

National Household Survey
Capability Programme

HOW TO WEIGH AND MEASURE CHILDREN

Assessing the Nutritional Status
of Young Children in Household Surveys



United Nations

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of Young Children in Household Surveys

Preliminary Version



United Nations
Department of Technical
Co-operation for Development
and Statistical Office

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PREFACE

The present manual was prepared by the United Nations Statistical Office as part of its programme of technical documentation in household surveys to provide operational guidance on the content, collection, processing, analysis and reporting of household surveys on the nutritional status of young children using anthropometric growth indicators. This work was undertaken in collaboration with the World Health Organization and UNICEF.

The document was developed within the framework of the National Household Survey Capability Programme, a programme of the United Nations to help national statistical offices of developing countries obtain through household surveys a continuing flow of integrated statistics for national and sectoral planning and to monitor and evaluate progress towards development goals. In a broader sense, however, it is hoped that this manual will be useful to those national agencies, especially ministries of health, and other institutions wishing to undertake or support the collection of anthropometric data.

This manual on **How to Weigh and Measure Children** is part of a larger activity on **Assessing the Nutritional Status of Young Children**. It is also intended to serve as a self-contained set of procedures to assist national survey administrators and data collection staff who may have little prior experience with the collection of anthropometric data.

An additional copy of the summary measurement procedures described in this manual and the section on procedures and precautions is provided inside the cover so that users may easily reproduce and incorporate these procedures in field manuals for specific surveys, or use them as self-standing training materials, with acknowledgement to the United Nations.

This manual was drafted by Mr. Irwin J. Shorr serving as a consultant to the United Nations, and, following extensive international review, has been revised and is being issued by the United Nations Statistical Office. Appreciation is expressed to the Bangladesh Bureau of Statistics for its co-operation in assisting with the illustrations in this manual. The illustrations in this manual were composed by Mr. Shorr.

This document is being issued in preliminary form to obtain comments and results of experience from as many users as possible, which should be directed to the National Household Survey Capability Programme, Statistical Office, United Nations, New York, 10017.

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I. Introduction

A. Purpose and Content of This Manual

This manual explains how to weigh and measure children. The measurements that are presented are standing height, recumbent length, weight and mid-upper arm circumference. Mid-upper arm circumference is not a core measurement for cross-sectional surveys but is included as a supplementary measurement as it is particularly useful for screening purposes.

The manual is a prototype which can be used for different purposes. It is structured for trainers to be used as a training manual or for supervisors or enumerators as a field manual. It can be used as a quick reference or as a resource document. Lay persons may find the details particularly useful especially when technical assistance is not available. A summary section of measurement procedures appears both in Section II and as a separate removable section inside the cover.

Weighing and measuring children are important elements in assessing the nutritional status of a population. Accurate measurements are required to classify children's growth properly using internationally accepted reference standards. Accurate measurements are also required if child growth is to be related to other components of a survey such as demographic, socio-economic, health, water or sanitation. However, since these measurements may seem deceptively simple, they are often done poorly and errors frequently occur.

To help minimize measurement error, the recommended procedures are presented in a summary form, and are then broken down into small steps in Section III. Although the procedures consist of several steps, once learned, the measurements can be done rapidly—approximately one minute per measurement. The procedures in this manual have been used in several countries and were designed to minimize physical stress to the child.

Errors can also result from misreading or incorrectly recording a measurement. Therefore, methods to reduce errors due to reading and recording are presented in Section IV on Quality Control.

Objective evaluation of measurement performance, although very important, is frequently overlooked in training and data collection. Therefore, a method to test enumerator measurement competency is presented in Annex H.

Another source of error is due to the measuring equipment used; its improper use, wear over time, or use of inadequate equipment not suitable for field surveys. A custom-made measuring board, specific model scale and

arm circumference tape are used to illustrate the measurement procedures. Sources and types of measuring equipment suitable for field survey work are described in Annex F. Since there are few low cost height measuring boards commercially available, guidelines for the construction of a portable board are presented in Annex G. A test to ensure equipment reliability is also presented.

B. Procedures and Precautions Before Measuring

1. Layout of The Manual

Each step of the measurement procedures in this manual is directed at specific participants, who are named in bold letters at the beginning of each step: e.g. **"Measurer"**, **"Assistant"**, etc.

2. Two Trained People Required

Two trained people are required to measure a child's height and length. The measurer holds the child and takes the measurements. The assistant helps hold the child and records the measurements on the questionnaire. If there is an untrained assistant such as the mother, then the trained measurer should also record the measurements on the questionnaire. One person alone can take the weight or arm circumference of a child and record the results if an assistant is not available.

3. Measuring Board and Scale Placement

Begin to observe possible places where the board can be positioned and the scale hung as soon as you walk towards a sample household. Be selective about where you place the measuring board and scale. It is best to measure outdoors during daylight hours. If it is cold, raining or if too many people congregate and interfere with the measurements, it may be more comfortable to weigh and measure a child indoors. Make sure there is adequate light.

4. Age Assessment

Before you measure, determine the child's age. If the the child is less than two years, measure length. If the child is two years of age or older, measure height (see Annex C). If accurate age is not possible to obtain, measure length if the child is less than 85 cm. Measure height if the child is equal to or greater than 85 cm.

5. When to Weigh and Measure

Weigh and measure after verbal information has been recorded on the questionnaire. This will allow you to become familiar with the members of the household. DO NOT weigh and measure at the beginning of the interview, i.e. as soon as you enter a household, which would be more of an upsetting intrusion.

6. Weigh and Measure One Child at a Time

If there is more than one eligible child in a household, complete the entire questionnaire, including the weighing and measuring of one child. Then proceed with the next eligible child's questionnaire in the household. DO NOT weigh and measure all the children together. This can easily cause confusion and will create a greater chance for error such as recording one child's measurements on another child's questionnaire. Return measuring equipment to their storage bags immediately after you complete the measurements for each household.

7. Control the Child

When you weigh and measure, you must control the child. The strength and mobility of even very young children should not be underestimated. Be firm yet gentle with children. Your own sense of calm and self confidence will be felt by the mother and the child.

When a child has contact with any measuring equipment, i.e. on a measuring board, in the weighing pants or with an arm circumference tape, you must hold and control the child so the child will not trip or fall. Never leave a child alone with a piece of equipment. Always have physical contact with the child except when you must let go of a child for a few seconds while taking the weight.

8. Coping With Stress

Since weighing and measuring requires touching and handling children, normal stress levels for this type of survey work are higher than for surveys where only verbal information is collected.

Explain the weighing and measuring procedures to the mother, and to a limited extent, the child, to help minimize possible resistance, fears or discomfort they may feel. You must determine if the child or mother is under so much stress that the weighing and measuring must stop. Remember, young children are often uncooperative; they tend to cry, scream, kick and sometimes bite. If a child is under severe stress and is crying excessively, try to calm the child or return the child to the mother for a moment before proceeding with the weighing and measuring.

Do not weigh or measure a child if:

- a. The mother refuses.
- b. The child is too sick or too distressed.
- c. The child is physically deformed which will interfere with or give an incorrect measurement. To be kind, you may want to measure such a child and make a note of the deformity on the questionnaire.

9. Recording Measurements and Being Careful

Record the measurements in pencil. If you make an error, completely erase the error and rewrite the correct numbers. Keep objects out of your hands and pencils out of your mouth, hair or breast pocket when you weigh and measure so that neither the child nor you will get hurt due to carelessness. When you are not using a pencil, place it in your equipment pack, pencil case or on the survey form. Make sure you do not have long fingernails. Remove interfering rings and watches before you weigh and measure. Do not smoke when you are in a household or when you weigh and measure.

10. Strive for Improvement

You can be an expert measurer if you strive for improvement and follow every step of every procedure the same way every time. The quality and speed of your measurements will improve with practice. You may be working with a partner to form a team. If so, you will be responsible for not only your own work, but also for the quality of work of your team.

You will be required to weigh and measure many children. Do not take these procedures for granted even though they may seem simple and repetitious. It is easy to make errors when you are not careful. Do not omit any steps. Concentrate on what you are doing.

II. Nutritional Status Measurement

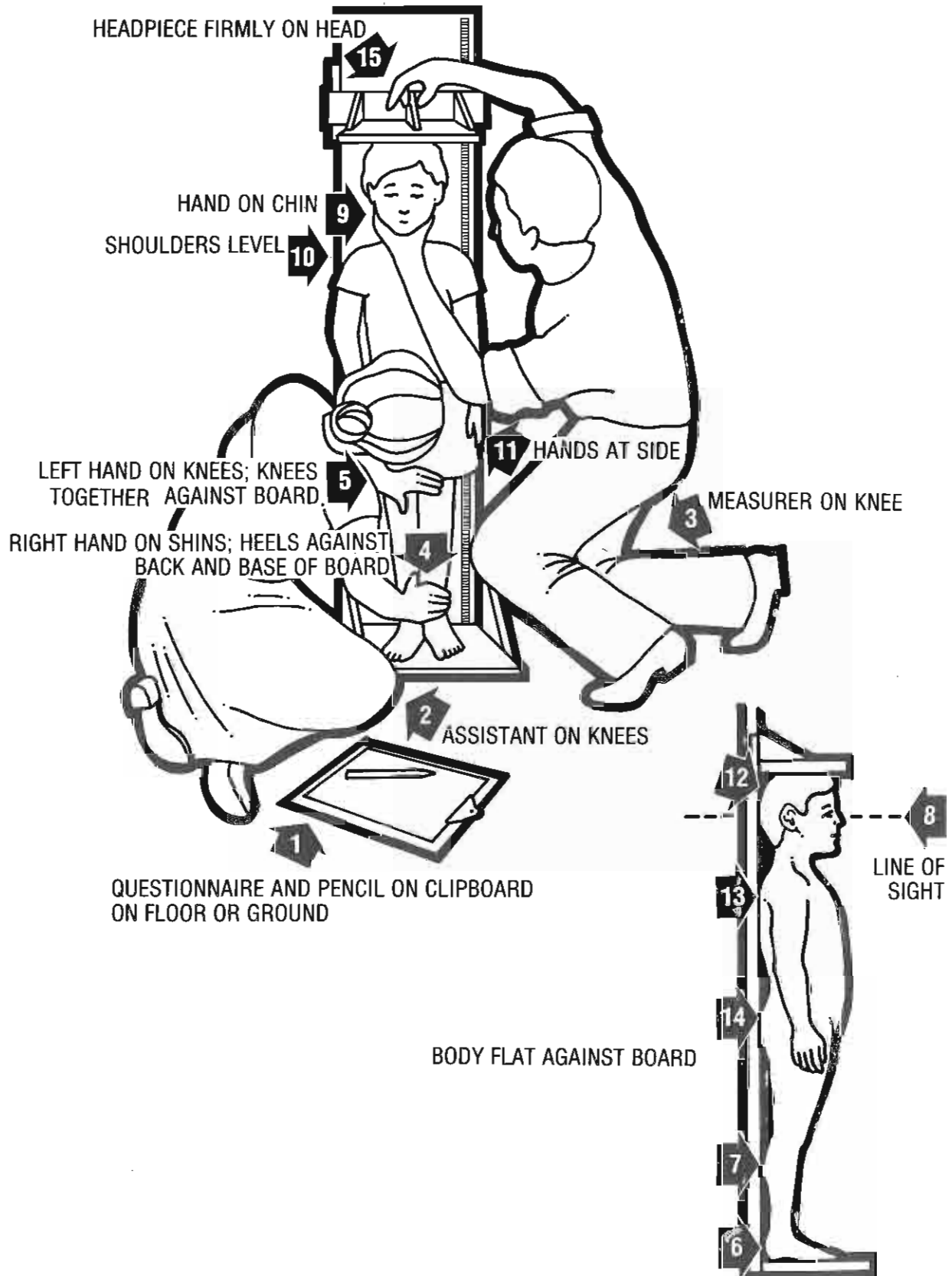
Summary Procedures

A. Child Height Summary Procedure (Illustration 1)*

1. **Measurer or Assistant:** Place the measuring board on a hard flat surface against a wall, table, tree, staircase, etc. Make sure the board is stable.
2. **Measurer or Assistant:** Ask the mother to remove the child's shoes and unbraid any hair that would interfere with the height measurement. Ask her to walk the child to the board and to kneel in front of the child (if she is not the assistant).
3. **Assistant:** Place the questionnaire and pencil on the ground (Arrow 1). Kneel with both knees on the right side of the child (Arrow 2).
4. **Measurer:** Kneel on your right knee only, for maximum mobility, on the child's left side (Arrow 3).
5. **Assistant:** Place the child's feet flat and together in the centre of and against the back and base of the board. Place your right hand just above the child's ankles on the shins (Arrow 4), your left hand on the child's knees (Arrow 5) and push against the board. Make sure the child's legs are straight and the heels and calves are against the board (Arrows 6 and 7). Tell the measurer when you have completed positioning the feet and legs.
6. **Measurer:** Tell the child to look straight ahead at the mother if she is in front of the child. Make sure the child's line of sight is level with the ground (Arrow 8). Place your open left hand on the child's chin. Gradually close your hand (Arrow 9). Do not cover the child's mouth or ears. Make sure the shoulders are level (Arrow 10), the hands are at the child's side (Arrow 11), and the head, shoulder blades and buttocks are against the board (Arrows 12, 13, and 14). With your right hand, lower the headpiece on top of the child's head. Make sure you push through the child's hair (Arrow 15).
7. **Measurer and Assistant:** Check the child's position (Arrows 1-15). Repeat any steps as necessary.
8. **Measurer:** When the child's position is correct, read and call out the measurement to the nearest 0.1 cm. Remove the headpiece from the child's head, your left hand from the child's chin and support the child during the recording.
9. **Assistant:** Immediately record the measurement and show it to the measurer.
NOTE: If the assistant is untrained, the measurer records the height.
10. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to erase and correct any errors.

