MICHIGAN WIC
ANTHROPOMETRIC MEASUREMENT PROCEDURES

(Weight, Height, Head Circumference)

WIC Division
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ANTHROPOMETRIC MEASUREMENTS

TABLE OF CONTENTS **PAGE**

INTRODUCTION 1

WIC ANTHROPOMETRIC SCREENING POLICY 2

SUPPLIES AND EQUIPMENT 2

SCREENING AREA 2

PROCEDURES FOR TAKING BODY MEASUREMENTS 4
- Weight 4
  - Digital Scale Procedures 8
- Length 11
- Stature 13
- Head Circumference 16

QUALITY CONTROL 18
- Measuring Technique Reliability Check 18
- Equipment Care 18
- Scale Maintenance 19
- Relocating a Scale 19
- Placement of Beam Weights 20
- Cleaning Equipment 20

COMMON MEASUREMENT ERRORS 21
- Types of Errors 21
- Impact of Errors 22

CDC AND VLBW GROWTH CHARTS 23
- Percentile Curves 23
- Growth Chart Characteristics 24
- Calculating Body Mass Index (BMI) 24

PLOTTING MEASUREMENTS. 25
- Steps in Plotting Measurements on the Child's Growth Chart 25
  - Calculating Individual's Age 25
  - Growth Chart Selection for Children 26
  - Completion of Growth Chart Data Boxes 26
  - Using a Ruler to Plot Measurements 27
  - Using the PrecisePlot™ or Accuplot™ 28
- Plotting Growth Charts for Premature Infants 29
  - Steps to Find Adjusted Age 29
  - Plot Age-Related Measurement Values 30

PRENATAL GAIN IN WEIGHT GRID 30
- How to Use the Prenatal Weight Gain Grid 31

PAGE

RECORDING MEASUREMENTS 32

REFERRAL CRITERIA 32
Children-Birth to 5 Years 32
Women-Prenatal and Postpartum 33

PROBLEM IDENTIFICATION 33
Interpreting Anthropometric Indicators 34

DETERMINATION OF RISK FOR INADEQUATE GROWTH 37

SPECIAL SCREENING SITUATION 42
Measuring Uncooperative Children 42
Measuring Individuals with Physical Disabilities 42
Impact of Improper Measurement Errors 44

APPENDIX A: Glossary of Terms 45

APPENDIX B: Equipment Sources 46

APPENDIX C: Recording Measurement Values 50-52
CDC Growth Charts and Prenatal Weight Gain Grid 50
Data Entry System 51
Summary Table 52

APPENDIX D: Guide for Rounding Measurement Values for Plotting 53

APPENDIX E: Guide for Understanding Measurement Lines on a Rule or Tapeline 54

APPENDIX F: Guide for Interpreting and Converting Fractions 55

APPENDIX G: Exhibits of Growth Charts 57-58

APPENDIX H: Summary of Plotting Unit Intervals for CDC-based Growth Charts 59

APPENDIX I: Guide for Plotting Age on CDC Growth Chart 60

APPENDIX J: Prenatal Weight Gain Grid 62

APPENDIX K: Exhibit of Gestational Wheel 63

APPENDIX L: Anthropometric Measurement Procedure Checklist 64-67

APPENDIX M: Instructions for Using "Minimum Expected Weight Gain Tables" .. 68-75

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ANTHROPOMETRIC MEASUREMENTS

INTRODUCTION

Measurements of height (length or stature) and weight are important indicators of health and nutritional well-being. These measurements identify whether an individual's body measurements are appropriate for that individual's chronological age. For children, body measurements plotted on growth charts can indicate when a child's growth is normal or delayed and when a child is overweight or underweight. 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 can indicate weight for height proportion, normal, under or overweight.

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 be employed. This handbook describes the procedures necessary to take accurate body measurements.

Anthropometric measurements are collected to:

1. provide objective health data which enable one to assess physical growth and development;

2. identify health problems (overweight and underweight, or potential developmental or neurological disabilities);

3. help evaluate an individual's nutritional status; and

4. identify individuals 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.

WIC ANTHROPOMETRIC SCREENING POLICY

Height and weight measurements must be obtained on all WIC Program applicants at each certification screening and infant health/nutrition evaluation (i.e. mid-cert evaluation). Head circumference measurements must be taken on all children under age two (2) years. For children, all measurements must be recorded and entered on the MI-WIC Anthro screen. For pregnant women, weight and height data, plus prenatal weight is 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 calculations of percentiles and for accurate plotting on the appropriate growth charts and prenatal grid. CPA's should confirm or use their clinical judgment and make the final determination of Weeks Gestation and EDD.

