 1/2 month). Instructions for rounding age are found in Appendix I.
- recumbent length\*
- weight\*
- head circumference\*

**2 to 5 Years of Age Growth Chart record:**

- name
- birth date
- date of measurement

- Age (round age in days to nearest year and month). Instructions for rounding age are found in Appendix I.
- stature\*
- weight\*
- BMI (calculated from stature and weight)

**\* Record confirming measurement. If measurement values are rounded off, place them in brackets next to the confirming ones on the growth chart. Often, the rounded off values are used to plot the measurement on the growth grid. See Appendix D for guidelines to rounding off fractions and ounces.**

4. If using the 2 to 5 CDC Growth Chart, calculate BMI and plot on BMI-for-age chart. Refer to previous section for BMI calculation method.
5. Plot height, weight, and head circumference or BMI values on appropriate CDC or VLBW Growth Charts (used for educational purposes). Appendix H contains a summary table highlighting plotting unit intervals.

If a ruler is used:

- a. Locate the vertical age line on length/stature-for-age, weight-for-age, and head circumference-for-age grids. Draw the vertical age line with a ruler. See Appendix I for directions on how to round age to nearest month or year and month.
- b. Locate the horizontal length/stature measurement line on the length/stature-for-age grid and draw the line with ruler. Place a dot or “x” where the vertical age line intersects the horizontal measurement line.
- c. Locate the vertical length/stature measurement line on the weight-for-length/stature grid and draw the line with ruler.
- d. Locate the horizontal weight measurement line on both the weight-for-age and weight-for-length/stature grids. Draw horizontal lines with ruler. Place a dot or “x” where the horizontal weight line intersects the vertical age and weight-for-length/stature lines.
- e. Locate the horizontal head circumference measurement line on the head circumference-for-age grid and draw the line with ruler. Place a dot or “x” where the horizontal measurement line intersects the vertical age line.

If PrecisePlot™ or Accuplot™ Plotting Aid is used:

- a. Length/Stature-for-Age
  - 1) Locate child's age on growth chart; mark spot with a small "x" along axis line (the age line).
  - 2) Locate child's measurement on growth chart; mark spot with a small "x" along axis line (the length/stature line).
  - 3) Place PrecisePlot™ or Accuplot™ vertical and horizontal lines to match-up with "x" markings for age and measurement.
  - 4) Mark the growth chart through the hole at the intersection of the PrecisePlot's™ or Accuplot's™ vertical and horizontal lines.
- b. Weight-for-Age  
Use the same directions as those for plotting length/stature for age.
- c. Head Circumference-for-Age  
Use the same directions as those for plotting length/stature for age.
- d. Weight-for-Length/BMI-for-Age
  - 1) Locate child's length/BMI measurement on growth grid; mark spot with a small "x" along axis line (the length/BMI line).
  - 2) Locate child's weight measurement/age on growth chart; mark spot with a small "x" along axis line (the weight/age line).
  - 3) Place PrecisePlot™ or Accuplot™ vertical and horizontal lines to match-up with "x" markings for length/BMI and weight/age.
  - 4) Mark the weight-for-length/BMI-for-age chart through the hole at the intersection of the PrecisePlot's™ or Accuplot's™ vertical and horizontal lines.