* If the assistant is untrained, e.g. the mother, then the measurer should help the assistant with the height procedure.

Illustration 1
Child Height Measurement

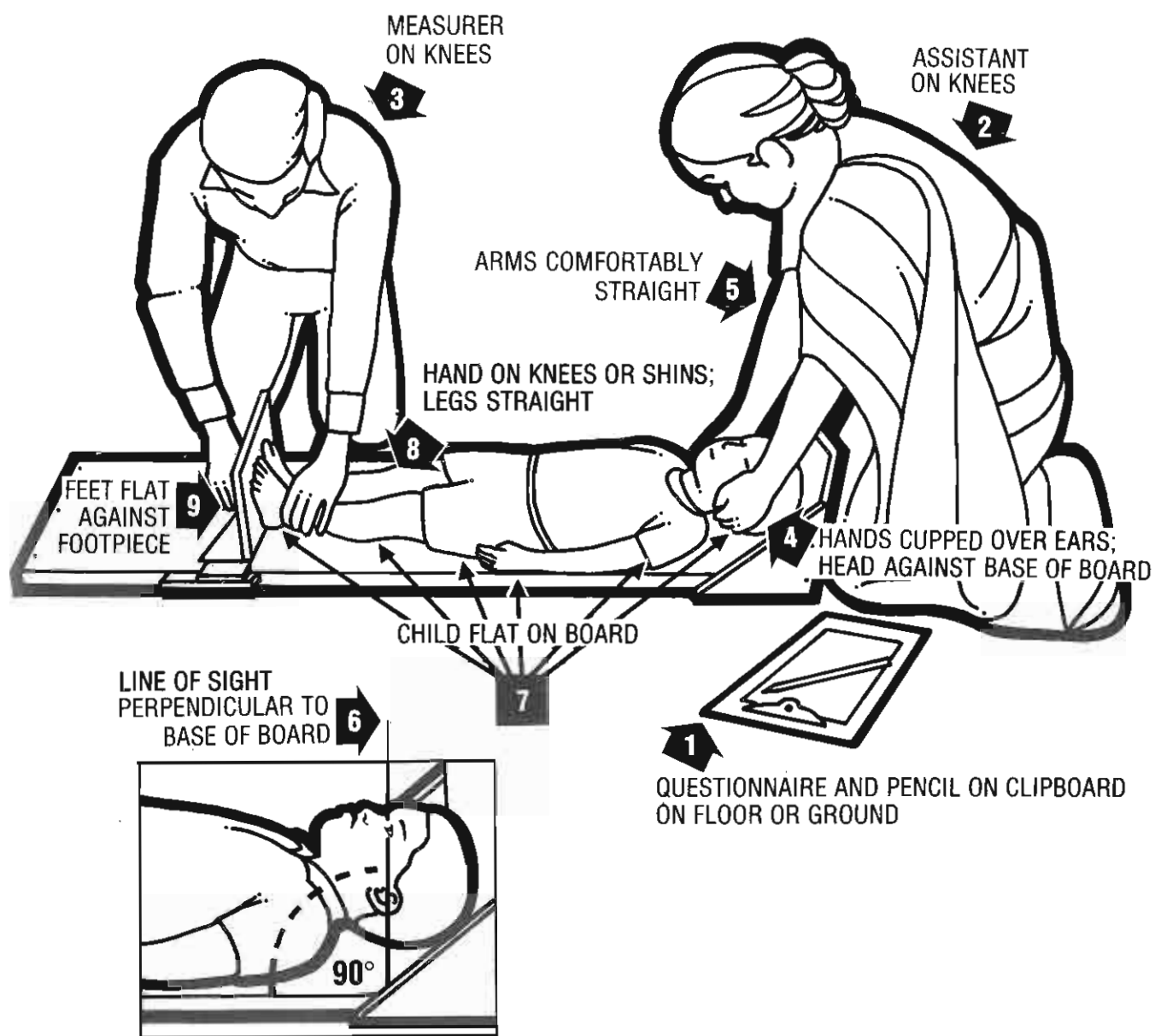


B. Child Length Summary Procedure (Illustration 2)*

1. **Measurer or Assistant:** Place the measuring board on a hard flat surface, i.e. ground, floor or steady table.
2. **Assistant:** Place the questionnaire and pencil on the ground, floor or table (Arrow 1). Kneel with both knees behind the base of the board, if it is on the ground or floor (Arrow 2).
3. **Measurer:** Kneel on the right side of the child so that you can hold the footpiece with your right hand (Arrow 3).
4. **Measurer and Assistant:** With the mother's help, lay the child on the board by doing the following:
 - Assistant:** Support the back of the child's head with your hands and gradually lower the child on the board.
 - Measurer:** Support the child at the trunk of the body.
5. **Measurer or Assistant:** If she is not the assistant, ask the mother to kneel on the opposite side of the board facing the measurer to help keep the child calm.
6. **Assistant:** Cup your hands over the child's ears (Arrow 4). With your arms comfortably straight (Arrow 5), place the child's head against the base of the board so that the child is looking straight up. The child's line of sight should be perpendicular to the ground (Arrow 6). Your head should be straight over the child's head. Look directly into the child's eyes.
7. **Measurer:** Make sure the child is lying flat and in the centre of the board (Arrows 7). Place your left hand on the child's shins (above the ankles) or on the knees (Arrow 8). Press them firmly against the board. With your right hand, place the footpiece firmly against the child's heels (Arrow 9).
8. **Measurer and Assistant:** Check the child's position (Arrows 1-9). Repeat any steps as necessary.
9. **Measurer:** When the child's position is correct, read and call out the measurement to the nearest 0.1 cm. Remove the footpiece, release your left hand from the child's shins or knees and support the child during the recording.
10. **Assistant:** Immediately release the child's head, record the measurement, and show it to the measurer.
 - NOTE:** If the assistant is untrained, the measurer records the length on the questionnaire.
11. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to erase and correct any errors.

*If the assistant is untrained, e.g. the mother, then the measurer should help the assistant with the length procedure.

Illustration 2
Child Length Measurement

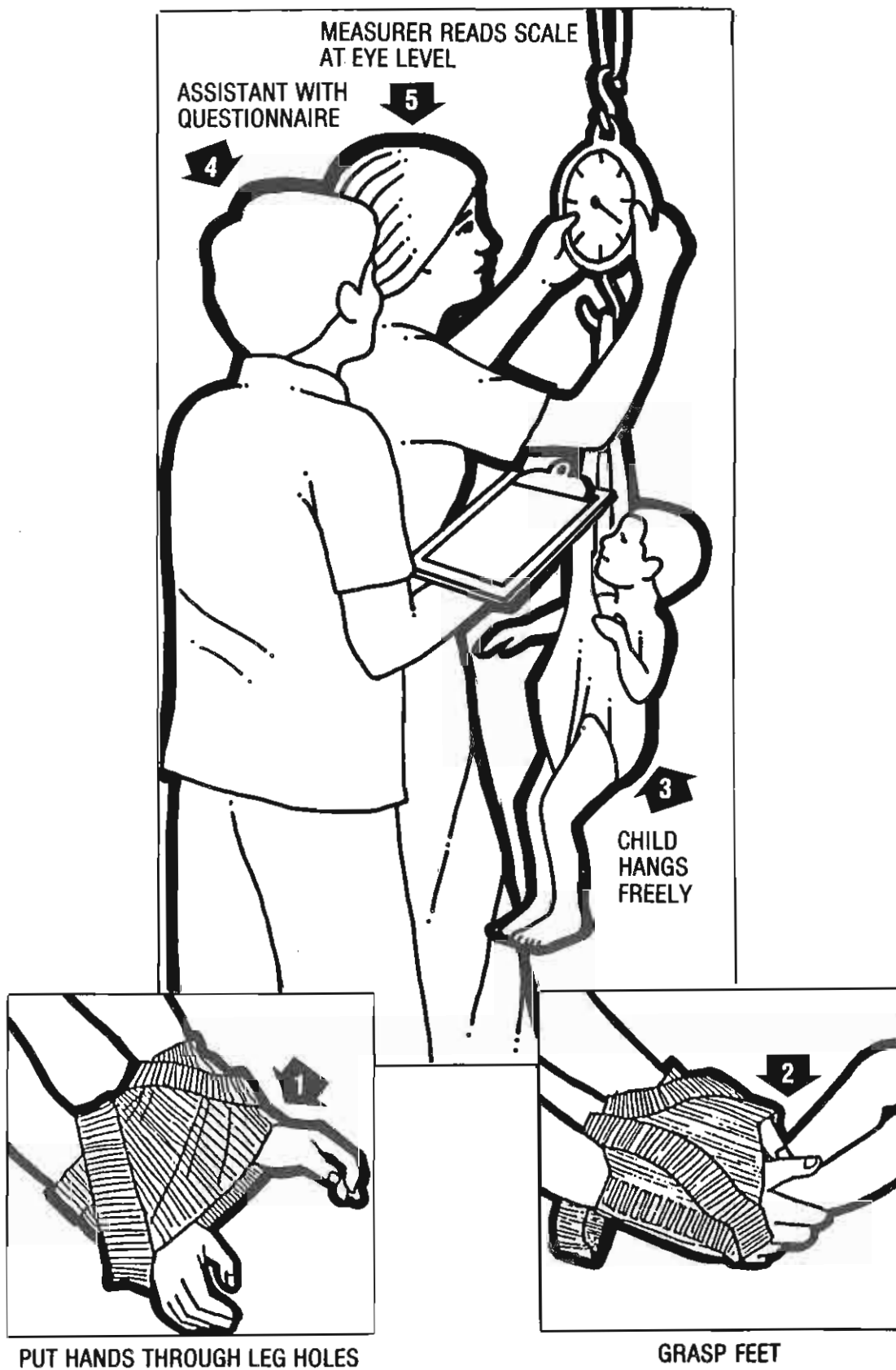


C. Child Weight Summary Procedure (Illustration 3)*

1. **Measurer or Assistant:** Hang the scale from a tree branch, ceiling beam, tripod or pole held by two people. You may need a piece of rope to hang the scale at eye level. Ask the mother to undress the child.
2. **Measurer:** Attach a pair of the empty weighing pants, infant sling or basket to the hook of the scale and adjust the scale to zero, then remove from the scale.
3. **Measurer:** Have the mother hold the child. Put your arms through the leg holes of the pants (Arrow 1). Grasp the child's feet and pull the legs through the leg holes (Arrow 2). Make certain the strap of the pants is in front of the child.
4. **Measurer:** Attach the strap of the pants to the hook of the scale. DO NOT CARRY THE CHILD BY THE STRAP ONLY. Gently lower the child and allow the child to hang freely (Arrow 3).
5. **Assistant:** Stand behind and to one side of the measurer ready to record the measurement. Have the questionnaire ready (Arrow 4).
6. **Measurer and Assistant:** Check the child's position. Make sure the child is hanging freely and not touching anything. Repeat any steps as necessary.
7. **Measurer:** Hold the scale and read the weight to the nearest 0.1 kg. (Arrow 5). Call out the measurement when the child is still and the scale needle is stationary. Even children who are very active, which causes the needle to wobble greatly, will become still long enough to take a reading. WAIT FOR THE NEEDLE TO STOP MOVING.
8. **Assistant:** Immediately record the measurement and show it to the measurer.
9. **Measurer:** As the assistant records the measurement, hold the child in one arm and gently lift the child by the body. DO NOT LIFT THE CHILD BY THE STRAP OF THE WEIGHING PANTS. Release the strap from the hook of the scale with your free hand.
10. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to erase and correct any errors.

*If the assistant is untrained, e.g. the mother, then weight should be taken by one person only, the trained measurer, who should also record the measurement on the questionnaire.

Illustration 3
Child Weight

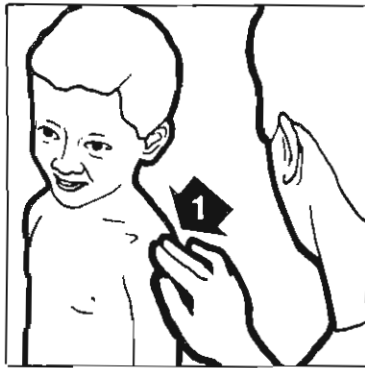


D. Child Mid-Upper Arm Circumference Summary Procedure (MUAC) (Illustration 4)*

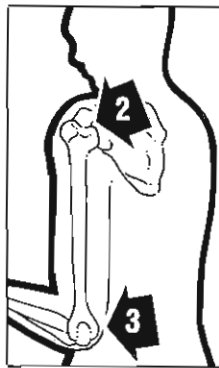
1. **Measurer:** Keep your work at eye level. Sit down when possible. Very young children can be held by the mother during this procedure. Ask the mother to remove clothing that may cover the child's left arm.
2. **Measurer:** Calculate the midpoint of the child's left upper arm by first locating the tip of the child's shoulder (Arrows 1 and 2) with your finger tips. Bend the child's elbow to make a right angle (Arrow 3). Place the tape at zero, which is indicated by two arrows, on the tip of the shoulder (Arrow 4) and pull the tape straight down past the tip of the elbow (Arrow 5). Read the number at the tip of the elbow to the nearest centimetre. Divide this number by two to estimate the midpoint. As an alternative, bend the tape up to the middle length to estimate the midpoint. A piece of string can also be used for this purpose. Either you or an assistant can mark the midpoint with a pen on the arm (Arrow 6).
3. **Measurer:** Straighten the child's arm and wrap the tape around the arm at the midpoint. Make sure the numbers are right side up. Make sure the tape is flat around the skin (Arrow 7).
4. **Measurer and Assistant:** Inspect the tension of the tape on the child's arm. Make sure the tape has the proper tension (Arrow 7) and is not too tight or too loose (Arrows 8-9). Repeat any steps as necessary.
5. **Assistant:** Have the questionnaire ready.
6. **Measurer:** When the tape is in the correct position on the arm with the correct tension, read and call out the measurement to the nearest 0.1 cm. (Arrow 10).
7. **Assistant:** Immediately record the measurement on the questionnaire and show it to the measurer.
8. **Measurer:** While the assistant records the measurement, loosen the tape on the child's arm.
9. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to erase and correct any errors.
10. **Measurer:** Remove the tape from the child's arm.