SUPPLIES AND EQUIPMENT

Head circumference tape
Pediatric beam-balance or digital scale
Adult beam-balance or digital scale
Infant recumbent length board
Disposable sheets or scale papers
Steel tapeline calibrated to 1/16 inch
Right angle head board

CDC growth charts, VLBW charts (IHDP)
Foot stool
Hand-Calculator for BMI
Prenatal weight gain grid
Ruler or Ross Lab Accuplot™
or PrecisePlot plotting grid

SCREENING AREA

Anthropometric measurement should be taken in a non-traffic area. Ideally, a separate room or quiet area where all equipment needed is available for the performance of the required assessments.

Enter the data into MI-WIC immediately after measurement, if a computer is available in the lab area. Best practice is to record measures on an Anthro Recording form, then enter into MI-WIC as son as possible.

Pediatric beam-balance scale and infant recumbent length board need to be placed on a sturdy table and have enough space to operate the equipment efficiently. Recumbent length board should be positioned so the person holding the head can stand directly behind the headboard for best position.

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.

The steel tapeline 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. Be sure to test with carpenter's measuring tape 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.

PROCEDURES FOR TAKING BODY MEASUREMENTS

WEIGHT

Birth to Two Years

Children from birth to two (2) years 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.

NOTE: Best practice is to record exactly in units used for measuring according to the precision of the equipment being used. Enter into MI-WIC after converting to MI-WIC units.

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).

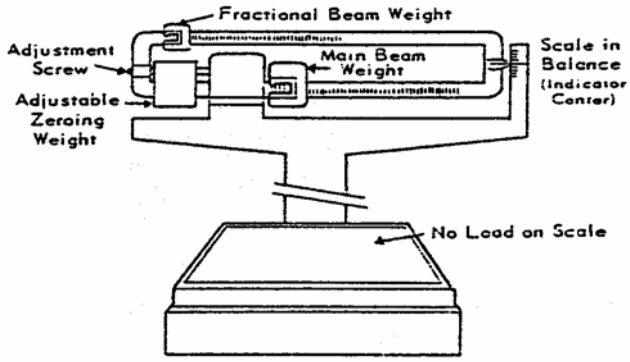


FIGURE A: **ADULT BALANCE-BEAM SCALE**

2. Zero balance the horizontal beam scale:

   a. For the adult scale, remove everything from the scale.

   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 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 scale is not in zero balance, use the adjustment screw 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.

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.

   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.

4. Actual weight measurement is taken by moving the main beam weight away from the zero

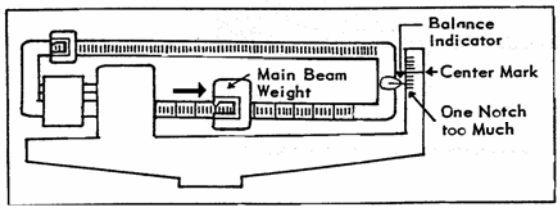
position into the notch, which first shows that too much weight has been added. This places the balance indicator below the center mark (Figure B). Move the main beam weight back one notch. This will raise the balance indicator above the center mark (Figure C).

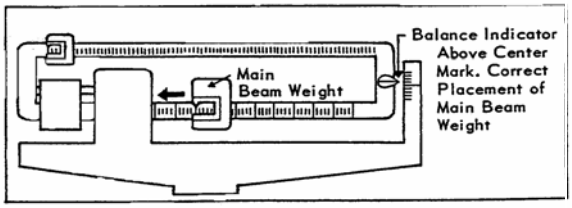
FIGURE B

FIGURE C

5. Move the fractional beam

FIGURE D





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.

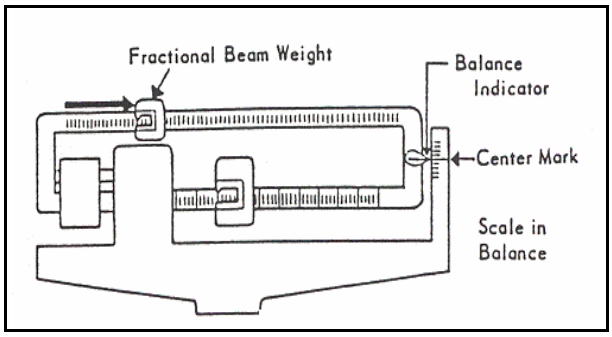
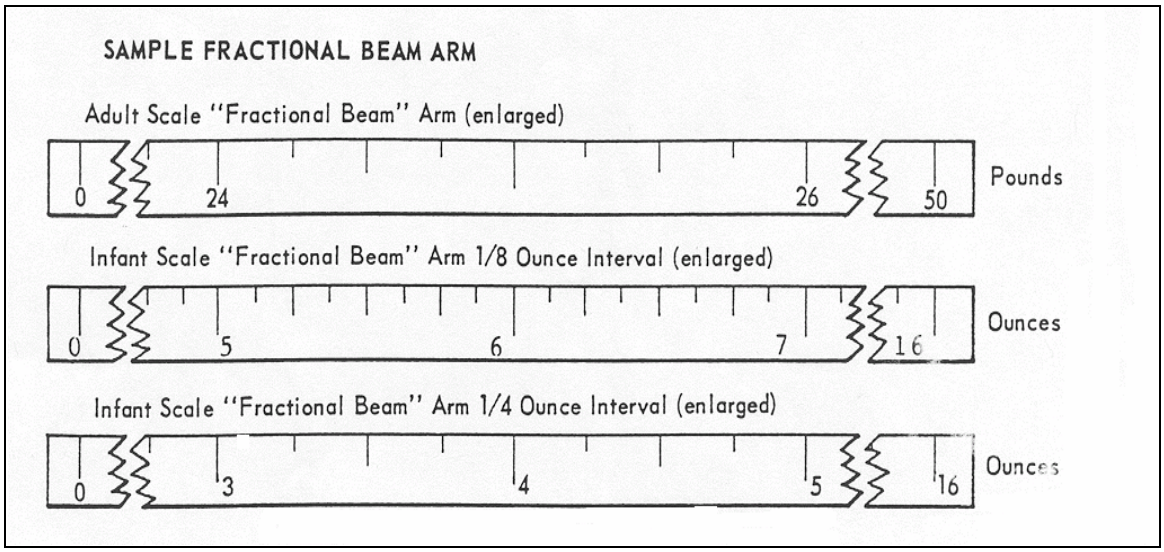