*If the assistant is untrained, e.g. the mother, then arm circumference should be measured by one person only, the trained measurer, who should also record the measurement on the questionnaire.

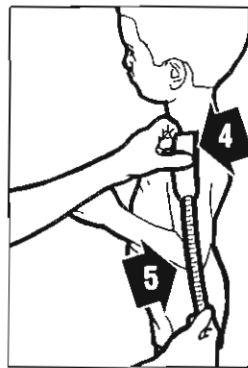
Illustration 4 Child Mid-Upper Arm Circumference Measurement



1 LOCATE TIP OF SHOULDER



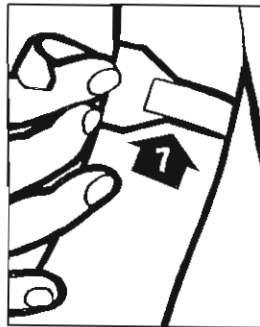
2 TIP OF SHOULDER
3 TIP OF ELBOW



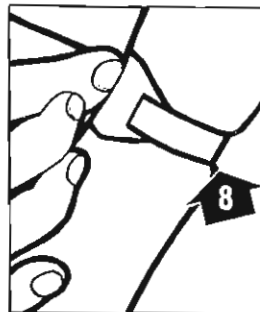
4 PLACE TAPE AT TIP OF SHOULDER
5 PULL TAPE PAST TIP OF BENT ELBOW



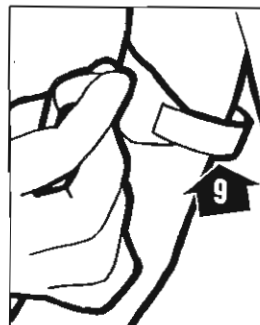
6 MARK MIDPOINT



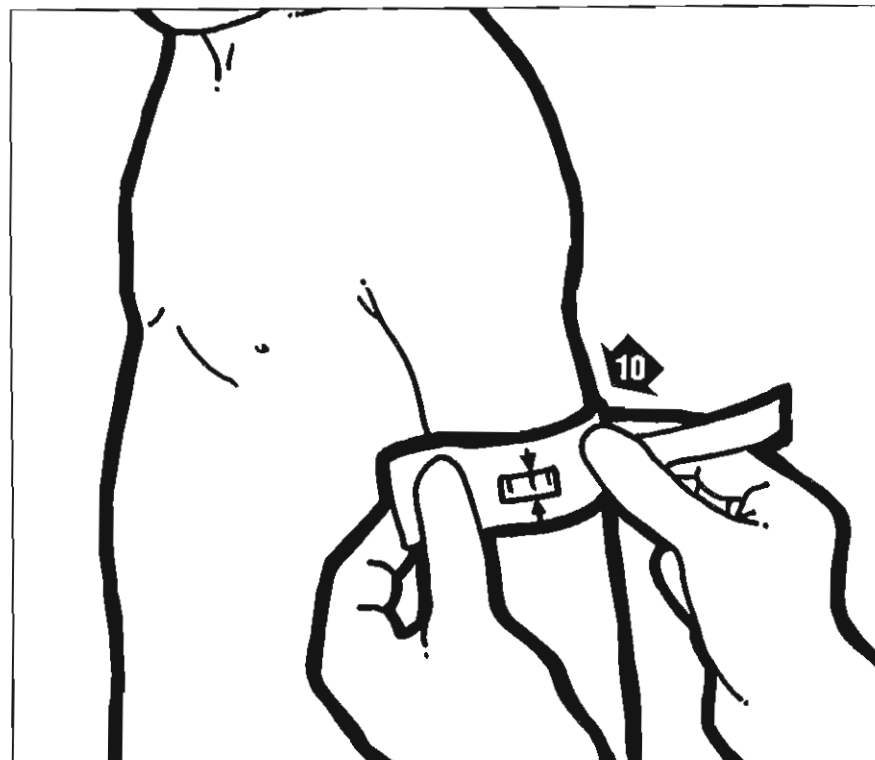
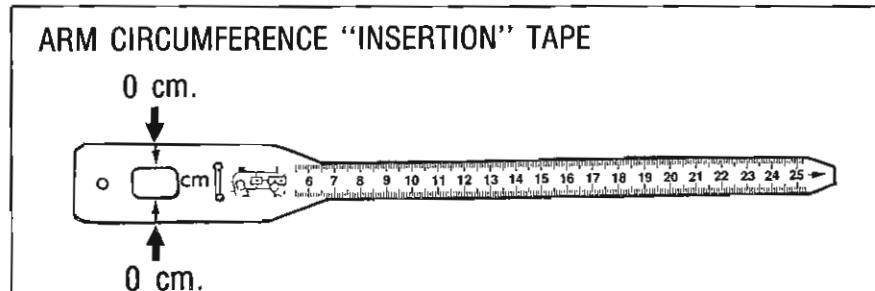
7 CORRECT TAPE TENSION



8 TAPE TOO TIGHT



9 TAPE TOO LOOSE



10 CORRECT TAPE POSITION FOR ARM CIRCUMFERENCE

III. Step-By-Step Measurement Procedures

A. Child Height Measurement Procedure*

IMPORTANT: HEIGHT IS MEASURED ONLY ON CHILDREN TWO OR MORE YEARS OF AGE (SEE ANNEX C). IF ACCURATE AGE CANNOT BE OBTAINED, MEASURE HEIGHT IF A CHILD IS GREATER THAN OR EQUAL TO 85 CM.

- 1. Mesurer and Assistant:** Make certain you have all the pieces of the measuring board and it is working properly. Pick a place where there is a hard flat surface against a wall, door, staircase, table, etc. Make sure the board is stable. The slightest movement of the board, particularly backwards, can make a child feel very insecure. You may have to place some small rocks under the base of the board to stabilize it. Place the questionnaire and pencil on the ground or floor on the side of the board where the assistant will help hold the child. Place knee pads on both sides of the board if available.

Illustration 5

Measuring Board and Questionnaire Placement



*If the assistant is untrained, e.g. the mother, then the mesurer should help the assistant with the height procedure.

- 2. Measurer or Assistant:** Ask the mother to remove any footwear or headgear on the child and unbraid any interfering hair.

Illustration 6

Unbraid Interfering Hair

- 3. Measurer and Assistant:** With the help of the mother, walk the child to the board. Stand the child on the base of the board with the child's back to the board.

IMPORTANT: WHILE THE CHILD IS ON THE BOARD, YOU MUST HOLD AND CONTROL THE CHILD SO THE CHILD WILL NOT TRIP AND FALL. NEVER LEAVE A CHILD ALONE ON A BOARD.

- 4. Assistant:** Kneel with both knees on the right side of the child.
- 5. Measurer:** Kneel on your right knee only, for maximum mobility, on the left side of the child. Support the child so the child does not trip and fall.

Illustration 7

**Assistant, Measurer and Child Positions
Before Height Measurement**

6. **Measurer or Assistant:** Ask the mother to kneel in front of the child so that the child will look straight ahead at the mother.

Illustration 8
Mother Kneeling in Front of Child



7. **Assistant:** Position the child's feet together in the centre of the board. The back of the heels must touch the back of the board. You may need to use two hands to move the child's feet into position. Place your right hand on the child's shins, just above the ankles, and hold them firmly (Illustration 9). Sometimes, children will stand on their toes (Illustration 10). Make certain the child's feet are flat on the base of the board.

Illustration 9
Correct Position
of Feet



Illustration 10
Incorrect Position
of Feet-Child on Toes



8. **Measurer:** Continue to support the child while the assistant places the child's feet in the correct position.

Illustration 11

**Assistant's Right Hand on Shins Above Ankles.
Measurer Supports Child**



9. **Assistant:** Place your left hand on the child's knees. Press them firmly together against the board. Make certain the calves, buttocks and trunk are in the centre of the board. Tell the measurer when you have completed positioning the child's feet and knees.

10. **Measurer:** Continue to support the child.

Illustration 12

**Assistant's Left Hand on Knees.
Measurer Supports Child**



- 11. Measurer:** Place your open left hand on, but not under, the child's chin with fingers spread. Gradually and gently close your fingers on the child's face.

Illustration 13
Left Hand on
Child's Chin.
Fingers Spread



Illustration 14
Gently Close
Fingers on
Child's Chin



Illustration 15
Final Left
Hand Position



- 12. Measurer:** Make certain your hand is on the child's chin and your fingers spread around the child's ears on the sides of the face only. Your hand and arm should be away from the child's chest. Do not place any part of your hand or arm on the child's ears or chest. Do not cover the child's mouth.

Illustration 16

**Correct Hand and Arm Position.
Fingers Spread Around Ears.
Arm Away From Child's Chest**



Illustration 17

**Incorrect Hand and Arm Position.
Fingers Pressing on Ears.
Arm Resting on Child's Chest**



Illustration 18

**Incorrect Hand Position.
Child's Mouth is Covered**



- 13. Measurer:** The position of the child's head is very important. The line from the hole in the ear to the bottom of the "orbit", i.e. bone, of the eye is called the "Frankfort Plane". This line should be parallel with the base of the board and at right angles to the back of the board.

Illustration 19

Position of Head "Frankfort Plane"



- 14. Measurer:** Tell the child to stand up tall and look straight ahead at the mother who is kneeling in front of the child. Place the head in the correct level position, i.e. note the "Frankfort Plane". You may have to pivot on your right knee back and forth to a position slightly in front of the child to see if the head is level, straight and in the centre of the board. Make certain the child's shoulders are straight and level and the shoulder blades and back of the head are touching the back of the board.

Illustration 20

Correct Child Position for Height



15. **Measurer and Assistant:** If the child holds onto the board, gently remove the child's hands and place them at his side.

Illustration 21
Incorrect Child Hand Position.
Child Holding Side of Board



16. **Measurer:** When the child's position is correct, place the headpiece a few centimetres above the child's head and slowly lower it on the head. Make certain you push the hair down so the headpiece is resting on the child's skull. Be firm, but do not press the headpiece against the head too hard. Make sure the child is looking straight ahead at the mother.

Illustration 22
Headpiece Above
Child's Head



Illustration 23
Headpiece on Top of
Child's Head



- 17. Measurer and Assistant:** Check the child's position: feet flat and together on the base of the board; heels, back of the knees, buttocks, shoulder blades and back of the head touching the back of the board; knees together and body in the centre of the board; shoulders level and eyes looking straight ahead; headpiece firmly on top of the child's head and firmly against the board. Repeat any steps as necessary.