FIGURE E



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.

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.)

NOTE: If children are very active on the scale, it may be necessary to zero balance the scale between readings.
At times it may be impossible to obtain an accurate weight of a child. A gross determination of weight may be obtained by weighing a child held by an adult and subtracting the adult weight to obtain an estimate of the child's weight. If the measure is considered inaccurate, check the 'Unk' box on the Anthro grid for weight. In the note field give the reason for the inaccurate measure and record the value obtained, if applicable.

11. The weight measurement will be plotted in MI-WIC on the CDC 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.

DIGITAL SCALE PROCEDURES

Equipment Preparation for Pediatric and Adult Beam-Balance Scales

1. The digital scale should be checked each day before use to insure accuracy of display. Check manufacturer's operating instructions.

2. 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.

3. 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.

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.

2. Zero balance the digital scale before each weight measurement is taken. If the scale has a re-weigh function, the scale needs to be zero balanced before each child; however, it is not necessary to remove the child for the confirming weight.

   a. Pediatric Digital Scale (**Birth to two (2) years of age and older):** Before zero balancing the scale, place a disposable sheet and appropriate 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.

   b. 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.

3. Pediatric Digital Scale:

   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.

4. Adult Digital Scale:

   a. Direct the individual to stand in the middle of the weighing surface.

   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.

5. Allow the digital scale to lock into the measurement value. The digital scale may beep or otherwise indicate the measurement is locked.

6. Read aloud the weight measurement and write the measurement value on the recording form exactly as it appears on the digital scale display.

7. If the scale does not have a reweigh function, zero balance the digital scale before taking a confirming measurement.

   a. Remove the infant from the pediatric scale and place the diaper back on the scale.

   b. Ask the individual to step off the adult scale.

8. Repeat steps 3 through 6.

9. **Confirm the measurement:** compare the measurement with the previous one. Re-measure until two (2) readings agree within one (1) ounce for pediatric scale and one-quarter (1/4) pound or 2 tenths (0.2) of a pound for adult scale. If the digital scale units are different, be sure the confirming measurement is equivalent in sensitivity.

10. When a confirming measurement is obtained, convert the measurement into MI-WIC units and enter on the Anthro screen **IMMEDIATELY** (Confirming measurement is the last measurement that agrees with a previous measurement according to allowable differences.). **Note**: If the digital scale measures in tenths of a pound, this measurement may be entered directly into the weight field on the MI-WIC Anthro grid.

NOTE: At times, it may be impossible to obtain an accurate weight of a child. A gross determination of weight may be obtained by weighing a child held by an adult. If the tare function of an adult digital scale is used to weigh an infant or special needs child, the measurement will not be as accurate. The adult scales do not have the sensitivity of pediatric scales. If the measure is considered inaccurate, check the 'Unk' box on the Anthro grid for weight. In the note field give the reason for the inaccurate measure and record the value obtained, if applicable.

11. The weight measurement will be plotted in MI-WIC on the CDC 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.

LENGTH

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. 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. 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 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. Place a disposable sheet on recumbent length board.

2. Ask caregiver to remove child's shoes, other footwear, and outdoor wear.

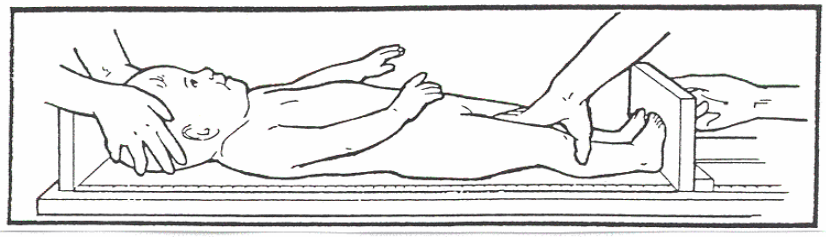
3. Place the child in the middle of the board.

   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. 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 **IMMEDIATELY** on MI-WIC Anthro grid.

6. The height measurement will be plotted in MI-WIC on the CDC 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.

STATURE

Two Years and Older

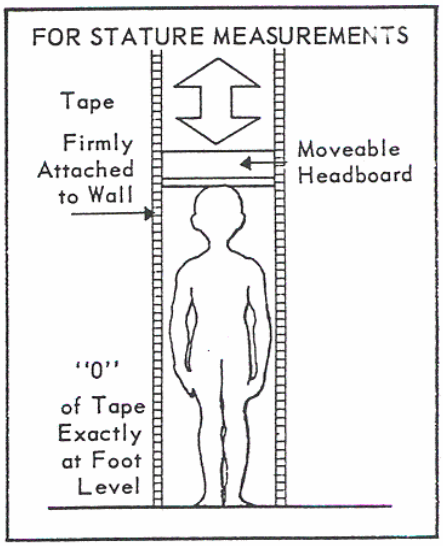
Stature/height measurement should be performed on an uncarpeted area using an 84" steel tapeline attached to a true vertical flat surface, such as a wall without a baseboard or door jamb and a right angle head board. A wall mounted stature measurement board with at least a 75 inch tape line and permanently 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) inch.

NOTE: Height measuring rods which are affixed to 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

FIGURE G



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.

Steps in Obtaining Stature Measurement

1. Tell the individual to remove their shoes.

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. (Figure H)

4. Place the body so that the shoulder blades, buttocks, and heels are touching the wall or vertical flat surface of the measuring device. (Figure I)

FRONT VIEW SIDE VIEW

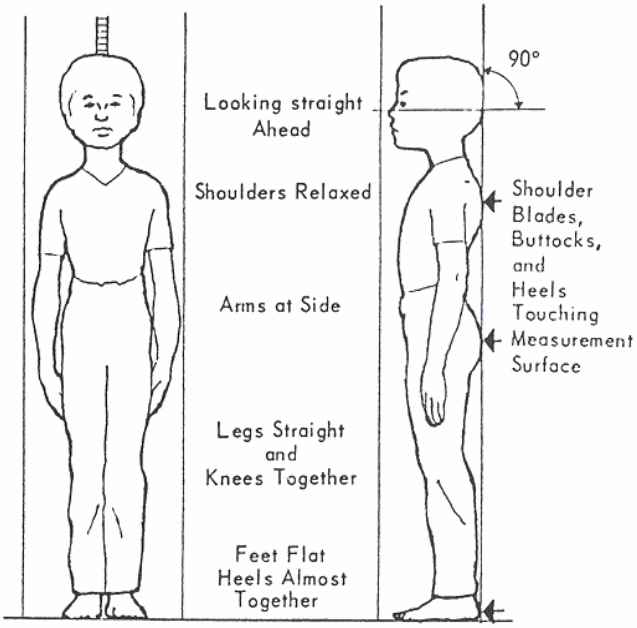


FIGURE H FIGURE I

5. The shoulders must be relaxed and in contact with the measurement surface. (Figure I)

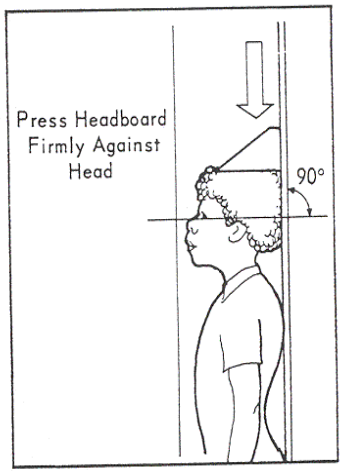
6. The head often is not in contact with the measurement surface. The line of sight is horizontal.

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)

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. 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 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: Children between two and three years of age can have either length or stature measurement taken. MI-WIC has a field indicating whether the measurement was taken RECUMBENT (*R)* or STATURE (*S)* for a C-2 (2 year old) staff must select '*R*' if the child was measured recumbent. MI-WIC defaults to '*S*' for C-2's.

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). 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.

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. 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 **IMMEDIATELY into** MI-WIC.

6. The head circumference measurement will be plotted in MI-WIC on the CDC 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.