Correct Positions for Child Height

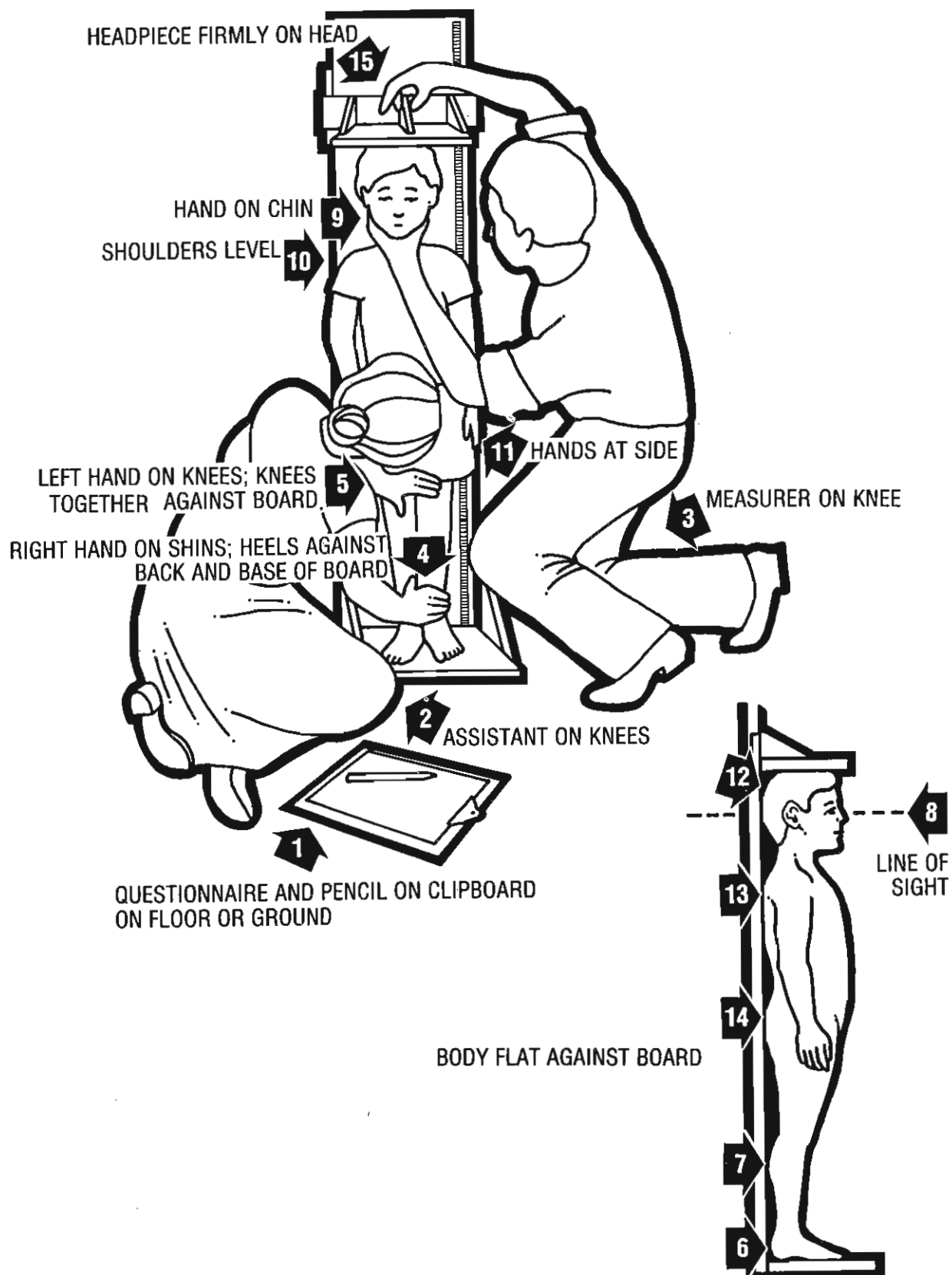
Illustration 24



Illustration 25



Illustration 26
Correct Positions for Child Height Measurement



18. Assistant: NOTE COMMON HEIGHT MEASUREMENT MISTAKES

Illustration 27
*Incorrect Position of Feet.
Child on Toes*



Illustration 28
*Incorrect Position
of Knees.
Child's Knees Bent*



Illustration 29
*Incorrect Child Hand Position.
Child Holding Side of Board*



Illustration 30
*Incorrect Child Position.
Not in Centre of Board*



19. Measurer: NOTE COMMON HEIGHT MEASUREMENT MISTAKES

Illustration 31: *Incorrect Position of Child's Shoulders—Not Level*



Illustration 32: *Incorrect Hand Position—Child's Mouth is Covered*



Illustration 33: *Incorrect Hand and Arm Positions. Fingers on Child's Ears; Hand Resting on Child's Chest*



Illustration 34: *Incorrect Head Position—Child Not Looking Straight Ahead*



Illustration 35: *Incorrect Position of Headpiece—Not Pressing Through Hair on Child's Skull*



Illustration 36: *Incorrect Position of Child's Body. Not Against Board*



20. Supervisor: Observe the measurement from several positions:

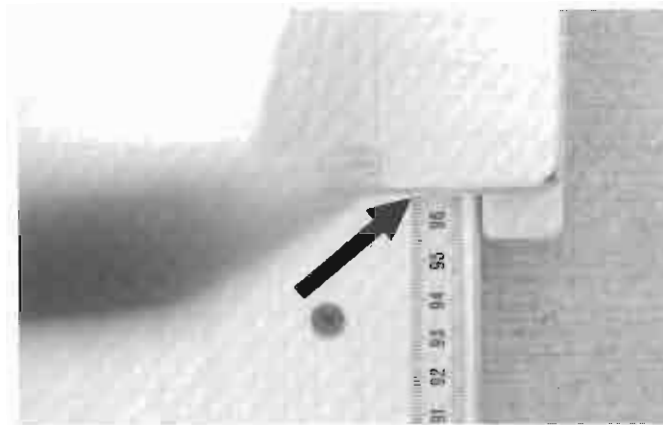
- Move to one side to check that the back of the heels and knees, buttocks, shoulder blades and head are touching the board.
- Stand near the assistant to check the position of the feet and knees.
- Stand behind the mother to check the position of the child's head and shoulders (child looking straight ahead at the mother and shoulders level) and to observe the whole measurement procedure from a distance, i.e. a few feet away.
- Move behind the measurer to check the position of the measurer's hand on the child's chin, the headpiece and the actual height measurement, i.e. the numbers on the tape.
- Correct any errors immediately.

Illustration 37
Supervisor Observing Child Height Procedure



- 21. Measurer:** When the child's position is correct, read and call out the height measurement to the nearest 0.1 cm. at the headpiece.

Illustration 38
Read Measurement at Headpiece



- 22. Measurer and Assistant:*** Follow the Reading and Recording System.
- 23. Assistant:*** Immediately release the child's feet and knees and record the measurement on the questionnaire.
- 24. Measurer:** While the assistant records the measurement, remove the headpiece, release your left hand from the child's chin and support the child.

Illustration 39
Assistant Records Measurement.
Measurer Supports Child



* If the assistant is untrained, e.g. the mother, then the measurer should record the height on the questionnaire.

- 25. Assistant:*** As soon as you have completed recording the height measurement, immediately show the questionnaire to the measurer.

Illustration 40

Assistant Shows Questionnaire to Measurer



- 26. Measurer:** Check the recorded measurement for accuracy and legibility. Are the numbers the same as you called out; neat, legible and inside the boundaries of the boxes on the questionnaire? If not, instruct the assistant to correct any errors. When you accept the measurement, tell the assistant.
- 27. Measurer and Assistant:** Repeat any steps as necessary.
- 28. Measurer or Assistant:** Return the child to the mother. Put the measuring board away if there are no other children to be measured.

End of Child Height Measurement Procedure

* * *

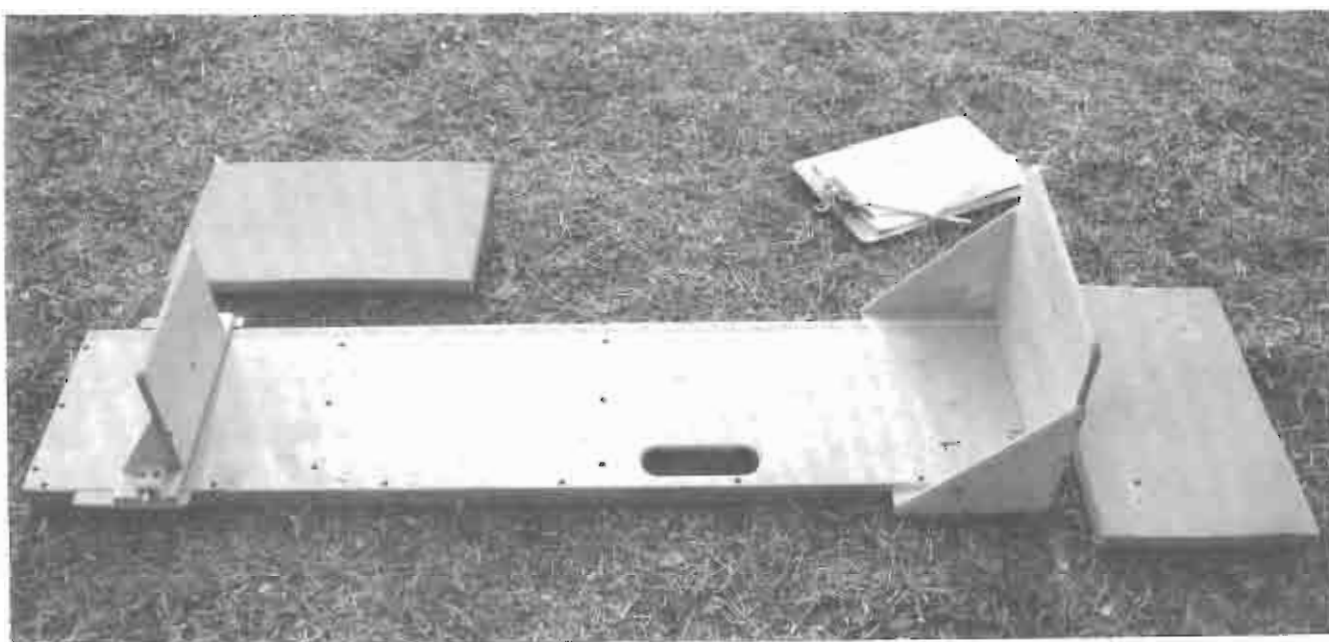
* If the assistant is untrained, e.g. the mother, then the measurer should record the height on the questionnaire.

B. Child Length Measurement Procedure*

IMPORTANT: LENGTH IS MEASURED ON CHILDREN LESS THAN TWO YEARS OLD (SEE ANNEX C). IF ACCURATE AGE CANNOT BE OBTAINED, MEASURE LENGTH ON THOSE CHILDREN WHO ARE LESS THAN 85 CM.

- 1. Measurer or Assistant:** Make certain you have all the pieces of the measuring board and it is working properly. Place the board on a hard flat surface, i.e. ground, floor or a steady table. If available, place one knee pad behind the base of the board and another on the side where the measurer will kneel.
- 2. Measurer:** Place the footpiece at the end of the board.
- 3. Measurer or Assistant:** Place the questionnaire and pencil near the base of the board where the assistant will kneel, i.e. where the child's head will be placed.

Illustration 41
Measuring Board Position for Length.
Questionnaire and Knee Pad Placement



* If the assistant is untrained, e.g. the mother, then the measurer should help the assistant with the length procedure.

4. **Measurer or Assistant:** Ask the mother to remove any footwear or headgear on the child, unbraid any interfering hair and carry the child to the board.
5. **Assistant:** Kneel on the ground or floor with both knees behind the base of the board.
6. **Measurer:** Kneel on the right side of the child so that you can hold the footpiece with your right hand.
7. **Measurer and Assistant:** Lay the child on the board by doing the following:
 - Assistant:** Support the back of the child's head with your hands and gradually lower the child on the board.
 - Measurer:** Support the child as the child is being lowered on the board.

IMPORTANT: WHILE THE CHILD IS ON THE BOARD, YOU MUST HOLD AND CONTROL THE CHILD SO THE CHILD WILL NOT ROLL OFF OR HIT ITS HEAD ON THE BOARD.

Illustration 42
Assistant and Measurer Positions.
Lowering Child on Board



8. **Measurer or Assistant:** Ask the mother to kneel on the opposite side of the board facing the measurer to help keep the child calm.

Illustration 43

Position of Mother During Length Measurement



9. **Assistant:** Cup your hands over the child's ears, with thumbs tucked inward against your fingers. Hold the child securely yet comfortably.

Illustration 44

Correct Hand and Head Position



10. **Assistant:** Do not press your hands flat against the child's ears, or your thumbs on the child's shoulders.

Illustration 45
Incorrect Hand Position.
Hands Pressing Against Ears.
Thumbs Pressing on Shoulders



11. **Assistant:** Place the child's head against the base of the board. If the head is not against the base, have the measurer hold the child at the trunk and lift the child towards the end of the board. Guide the child's head into position.

Illustration 46
Incorrect Head Position.
Head Away From Base of Board

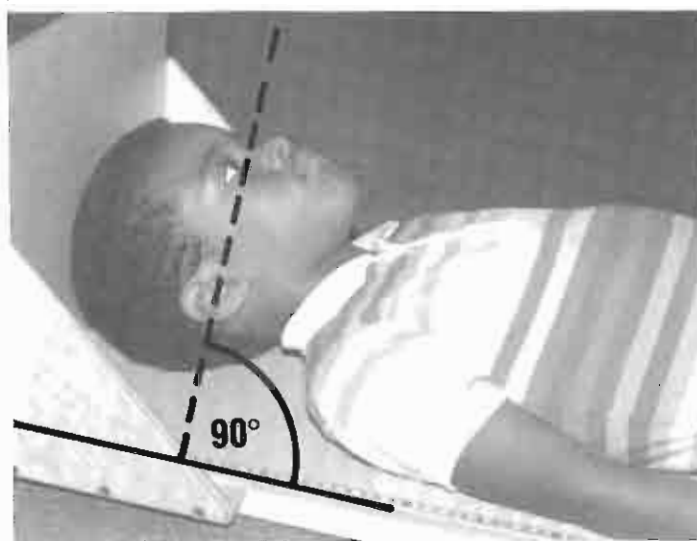


Illustration 47
Reposition Child



- 12. Assistant:** The position of the child's head is very important. The line from the hole in the ear to the bottom of the "orbit", i.e. bone, of the eye is called the "Frankfort Plane". This line should be parallel with the base of the board and at right angles to the back of the board.

Illustration 48
Position of Head "Frankfort Plane"



- 13. Assistant:** Make sure the child's head is straight and level and eyes are up. Place your head above the child's head. Look directly into the child's eyes. Keep your arms comfortably straight.

Illustration 49
Child and Assistant Positions



14. **Assistant:** Make certain the child's chin is not tucked in against his chest or stretched too far back.

Illustration 50

*Incorrect Child Head Position.
Chin Against Chest*



Illustration 51

*Incorrect Child Head
Position—Head Stretched
Too Far Back*



15. **Assistant:** Tell the measurer when you have placed the child's head in the correct position.
16. **Measurer and Assistant:** Position the child so the shoulders, back and buttocks are flat along the centre of the board.

Illustration 52

Child Flat on Board



- 17. Measurer:** After the assistant has placed the child's head in the correct position, place your left hand on the child's shins (above ankles) or on the knees. Hold the footpiece with your right hand firmly against the child's heels so that both feet are at right angles to the back of the board.

Correct Position of Feet

Illustration 53



Illustration 54



- 18. Measurer:** A child's feet can be very strong. You may have to straighten them with your hands. You can lift them with your left hand away from the board. With your right hand, hold the footpiece against the feet and lower onto the board.