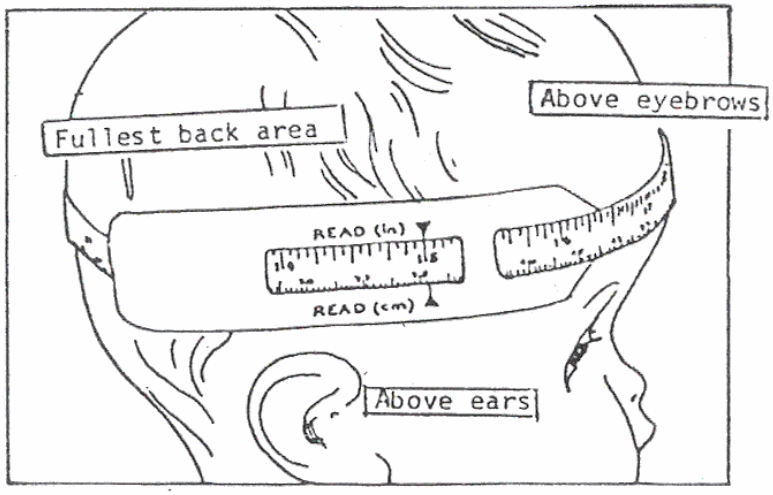


FIGURE K.

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 'Unk' box indicating an inaccurate measure was taken. Explain why the measurement was inaccurate in the note field.

QUALITY CONTROL

MEASURING TECHNIQUE RELIABILITY CHECK

Check body measurement technique 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:

   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.

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. 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.

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.

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 36 Months of Age and for boys and girls 2 to 5 Years of Age. 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 CDC growth charts are found in Appendix G. Michigan Department of Community Health obtained permission from CDC to reproduce them.

The Birth to 36 Months of Age Growth Charts and VLBW Charts should only be used to plot height measurements taken in the recumbent (laying down) position. If a child's height is measured in the standing position, this measurement must be plotted on the 2 to 5 Years of Age Growth Charts. The reference source used to prepare the Birth to 36 Months of Age Growth Charts was based on height measurements taken in the supine position. If a child's height measurement is taken in the standing position (stature) and the data are plotted on the Birth to 36 Months 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.

PERCENTILE CURVES

Growth charts can tell how each child's measurements compare with a sample of 100 children of the same sex and age. Each chart has a set of curves, seven percentile lines, with the numbers 5, 10, 25, 50, 75, 90, and 95 printed along the right hand side. The new CDC 2 to 5 charts for BMI-for-Age has an 85 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 75th percentile. This means that 75 percent of the boys weigh less and 25 percent weigh more.

GROWTH CHART CHARACTERISTICS

Before plotting body measurements and age on the growth charts, it is necessary to become familiar with the distinguishing features of each set of growth charts.

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

PLOTTING UNIT INTERVALS

Growth Charts	Age Interval	Length/ Stature For Age	Weight For Age	Head Circumference	Weight for Length BMI-for-age
Birth to 36 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):

BMI = [Weight (lbs.) _____ ÷ stature (in.)_____ ÷ stature (in.)____] X 703

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

PLOTTING MEASUREMENTS

STEPS IN 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	2010	4	15
MINUS Birth date	- 2008	- 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)
	08	6	
Date of Measurement	20~~09~~	~~7~~	~~15~~
MINUS birth date	- 2007	- 10	- 28
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 2009 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 2007 from 2008 = 1 years (2009 - 1 = 2008)

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 36 Months of Age CDC-based Growth Charts or VLBW Charts can only be used to plot recumbent length measurements. These charts are based on a reference 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 36 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*

<u>2 to 5 Years of Age Growth Chart record</u>:

- 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.

PLOTTING GROWTH CHARTS FOR PREMATURE INFANTS

The measurement values for premature infants are to be plotted on appropriate sex and age-specific CDC and VLBW Growth Charts (used for educational purposes). When a premature 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 premature infant's physical growth, it is necessary to take into account the number of weeks the infant is premature and adjust the infant's age for plotting length and weight measurements on the growth chart. Use adjusted age for premature 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 premature.

STEPS TO FIND ADJUSTED AGE FOR PLOTTING PREMATURE INFANT MEASUREMENTS

1. Find number of weeks premature.

   a. 40 weeks (full-term) minus number weeks of gestation at birth equals weeks premature.

   b. Example: 40 weeks (full-term)
      - 33 weeks (gestational age)
      7 weeks premature (Adjustment for Prematurity)

2. Find number of months premature, rounding to the half month

   a. Weeks premature divided by 4 equal number of months premature.

   b. Round fraction to the half month:
      If fraction of month is ¼ - round down to whole month
      If fraction of month is ½ - ½ month
      If fraction of month is ¾ - round down to ½ month

   c. Example: $\frac{\text{7 weeks premature}}{4}$ = 1 ¾, then round to 1 ½ (months premature.)

3. Determine Gestation Adjusted Age (GAA)

   a. Actual age minus number months premature equals Gestation Adjusted Age.

   b. Example: 4 months actual age
      - 1 ½ months premature.
      2 ½ months Gestation Adjusted Age

Plot Age-Related Measurement Values

Normal, healthy premature infants grow rapidly after birth. While premature infants who are Low Birth Weight (LBW) have slightly different growth patterns, they will still be plotted on the CDC Birth to 36 Month Growth Chart. Even though VLBW infants have a distinctly different pattern of growth, the CDC Growth Charts, adjusted for prematurity, will be used for risk codes. It is recommended for nutrition education to also use the VLBW Charts. If you use the CDC Birth to 36 Month Chart and the VLBW Chart, continue using the same charts and continue using the age adjustment for prematurity until the switch is made to using the Growth Chart for 2 to 5 years.

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

PRENATAL WEIGHT GAIN GRID

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 shaded curves identify the desired pattern and rate of weight gain for each weight gain category (underweight, normal weight, overweight or obese) 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 shaded diagonal lines represent the desired pregnancy weight gain pattern for each weight gain category pregravid weight woman. The shaded 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 left hand corner box. This is the weight just before conception. Record also pregravid weight next to thick, dark horizontal line on the Grid. If the pregravid weight is unknown, record the first prenatal weight next to the dark horizontal line on the grid and note the weeks of gestation.

2. Measure the height (without shoes) and record in top left hand corner box.

3. Weigh with normal indoor clothing and without shoes and record in top left hand corner box.

4. Obtain the Expected Date of Confinement (EDC). Determine the weeks of gestation. Date the weeks of gestation line (vertical) on the grid. A gestational wheel aids in gestational age determination. 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. Place an X where the number of weeks gestation intersects the number of pounds of weight gained or lost. Write the date and weight on bottom of grid.

7. At each prenatal visit, plot the weight gained or lost at the appropriate weeks gestation. Each point can be connected to establish a pattern that can be compared with the shaded weight gain curve for the weight gain category preprinted on the grid to assess weight gain curve.

NOTE: Estimation method for unknown or "suspect" pregravid weight, plot as:

1. **Estimate pregravid weight gain category based on today's weight and height.**

2. **Locate weeks gestation vertical line and place a "dot" or "x" at the mid-point of weight gain category shaded area for pounds gained.**

3. **Read the estimated plotted point to obtain an estimated weight gain. (This estimated weight gain reflects the mid-point for the weeks gestation for the individual's weight gain category).**

4. **At subsequent visits, obtain weight measurement and plot weight gain for weeks gestation. Then, it is possible to determine if weight gain is appropriate.**

RECORDING MEASUREMENTS

All results 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

Any child whose height, weight and/or head circumference are above the 95th percentile or below the 5th 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

CDC Growth Chart	Birth to 36 Mos.	2 Yrs. to 5 Yrs.
Length or stature-for-age	below 5th percentile	below 5th percentile
Weight-for-length or BMI-for-age	below 5th percentile **or** above 95th percentile	below 5th percentile **or** above 95th percentile
Head circumference-for-age	below 5th percentile **or** above 95th 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.

PROBLEM IDENTIFICATION

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 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 5th percentile. This should be assessed to determine if the short statue is due to heredity or inadequate nutrition and poor health.

2. Low weight-for-age: weight-for-age less than the 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 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 95th 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 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 5th percentile suggests underweight and above the 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 5th percentile suggests microcephaly and on or above the 95th 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 95th percentile 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 should have their weight 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 5th 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 5th and at the 10th percentile is considered at risk for becoming underweight and should have their weight 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 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 their 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 THE RISK FOR INADEQUATE GROWTH (Risk Code 135+)

Anthropometric measurements are used to screen children for risks of poor growth. Weight measures are used to establish a growth pattern, requiring a series of plot points. From these two or more plot points, it is possible to judge whether there has been Adequate or Inadequate Growth, as most healthy children follow an established growth curve pattern.

Why is Screening for Inadequate Weight Gain Important?

A Weight for age is a sensitive indicator of acute nutritional inadequacy. The rate of gain during infancy, especially early infancy is rapid, and abnormalities in rate of weight gain may often be detected in just a few months. There is little question that decrease in the rate of weight gain during infancy is the earliest indication of nutritional failure. Infants and children with abnormally slow growth can benefit from nutrition and health interventions to improve weight and height gain.

Source: USDA WIC policy Memo 98-9, in reference to Risk Code 135 +

Risk code 135+ is a risk code that allows you to screen two weight measurements over a period of time. It only applies to the Weight-for-Age chart. The criteria applies to 3 different age periods: 1) birth to 1 month; 2) birth to 6 months; and 3) 6 months to 59 months.

General Criteria for Inadequate Growth: Risk Code 135+

1. Birth to 1 month age group
   elated to weight loss and gain after birth

2 & 3. Birth to 6 months and 6 months to 59 months
based on two weights over minimum time period to determine if *Minimal Expected Weight Gain* has occurred. If not, then we say there has been *Inadequate Growth*.

Key terms: Inadequate Growth
Inadequate Growth = Lack of Minimal Expected Weight Gain from two measurements taken over minimal time periods.

Key terms: Minimal Expected Weight Gain
Minimal Expected Weight Gain represents the 10th percentile of average rate of weight gained each month for the reference population. For example, looking at R.C. 135+ for 3rd month, the Minimal Expected Weight Gain of 19 oz. means that only 10 % of infants gain less than 19 oz. during their 3rd month.