Lift Feet to Assist Correct Positioning

Illustration 55

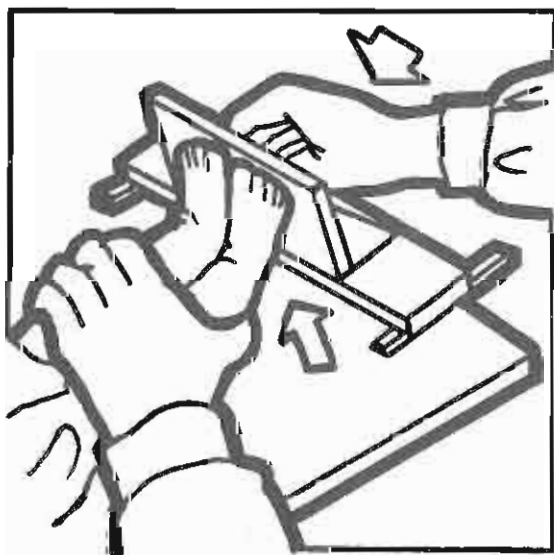


Illustration 56



19. Assistant: NOTE COMMON LENGTH MEASUREMENT MISTAKES

Illustration 57

Incorrect Head Position.
Head Not Against Base of Board



Illustration 58

Incorrect Head Position.
Chin Tucked into Chest



Illustration 59

Incorrect Head Position.
Head Stretched Too Far Back



Illustration 60

Incorrect Hand Position.
Hands Pressing Flat Against Ears.
Thumbs on Shoulders



Illustration 61: *Incorrect Child Position.*
Not in Centre of Board



20. Measurer: NOTE COMMON LENGTH MEASUREMENT MISTAKES

Illustration 62
*Incorrect Measurer Position.
Not Directly at Feet*



Illustration 63
*Incorrect Measurer Position.
Knee Up Impairs Vision*



Illustration 64
*Incorrect Measurer Position.
Too Far Away From Board*



Illustration 65
*Incorrect Position of Feet.
Not Flat Against Footpiece*



Illustration 66
*Incorrect Position of Footpiece.
Not Flat on Board*

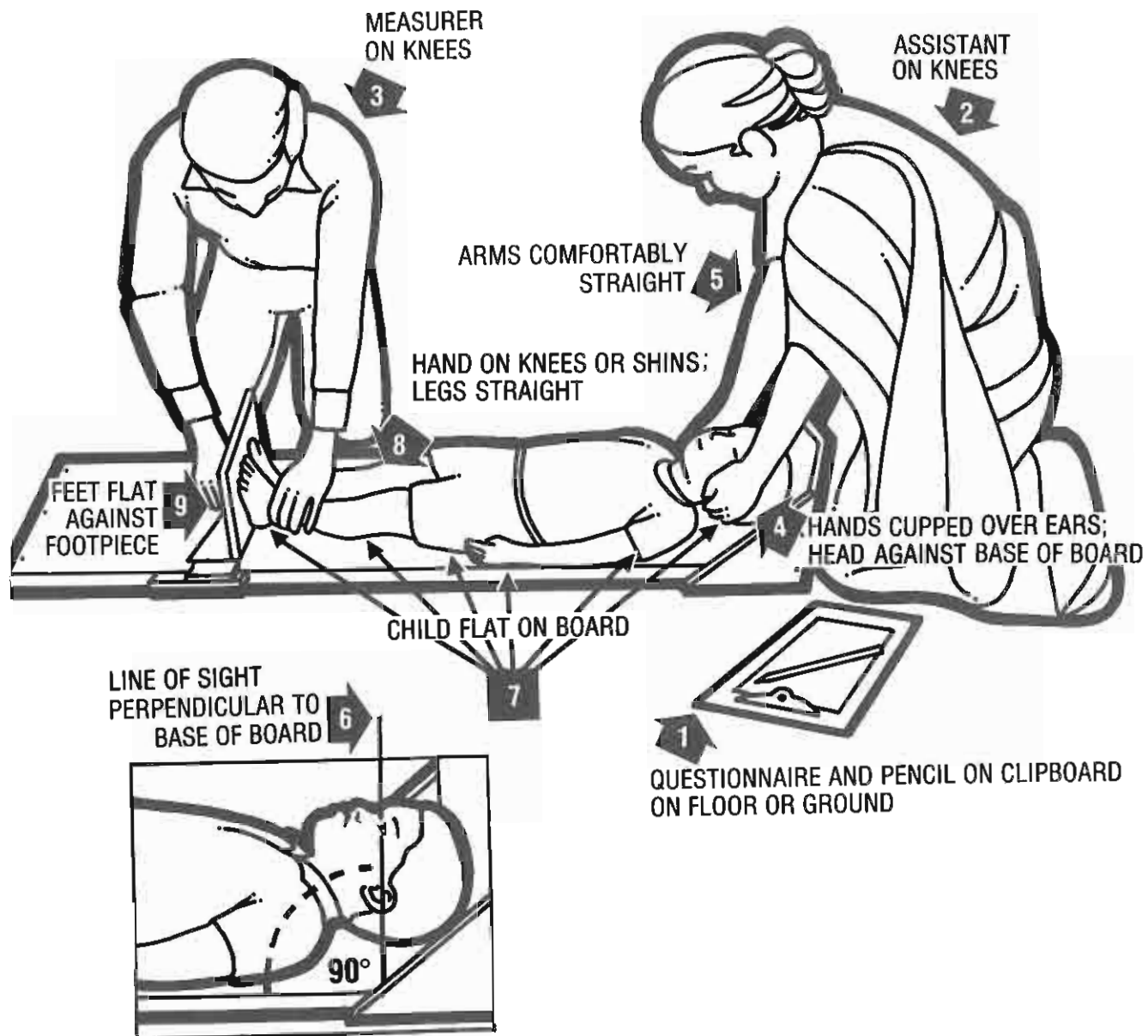


Illustration 67
*Incorrect Position of Footpiece.
Upside Down*



21. **Measurer and Assistant:** Check the child's position: head against the base of the board, with eyes looking straight up; body and legs straight and flat in the centre of the board; heels and feet firmly against the footpiece. Repeat any steps as necessary.

Illustration 68
Correct Positions for Child Length Measurement



22. Supervisor: Observe the measurement from several positions:

- Stand near the assistant to check that the head is in the correct position, i.e. against the board and eyes looking straight up.
- Check that the body is flat in the centre of the board.
- Stand near the measurer to check the position of the feet and the actual length measurement, i.e. the numbers on the tape.
- Observe the whole measurement procedure from a distance, i.e. a few feet away.
- Correct any errors immediately.

Supervisor Observing Child Length Procedure

Illustration 69

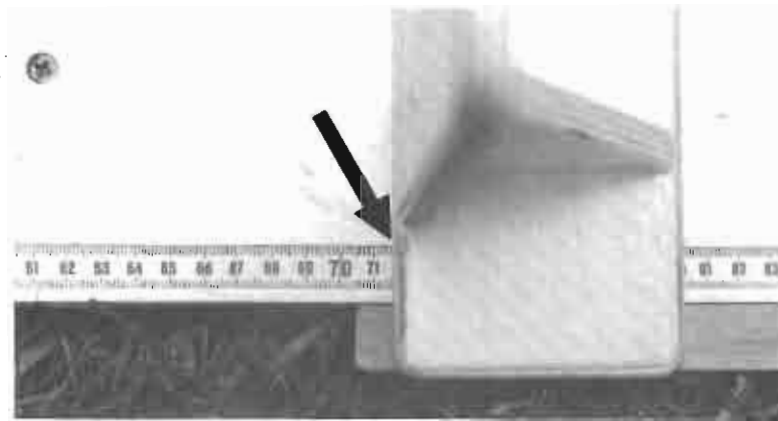


Illustration 70



- 23. Measurer:** When the child's position is correct, read and call out the length measurement to the nearest 0.1 cm.

Illustration 71
Read Measurement at Footpiece



- 24. Assistant:** Keep your eyes on the child's head at all times. DO NOT look up during the reading.
- 25. Measurer and Assistant:** Follow the Reading and Recording System.
- 26. Assistant:** Immediately release the child's head and record the measurement on the questionnaire.
- 27. Measurer:** While the assistant records the measurement, take the foot-piece away from the child's feet. Release your left hand from the child's shins and support the child during the recording.

Illustration 72
Assistant Immediately Records Length Measurement.
Measurer Supports Child



- 28. Assistant:*** As soon as you have completed recording the measurement, immediately show the questionnaire to the measurer.

Illustration 73
Assistant Shows Questionnaire to Measurer



- 29. Measurer:** Check the recorded measurement for accuracy and legibility. Are the numbers the same as you called out; neat, legible, and inside the boundaries of the boxes on the questionnaire? If not, instruct the assistant to correct any errors. When you accept the measurement, tell the assistant.
- 30. Measurer and Assistant:** Repeat any steps as necessary.
- 31. Measurer or Assistant:** Return the child to the mother. Put the measuring board away if there are no other children to be measured.

End of Child Length Measurement Procedure

*

*

*

* If the assistant is untrained, e.g. the mother, then the measurer should record the length on the questionnaire.

C. Child Weight Procedure*

1. **Measurer and Assistant:** Make certain you have the scale, weighing pants, infant sling or basket and a five foot piece of rope.
2. **Measurer or Assistant:** Ask the mother to undress the child.
3. **Measurer or Assistant:** Hang the scale from a tree branch, ceiling beam or tripod. A pole or broom handle held by two people can be used. In urban areas a metal scale hanger can be used which can be hung from a door. You may have to use a piece of rope to lower the scale to eye level. If so, tie the ends of the rope together to make a loop. The rope can then be looped around a tree branch or beam. Place the hook of the scale on the rope.

Illustration 74
Scale and
Weighing
Equipment



Illustration 75
Scale on Rope from Tree

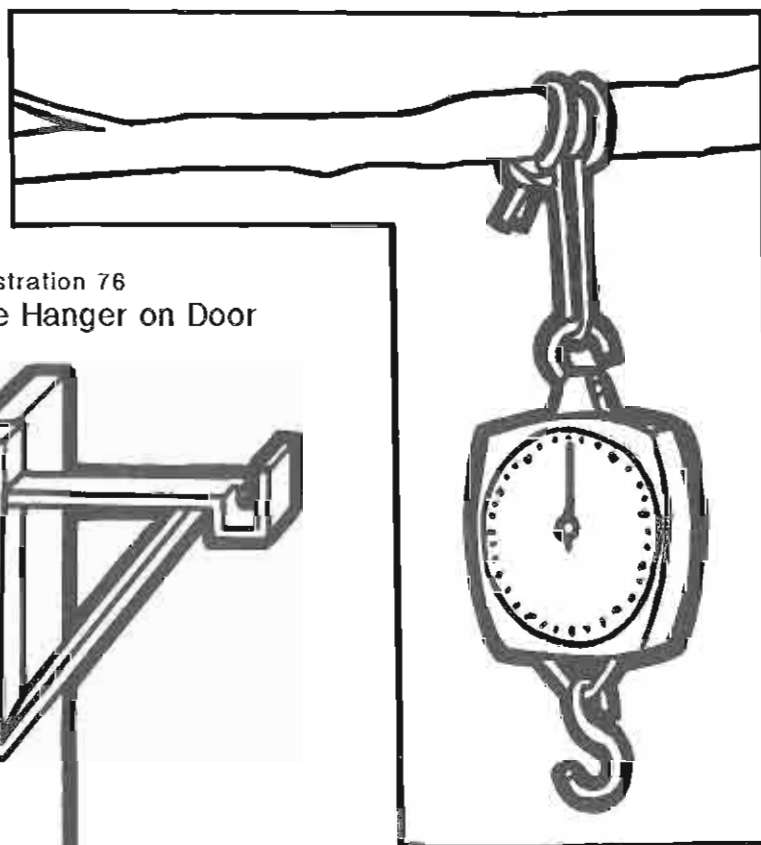
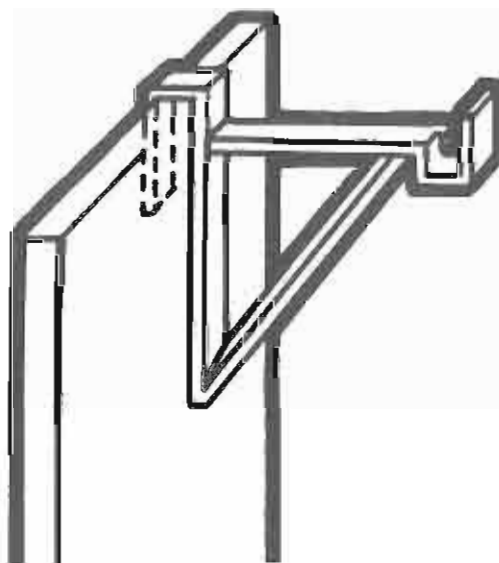


Illustration 76
Metal Scale Hanger on Door



* The weight procedure may be done by one person only, the measurer, if necessary.

4. **Measurer:** Place a pair of the empty pants, infant sling or basket on the hook of the scale.
5. **Measurer:** Adjust the scale to zero with the empty pants, sling or basket hanging from the scale, then remove from the scale.