Inadequate Growth - Infants from Birth to 1 month

Normally infants lose weight after birth, during the first 4-8 days of life.
Loss of 7-10 % of birthweight is normal for full term infants. Loss of up to 15-20% if born prematurely. Birth weight is usually regained by 10-14 days of age, although premature infants may take up to 22 days. Many factors can affect these generalized patterns.

Jan Cox, Nutritional Manual for At-Risk Infants and Toddlers.

To meet the Inadequate Growth - Risk Code 135+ Criteria for Infants from Birth to 1 month, any of the following will apply:

1) Excessive weight loss after birth

2) Not back to birth weight by 2 weeks of age

If criteria met - Risk Code 135+ applies. Further assessment required to analyze individual factors to determine the extent of risk.

What is *Excessive* weight loss after birth?
Clinical judgment based on individual infant compared to range of normal weight loss. For example, loss of greater than 10% for full term or greater than 15% for premature infants could be considered excessive. For summary of studies see Jan Cox, Nutritional Manual for At-Risk Infants and Toddlers.

INADEQUATE GROWTH - CRITERIA BASED ON 2 WEIGHT MEASUREMENTS:

Infants birth to 6 months:

Based on 2 weights at least 1 month apart, weight gain is less than table (varies by month)

1st mo. - 19 oz./ mo.
2nd mo. - 27 oz./ mo.
3rd mo. - 19 oz./ mo.
4th mo. - 17 oz./ mo.
5th mo. - 15 oz./ mo.
6th mo. - 13 oz./ mo.

See Policy 2.13A, Risk Code 135+

For example, baby James is enrolled as newborn and weighs 6 lbs. 10 oz. at birth. At one month he weighs 7 lbs. 10 oz. His gain is only 16 oz. The minimal gain from the first month from the table above shows 19 oz. Therefore James meets the criteria for inadequate growth and Risk Code 135+ applies.

Infants & children 6-59 months:

Based on 2 weights at least 3 months apart, weight gain is less than table (varies by period)

6-12 mos. - 9 ½ oz/ mo.
12-59 mos. - 2.7 oz./ mo.

See Policy 2.04A, Risk Code 135+

For example, Hillary was seen at the WIC clinic at 6 months of age and weighed 13 lbs. 8 oz. At 9 months, she weighed 15 lbs. 6 oz., or a gain of 30 oz. The minimal gain from the table above is 9.5 x 3 = 28.5 oz. Hillary did gain enough to meet the criteria for adequate growth, therefore Risk Code 135+ does not apply.

Now that I know the criteria, how do I efficiently calculate in a WIC clinic?

The above examples were easy since there was only one month and three months between weighing. If weights taken are further apart, then a Look-up Method will be provided using a Weight Gain Table, if necessary, due to observation of a weight **drop** on the Weight-for-Age chart. Determine if a calculation is necessary by examining the Weight-for-Age plots on the growth chart. This step will be called making a Preliminary Screen.

Preliminary Screen

In order to avoid making calculations on all children, Michigan WIC policy allows staff to determine if a decrease from one weight measurement to the next is sufficient to require a calculation. No calculation is necessary if weight-for-age from the two measurements are:

1) Still at the same percentile, or
2) At a higher percentile on the second measurement.

If the first weight-for-age is below the 25th percentile, then any decrease in percentile on the second weighing requires calculation.

If the first weight-for-age is above the 25th percentile, then a decrease of 5 or more percentiles on the second weighing requires calculation.

Most WIC children will NOT require calculation using these guidelines.

Example A: Preliminary Screen - First weight above the 25th percentile

For example, if the first weight-for-age was at the 50th percentile and the second weight, at least three months later, was below the 45th percentile, then a calculation would be necessary. However, if the second weight-for-age was above the 45th percentile, then no calculation is necessary.

Example B: Preliminary Screen - First weight below the 25th percentile

If the first weight-for-age percent was at the 20th percentile, then any percentile below the 20th on the second weight would require a calculation. (Inadequate growth is more sensitive in lower percentiles)

If the preliminary screen indicates a calculation is needed, then proceed to determine if there has been Minimal Expected Weight Gain using the last two weight plot points.

Steps in Determining Inadequate Growth by using Minimal Expected Weight Gain:

1) Determine if there was minimum time between weights.
2) Determine Actual Weight Gain.
3) Use one of 2 methods to determine Minimum Expected Weight Gain.
4) If Actual is greater than Expected, then weight gain is Adequate, if not then R.C. 135+ applies!

Inadequate growth - calculation: Gross Method ("Quick and dirty")

If weight is measured over an exact 6 month period (+ or - 2 weeks)

Inadequate growth is determined when weight gain is less than or equal to expected pounds gained on right of table:

Age in months at end of period	Pounds gained in 6 mos.
6	≤ 7
9	≤ 5
12	≤ 3
18 - 60	≤ 1

See Policy 2.13A, Risk Code 135+

Example of Inadequate Growth for an Infant: Gross Method

From birthweight to weight at 6 months: Amount gained = 6 lbs. 8 oz.
By the Gross Method Chart, at the end of 6 months, weight gain should exceed 7 lbs. Since the weight gain was less, this infant has Inadequate growth and Risk Code 135+ applies.

LOOK-UP METHOD HANDOUTS

Instructions for Using "Weight Gain Tables" (Appendix M) For Inadequate Growth or Potentially Inadequate Growth. You may want to use the chart "Ounces to Pounds and Ounces Measurement Conversions."

Steps to calculate Inadequate Growth using "Look-up" Method with Tables 1-8

Step 1: Determine the infant/child's actual weight gain since their last visit.

Step 2: Find the table that has this infant/child's age at their current age on the left side, then find the previous weight on the top line. Age is in "Month/Weeks" format.

Step 3: Find box that intersects. If the number in the box is greater than the actual weight gain, Inadequate Growth should be assigned to the infant/child. If the number is less, Inadequate Growth does not apply. If the box is blank where the lines intersect, risk code may not be assigned.

Steps to calculate Inadequate Growth using "Weight Gain Table #8"

Step 4: If age is greater than 19 months on the second weight, use Table 8.

Step 5: For Table 8, use the first column to find the time between weights.

Step 6: The right column shows the expected weight gain. If the number in the box is less than the actual gain, Inadequate Growth does not apply.

Example: William was born on 1-1-2002. At one month of age on 2-1-2002, he weighed 9 lbs. 8 oz., on 5-1-2002, he weighed 14 lbs. 0 oz. Was there adequate weight gain?

Solution using the Lookup Tables:

Using Table #1: First age along top = 1.0
Second age along the left = 4.0
Expected gain from intersection = 63 oz.
Actual gain of 72 oz. is 9 oz. more than expected, therefore, weight gain is adequate.
Risk Code 135+ does not apply.

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.

MEASURING UNCOOPERATIVE CHILDREN

If an infant or young child is uncooperative and the height or length cannot be measured, document the reason in the progress notes. 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, the Birth to 36 Months growth chart should be used for plotting the recumbent length measurement. Be sure to document the actual measurement and procedure used on the appropriate forms.

If a child is uncooperative and cannot be weighed using the standard procedure, follow the procedure to be used for weighing children with physical handicaps. The measurement procedure should be documented on the appropriate forms.

MEASURING INDIVIDUALS WITH PHYSICAL DISABILITIES

Sometimes the standard measurements cannot be used because the individual is wearing a cast, missing a limb, or is physically handicapped. 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 the progress notes. 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 the progress notes. In addition, follow the MI-WIC procedures for not being able to obtain an accurate measurement (Check the 'Unk' box and enter measures and explanation in the 'Comments' field).

An individual wearing a cast can usually be weighed using standard procedures. Presence of a cast should be documented on the growth chart and in the progress notes. Remember that overweight risk factors may not be used for WIC certification in this situation, and plotting on the growth charts will be affected.

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. Use the Birth to 36 Months growth chart for children two to three years old.

For children older than three, use the growth chart for children 2 to 18 years of age. Care should be taken when interpreting the growth chart for children 2 to 18 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 and the procedure used on the appropriate forms.

PHYSICALLY HANDICAPPED OLDER CHILDREN

Older children with physical handicaps 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.

Record the measurement and the procedure used on the required forms.

PHYSICALLY HANDICAPPED YOUNG ADULTS

If an adult has a physical handicap that prevents her/him from being measured, document the problem in the progress notes.

LEG SHORTER THAN THE OTHER

If a child is less than three 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 of the longer leg and document this measurement in the progress notes and on the Birth to 36 Months growth chart and any other required forms.

A child over three years of age or a woman can be measured in a standing position by having him/her stand on his/her longest leg. Record the child's measurement on the growth chart for 2 to 18 years of age.

AMPUTEE/MISSING LIMBS

Infants or young children who are missing arms or legs may be weighed on the pediatric beam-balance scale using the standard procedure. If the client is an older child or an adult who can stand alone, they should be weighed on the adult beam-balance scale using the standard procedure. Document the physical problem and weight on all appropriate forms for your agency. It is very important to remember that the risk factors for being underweight cannot be used for WIC certification in this situation. If an older child or adult cannot stand to be weighed and cannot be held by a caretaker to be weighed, the weight measurement should be omitted. These circumstances

should be documented in the progress notes.
If an individual is missing limbs that prevent the recumbent length or height from being measured, this measurement should be omitted, and this fact should be documented in the progress notes. 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 growth of an individual with congenital or metabolic disorders cannot be compared to the reference population. Therefore, the CDC growth charts will not be accurate. 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 which can precede 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; 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. Every effort needs to be made to assure that proper equipment is available and correct technique is followed.

Inaccurate measurements may also impact on a child's failure for certification in the WIC program.