Illustration 77

Hang Scale From Rope on Tree.
Adjust Scale to Zero with Empty Pants



Illustration 79
Basket on Scale

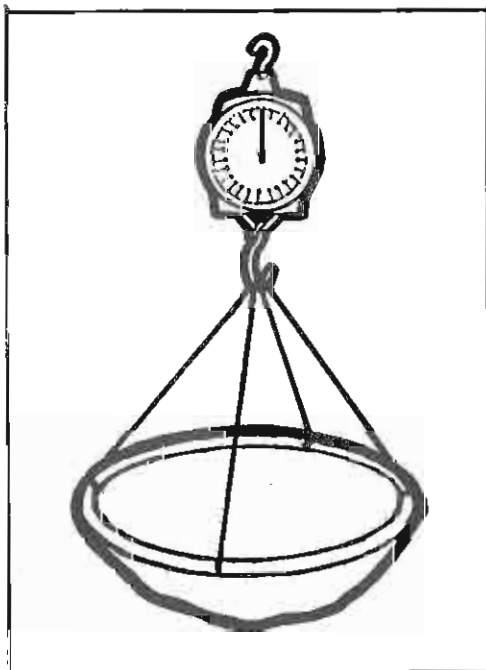


Illustration 78

Infant Sling on Scale

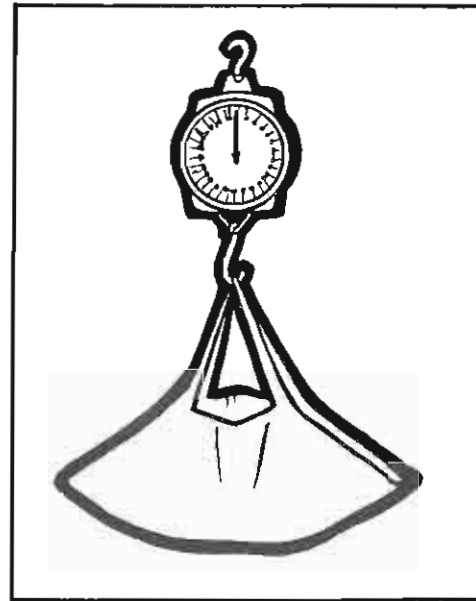
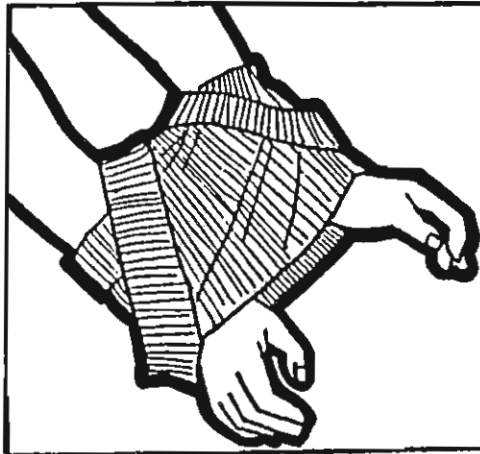


Illustration 80
Adjust Scale to Zero



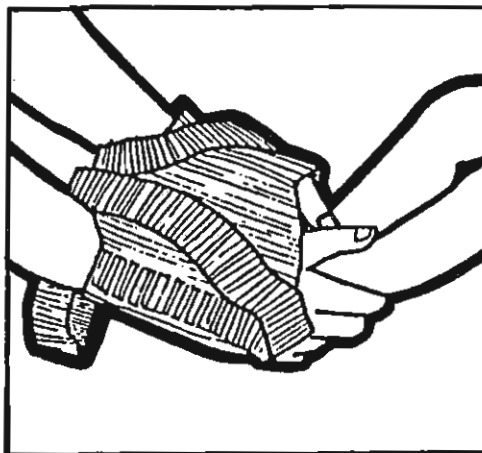
- 6. Measurer:** Ask the mother to hold the child. Put your arms through the leg holes of the pants. Make certain the strap of the weighing pants is on top of your arms.

Illustration 81
**Arms Through Leg Holes.
Strap on Top of Arms**



- 7. Measurer:** Grasp the child's feet. Pull the legs of the child through the leg holes of the pants. Make certain the strap is in front of the child.

Illustration 82
Grasp Feet



IMPORTANT: WHILE THE CHILD HAS THE WEIGHING PANTS ON, YOU MUST HOLD THE CHILD SO THE CHILD WILL NOT TRIP AND FALL. HOLD THE CHILD BY THE BODY. DO NOT HOLD OR CARRY THE CHILD BY THE STRAP ONLY.

Illustration 83
Hold Child by the Body.
Pant Strap in Front of Child



8. **Assistant:*** Have the questionnaire ready and open to where the weight measurement will be recorded.
9. **Measurer:** Attach the strap of the pants to the scale hook.

Illustration 84
Attach Pant Strap to Scale Hook.
Assistant with Questionnaire



* If the assistant is untrained, e.g. the mother, then the measurer should record the weight on the questionnaire.

10. **Measurer:** Lower the child gently and allow the child to hang freely.
11. **Measurer:** If an infant sling is used for children less than one year of age, place the open sling on top of your arms. Ask the mother to place the child in the sling. If a basket is used, adjust the scale to zero with the empty basket. Do not remove the basket from the scale. Place the child in the basket.
12. **Assistant:** Stand slightly behind and to one side of the measurer so you can see the face of the scale and double-check the measurer's reading. Make certain the child is not touching anything.
13. **Supervisor:** Observe the weight measurement by standing behind and slightly to one side of the measurer. Check the child's position. Immediately correct any errors.

Illustration 85
Gently Lower Child



Illustration 86
Child Hangs Freely.
Assistant Moves Into Position



14. Measurer and Assistant: Note the examples of different places to hang the scale.

III. 87
Scale
Hung
From
Ceiling
Beam
Outdoors



III. 88
Scale
With
Basket
Hung
From
Ceiling
Beam
Indoors



III. 89
Scale
Hung
From
Tree

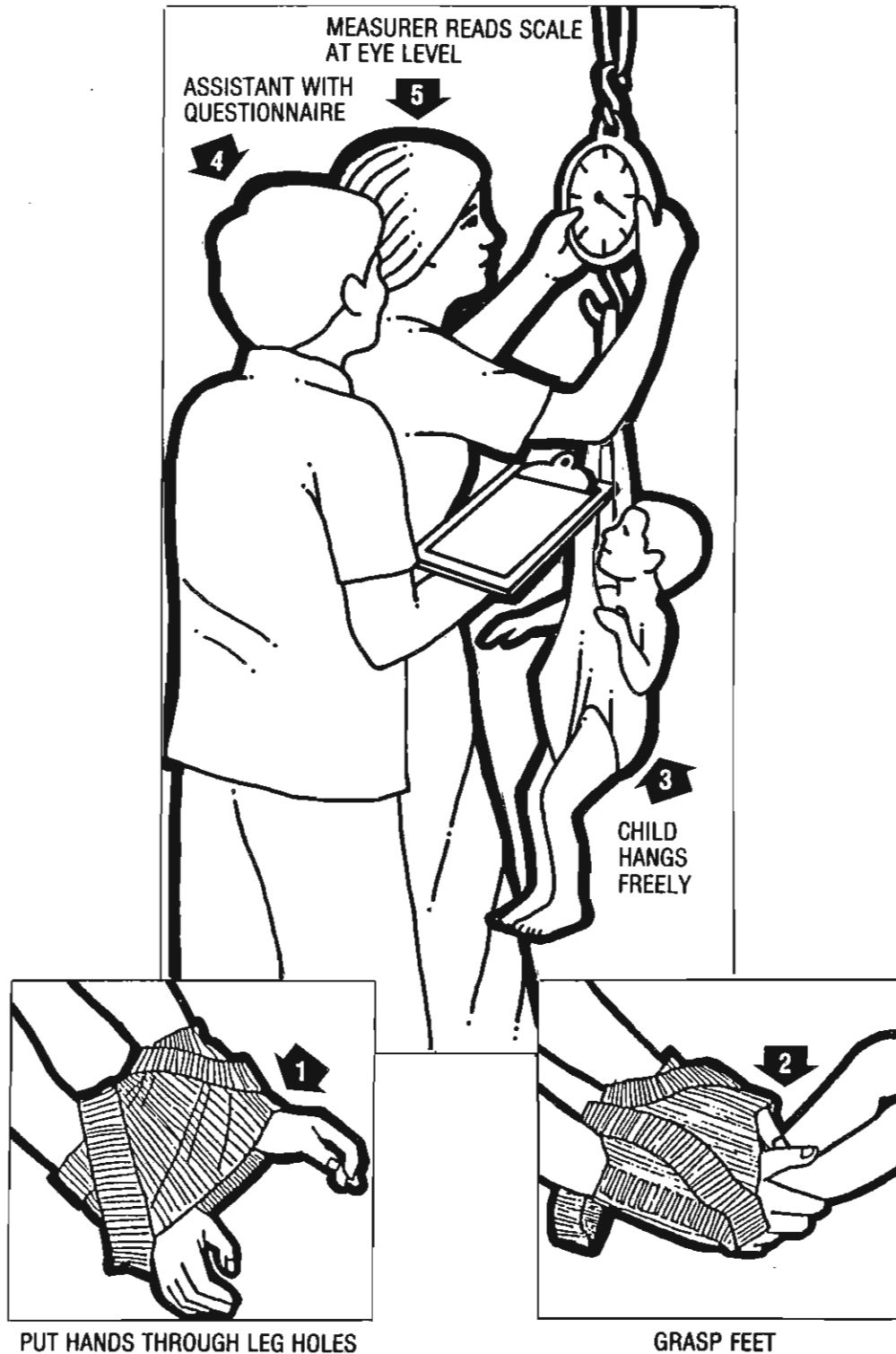


III. 90
Scale
Hung
From
Pole



15. **Measurer and Assistant:** Check the child and scale positions; scale is hung securely and at eye level, child is undressed, hanging freely and not touching anything. Repeat any steps as necessary.

Illustration 91
Correct Positions for Child Weight



- 16. Measurer:** When the child is in the correct position, hold the scale. DO NOT TOUCH THE HOOK. Read and call out the weight to the nearest 0.1 kg. Call out the reading only after the needle stops moving. Even children who are very active, which causes the scale needle to move greatly, will become still long enough, i.e. for one or two seconds, to take a reading. WAIT FOR THE NEEDLE TO STOP MOVING. Make certain you read the scale at eye level.

Illustration 92

Hold Scale and Read at Eye Level

- 17. Measurer and Assistant:*** Follow the Reading and Recording System.

- 18. Assistant:*** Immediately record the measurement on the questionnaire.

Illustration 93

Assistant Immediately Records Measurement

* If the assistant is untrained, e.g. the mother, then the measurer should record the weight on the questionnaire.

- 19. Measurer:** While the assistant records the measurement, hold the child in one arm and gently lift the child by the body. DO NOT LIFT THE CHILD BY STRAP OF THE WEIGHING PANTS ALONE. Release the strap from the hook of the scale with your free hand.

NOTE: If you are recording the measurement on the questionnaire, complete the recording before taking the child off the scale.

- 20. Assistant:** As soon as you have completed recording the measurement, immediately show the questionnaire to the measurer.

Illustration 94

Assistant Immediately Shows Questionnaire to Measurer



- 21. Measurer:** Check the recorded measurement for accuracy and legibility. Are the numbers the same as you called out; neat, legible and inside the boundaries of the boxes on the questionnaire? If not, instruct the assistant to correct any errors. When you accept the measurement, tell the assistant.
- 22. Measurer or Assistant:** With the help of the mother, remove the weighing pants from the child. Return the child to the mother.
- 23. Measurer and Assistant:** Put the scale and pants away if there are no other children to be weighed.

End of Child Weight Procedure

*

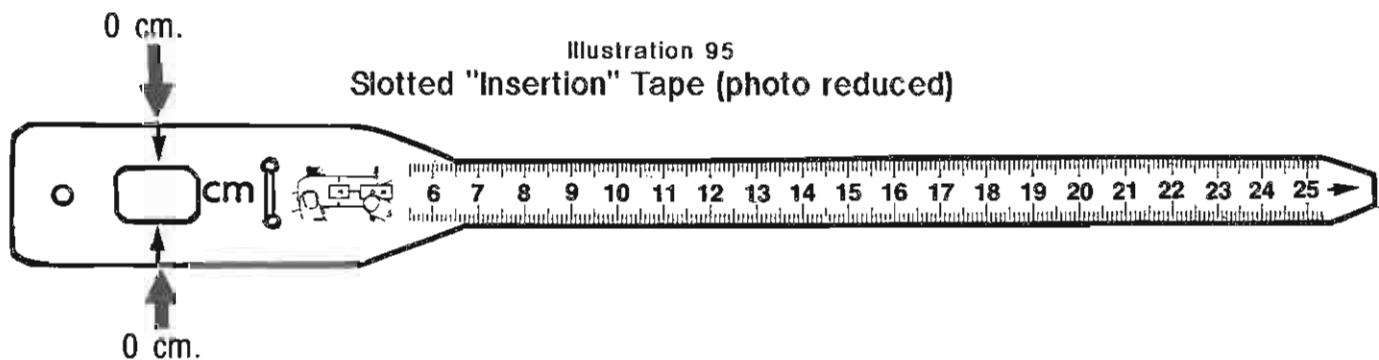
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D. Child Mid-Upper Arm Circumference Measurement Procedure (MUAC)*

IMPORTANT: DURING THE PROCEDURE, YOUR EYES SHOULD BE LEVEL WITH THE CHILD'S LEFT UPPER ARM. SIT DOWN WHEN POSSIBLE. HAVE THE MOTHER SIT AND HOLD THE CHILD IF NECESSARY.

1. **Measurer and Assistant:** Check the arm circumference tape. Make certain all the lines and numbers are clear. The tape can be marked in centimetres for an exact measurement or it can be marked in zones, i.e. normal, sub-optimal and danger, or in appropriate colours, usually green, yellow and red. In this procedure, the tape marked in centimetres is illustrated.



2. **Measurer:** Determine the midpoint of the child's left upper arm by first locating the tip of the child's shoulder with your finger tips.

Locate Tip of Shoulder

Illustration 96

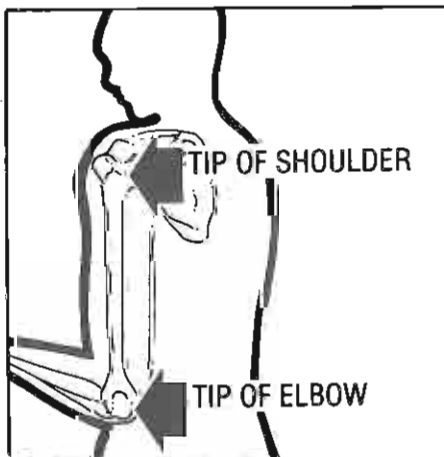


Illustration 97



*MUAC may be taken and recorded by one person only, the measurer, if necessary.

ARM CIRCUMFERENCE

- 52 -

- 3. Measurer:** Bend the child's left arm at the elbow to make a right angle. The mother may help by holding the child. Very young children can sit in the mother's lap.

Illustration 98
Bend Left Arm at Elbow



- 4. Measurer:** Place the tape at zero, which is indicated by two arrows, on the tip of the shoulder. Hold the tape in place with your thumb.
- 5. Measurer:** Pull the tape straight down past the tip of the elbow. Do not bend the tape around the elbow.

Illustration 99
Tape Position for Midpoint



6. **Measurer:** Read the number at the tip of the elbow to the nearest centimetre.
7. **Measurer:** Divide the number by two. The result is the midpoint of the upper arm. You can hold the tape in one hand and mark the midpoint with a pen on the arm. The midpoint can also be marked by a trained assistant while you hold the tape with either one or two hands.

Another method to determine the midpoint is to bend the tape, or a piece of string, up to the middle length of the distance from the tip of the shoulder to the tip of the elbow. Either you or a trained assistant can mark the midpoint with a pen on the arm.

Illustration 100
Mark Midpoint

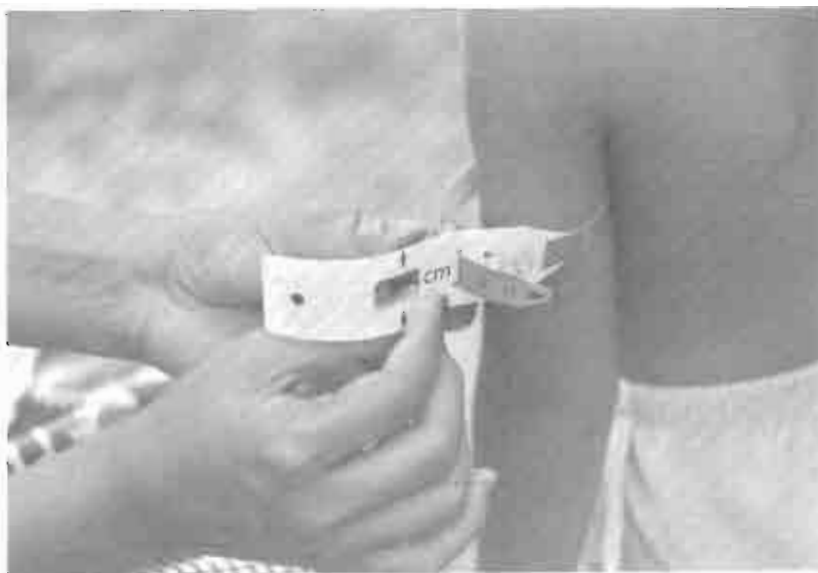


ARM CIRCUMFERENCE

- 54 -

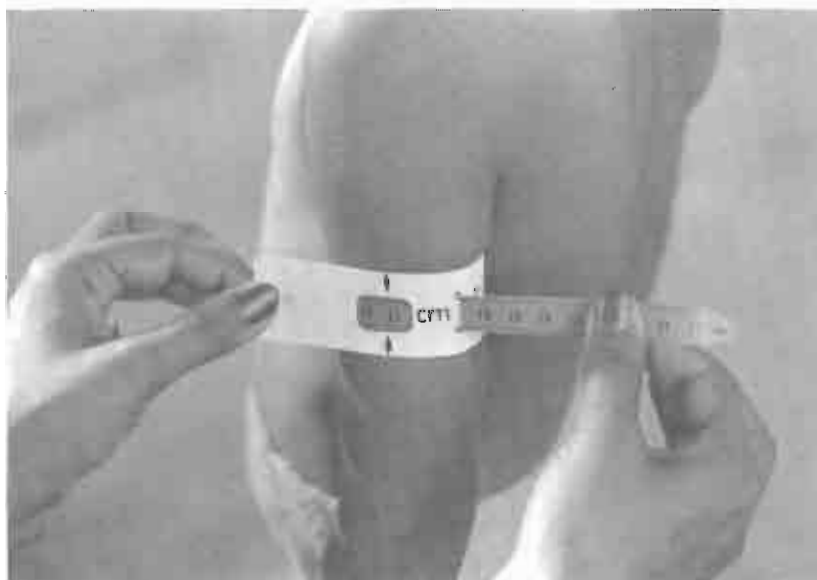
8. **Measurer:** Gently straighten the arm. Make sure the arm is not wet or sweaty. Wrap the tape around the arm at the midpoint mark. Cover the mark with the tape. If a slotted tape is used, put the end of the tape through the slot. Make certain the numbers are right side up. Position the window on the slotted tape to face you on the outside of the arm.

Illustration 101
Wrap Tape Around Arm



9. **Measurer:** With your right hand, hold the tape that you have just put through the slot. With your left hand, hold the other end of the tape. Pull the tape at both ends at the same time to 'get a feel' of the arm.

Illustration 102
Hold Tape With Both Hands.
Pull to 'Get the Feel' of the Arm



- 10. Measurer:** Check the tension of the tape around the arm. Do not pull too tightly. Do not have the tape too loose. Make certain the tape is flat on the skin.

Illustration 103
**Correct Tension
of Tape**



Illustration 104
**Incorrect Tension.
Tape Too Tight**



Illustration 105
**Incorrect Tension.
Tape Too Loose**



- 11. Measurer:** When you have a satisfactory tension, secure the tape by placing the index finger and thumb of your right hand directly next to the junction between the tape and the slot. Take your left hand off the end of the tape. The tape is now secure.

IMPORTANT: THIS STEP IS FOR SLOTTED INSERTION TAPES ONLY.

Illustration 106
Securing the Tape



ARM CIRCUMFERENCE

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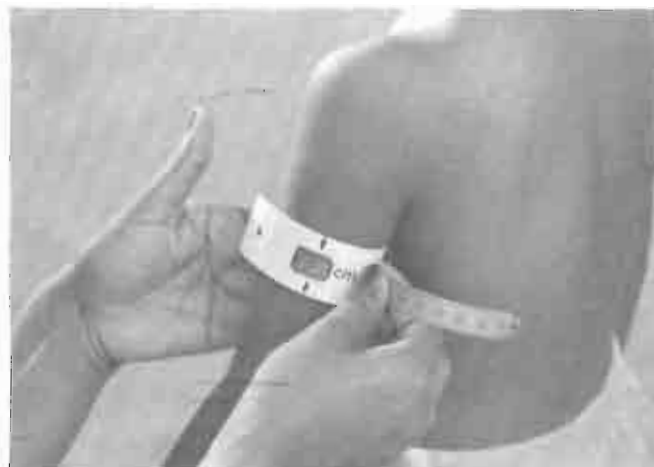
12. **Measurer:** Look around the arm to see if the tape is in a satisfactory position with correct tension. Use your left hand to feel the tape against the arm.
13. **Assistant:*** Look around the arm to check the tension and position of the tape. Have the questionnaire ready.

Inspect Tape Around Arm

Illustration 107



Illustration 108



14. **Measurer:** When you are satisfied with the position of the tape, place your left hand back on the tape (near the window if using a slotted insertion tape). Place the window over the numbers. Align the arrows against the numbers. Repeat any steps as necessary.

Illustration 109

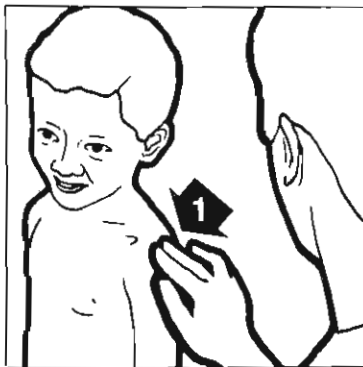
Correct Tape Position For Reading MUAC



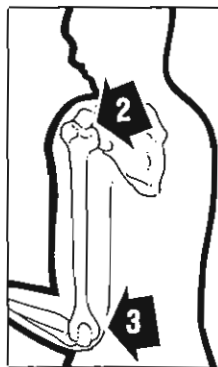
*If there is an untrained assistant, e.g. the mother, then the measurer should record the arm circumference on the questionnaire.

Illustration 110

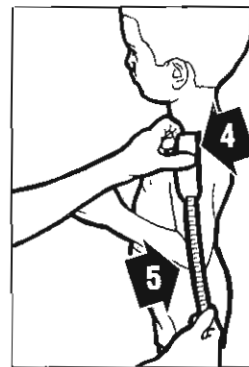
Correct Positions of Tape for Mid-Upper Arm Circumference Measurement



1 LOCATE TIP OF SHOULDER



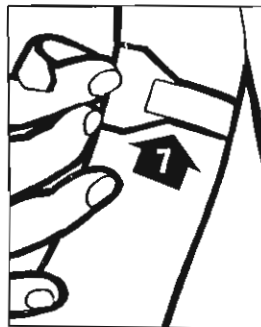
2 TIP OF SHOULDER
3 TIP OF ELBOW



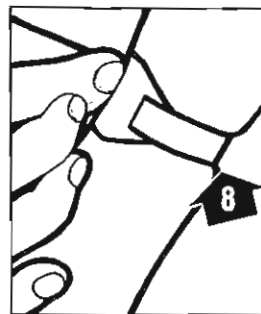
4 PLACE TAPE AT TIP OF SHOULDER
5 PULL TAPE PAST TIP OF BENT ELBOW



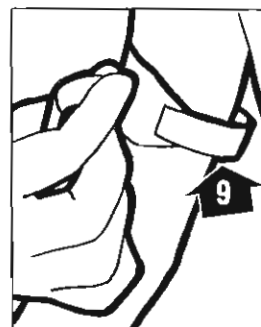
6 MARK MIDPOINT



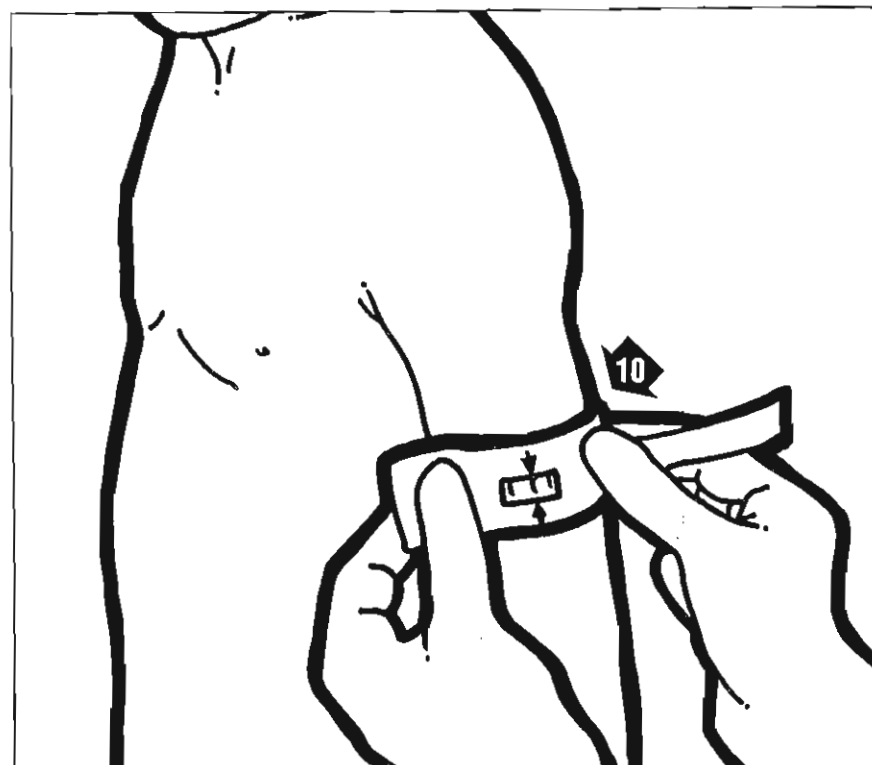
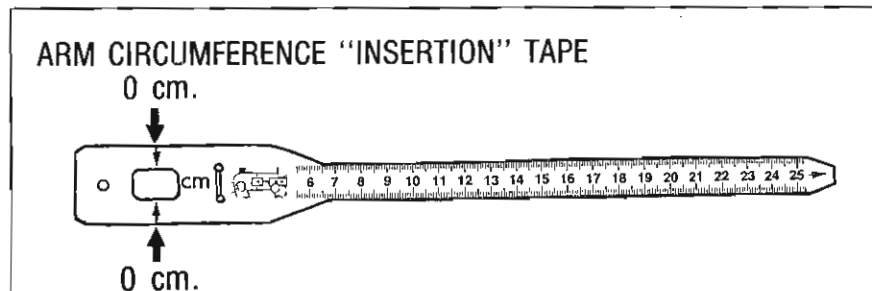
7 CORRECT TAPE TENSION



8 TAPE TOO TIGHT



9 TAPE TOO LOOSE



10 CORRECT TAPE POSITION FOR ARM CIRCUMFERENCE

ARM CIRCUMFERENCE

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15. **Supervisor:** Check the position and tension of the tape. Immediately correct any errors.
16. **Measurer:** When the tape is in the correct position, read and call out the arm circumference measurement to the nearest 0.1 cm. If you are using a coloured arm band, call out the appropriate colour.
17. **Measurer and Assistant:** Follow the Reading and Recording System.
18. **Assistant:*** Immediately record the arm circumference measurement on the questionnaire and show it to the measurer.

Illustration 111
Assistant Immediately
Records Measurement



Illustration 112
Assistant Shows
Questionnaire to Measurer



*If the assistant is untrained, then the measurer should record the arm circumference on the questionnaire.

- 19. Measurer:** Check the recorded measurement for accuracy and legibility. Are the numbers the same as you called out; neat, legible and inside the boundaries of the boxes on the questionnaire? If not, instruct the assistant to correct any errors. When you accept the measurement, tell the assistant.
- 20. Measurer:** Remove the tape from the child's arm and put it away. Return the child to the mother.

End of Child Arm Circumference Measurement Procedure

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IV. Quality Control

A. Reading Measurements

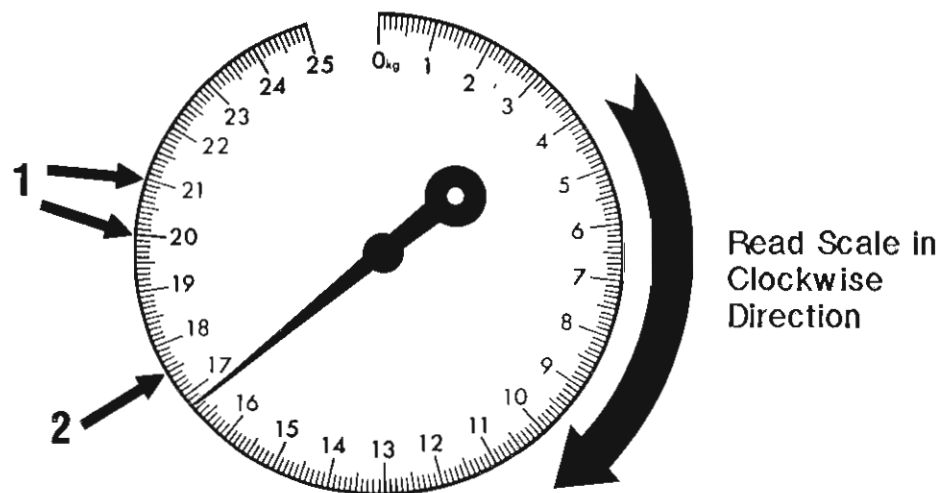
1. The reading areas of the tape on the measuring board and the arm circumference tape are in centimetres which are numbered (Illustration 113). Each centimetre is divided into ten gradations, i.e. small vertical lines, which are each 0.1 centimetre, or 1 millimetre. The line at five millimetres is slightly longer (Illustration 113, Arrow 1). Large numbers appear every ten centimetres (Illustration 113, Arrow 2).

Illustration 113
Section of Measuring Board Tape



2. Similarly, there are numbers on the hanging scale at each kilogram (Illustration 114, Arrows 1), small lines at each 0.1 kg. and a slightly longer line at each 0.5 kg. (Illustration 114, Arrow 2).

Illustration 114
Face of Hanging Scale

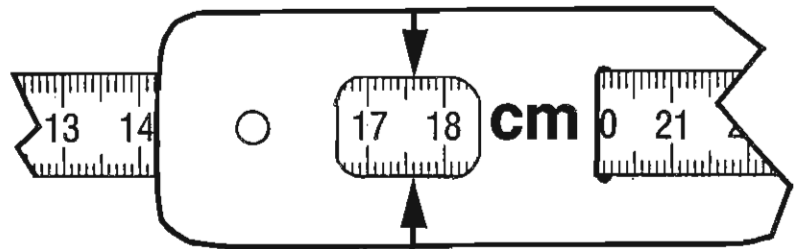


3. Be careful to read the scale on the measuring equipment properly. The tape on the measuring board should be read in an upward direction for height and left to right for length; the arm circumference tape from left to right; and the hanging scale clockwise. Do not read the numbers in a 'backward' direction. For example, the reading of the tape in Illustration 115 is 96.7 cm., NOT 97.3 cm. The reading of the arm circumference tape in Illustration 116 is 17.6 cm., NOT 18.4 cm. The weight reading of the scale in Illustration 114 is 16.8 kg., NOT 17.2 kg.

Illustration 115
Correct Reading is
96.7 cm., NOT 97.3 cm.



Illustration 116
Correct Reading is
17.6 cm., NOT 18.4 cm.



4. Make sure to count the number of visible lines, i.e. millimetres, when you read the tape. Note the reading in Illustration 115 which is 96.7 cm. The headpiece falls almost directly on the seventh line. Since it can be seen, it is counted towards the measurement.
5. If the dial of the hanging scale or the arrows of the arm circumference tape fall directly on a line, count that towards the measurement. The dial of the scale in Illustration 114 is directly on the eighth line after 16 kg. Therefore, the reading is 16.8 kg. The arm circumference tape reading in Illustration 116 is 17.6 cm. since the arrows fall directly on the sixth line after 17 cm.
6. If the movable headpiece or footpiece, the dial of the scale or the arrows of the arm circumference tape fall between two lines, record the measurement of the LOWER number. For example, the reading of the tape below is 105.6 cm., since the arrow falls between the 6th and 7th lines after 105.

Illustration 117
Arrow Between Lines 105.6 and 105.7 cm.
Record the Lower Number, 105.6



(PHOTO ENLARGED)

B. Recording Measurements

- Place numbers in appropriate boxes for the measurements. Be careful to make clear and neat numbers the same way every time. The following is a suggested way of writing numbers.

1 2 3 4 5 6 7 8 9 0

- Notes:

1 : A single vertical line. Do not slant the 1 (/). Do not put a 'hat' or base on the 1 (1 , 1).

2, 3 : Make 2 and 3 with no loops (2 2 3 3).

4 : Make open 4's. Closed 4's can look like 9's (4).

5 : Be careful not to connect the 5 which can look like a 6 (5).

6 : Be careful with the loop of the 6 which can look like a zero (6).

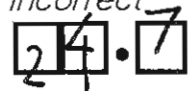
7 : Cross the 7. This way it will not look like a 1 (7 : 1 or 7?).


8 : Make with two separate loops. 'Figure-eight' 8's can look like 0 (8). Be careful not to separate the two loops (8).



9 : Make sure to close the loop of the 9 which could look like a 4 (9 : a 9 or a 4?).

0 : Put a diagonal line through zeros for easy identification. Zeros can look like the number 6 (0 : a 0 or 6?).

- Make sure you place numbers inside the boundaries of the box on a questionnaire.

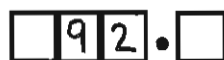
Incorrect


Correct


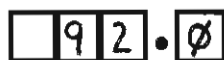
- Number single digits 1-9 as follows:  or 

- Fill in all boxes. Make sure to put numbers, including zeros, in the correct boxes. Example: Child height is 92.0 cm.

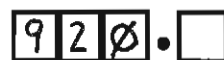
Incorrect



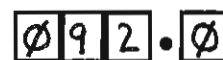
Incorrect



Incorrect



Correct



- Use pencil only. If you make a mistake, completely erase the mistake; then rewrite the correct numbers.

C. Reading and Recording System*

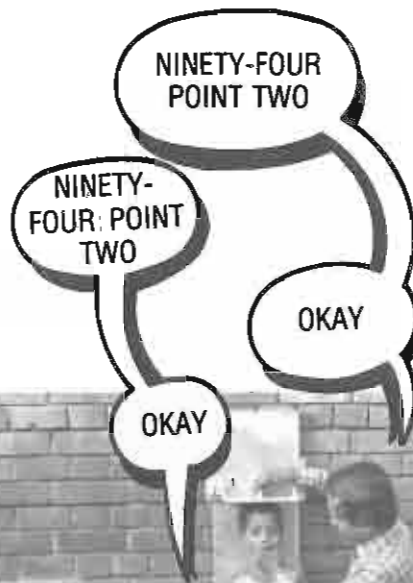
When a team of two people measures height, length, weight or arm circumference, one team member, the measurer, reads the measurement, while the other, the assistant, records the measurement on the questionnaire. One of the greatest sources of error takes place during the reading and recording of a measurement. The following dialogue illustrates a reading and recording verification system which should decrease errors.

SITUATION: A child's height has been measured by a team, the measurer and assistant.

1. **Measurer calls out the measurement:**
*"Ninety-four point two" (centimetres). ***
2. **Assistant hears and repeats:** *"Ninety-four point two"*
3. **Measurer hears and acknowledges:** *"Okay"*
4. **Assistant hears acknowledgement and responds:** *"Okay"*
5. **Assistant now records the height measurement '94.2' in the appropriate boxes on the questionnaire.**
6. **Assistant shows the questionnaire to the measurer.**
7. **Measurer checks to see if the assistant wrote down the correct measurement (94.2) in the correct place on the questionnaire.**

* If the assistant is untrained, e.g. the mother, this reading and recording system should not be used. The measurer should record the measurements on the questionnaire.

**94.2 should be read as "Ninety-four point two" not "Nine four point two". As another example, 112.3 should be read as, "One hundred twelve point three", not "One one two point three". Make certain you read zeros. For example, 84.0 should be read as, "Eighty-four point zero", not just "Eighty-four". The words "centimeteres" and "kilograms" should not be read aloud.



Assistant
Repeats
Measurement

Illustration 118
Measurer
Calls Out
Measurement



Assistant
Records
Measurement

Illustration 119
Measurer
Supports
Child



Assistant
Shows
Measurement
to Measurer

Illustration 120
Measurer
Checks
Measurement



D. Checking Your Measurement Technique

1. All Measurements

- a. Did you follow the procedures you were taught in training?
- b. Were you firm yet gentle with the child? Did you control the child?
- c. Were you at eye level with the site of each measurement, i.e. top of the head for height; bottom of the feet and heels for length; face of the scale for weight; and at the child's upper arm during arm circumference?
- d. Did you read and record carefully? Did you follow the Reading and Recording System?
- e. Was the questionnaire near the enumerator who records the measurement?
- f. Did the assistant or measurer record the measurements in the correct places on the questionnaire?
- g. Did you check the equipment after each measurement? Were the board and scale working properly and positioned securely?
- h. Did you double check to make certain you had not left any equipment behind in a household?

2. Height/Length

- a. Did you determine if the child was less than, equal to, or greater than two years of age? If less than two, did you measure length? If two years of age or older, did you measure height?
- b. Were the footwear and headgear removed? Was interfering hair untied before the measurement? If this was not possible because it was too cold or the child or mother were uncooperative, did you note this on the questionnaire?
- c. Was the child in the correct position, i.e. the head, body, knees and feet? Was the child's head level and the child looking straight ahead for height? Was the child's head against the base of the board and eyes looking straight up for length?
- d. Did the assistant support the child during the recording?

3. Weight

- a. Was the scale hung correctly and from a strong place?
- b. Was the scale zeroed with empty measuring pants, infant sling or basket?
- c. Was the child undressed? If not, did you note this on the questionnaire?
- d. If the scale needle wobbled, did you wait until the child was still before taking a reading?
- e. Was the strap of the weighing pants in front of the child?
- f. Was the child hanging freely during the measurement?

4. Arm Circumference

- a. Did you calculate the midpoint of the child's upper arm properly? Did you locate the tip of the child's shoulder? Did you bend the child's arm to make a right angle?
- b. Was the child's upper arm straight during the measurement?
- c. Did you measure the left arm?
- d. Did you have the correct tension on the tape, i.e. not too tight or too loose?
- e. Did you secure and inspect the tape?
- f. If you used a slotted tape with a reading window, was the window on the outside of the arm and the numbers right side up?

5. Numbers

- a. Were you careful to make all the numbers as instructed?
- b. Did you place the numbers in the boundaries of the boxes on the questionnaire?
- c. Did you record the measurements in the appropriate places on the questionnaire?

*

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Annex A: Definitions of Terms

1. **Anthropometry:** The technique that deals with the measurement of the size, weight and proportions of the human body. The anthropometric measurements described in this manual are standing height*, recumbent length, weight and mid-upper arm circumference.
2. **Height/Stature:*** Distance from the crown of the head to the bottom of the feet (heels) while the child is measured standing (for children two years of age or older).
3. **Length:** Distance from the crown of the head to the bottom of the feet (heels) while the child is measured supine (for children less than two years of age).
4. **Weight:** Measurement of a child's total body mass undressed.
5. **Mid-Upper Arm Circumference (MUAC):** The measurement of a child's arm circumference at the midpoint between the tip of the shoulder and elbow.
6. **Height Measuring Board:** A measuring board that can be used to measure either standing height or recumbent length, graduated in 0.1 cm.
7. **Headpiece/Footpiece:** The part of the measuring board that moves and rests on the child's head for height, and against the child's feet for length.
8. **Hanging Scale:** A commercially produced portable, lightweight and durable scale suitable for field surveys, graduated in 0.1 kg.
9. **Weighing Pants:** The pants used to hold children one year or older during the weight measurement procedure. Weighing pants may be used with caution for children under one.
10. **Infant Sling:** A sling in which infants, i.e. children less than one year of age, are placed for the weight measurement procedure.

* The strict definition of "height" includes *both* stature (standing height) and recumbent length (measured lying down). In this manual "height" is used to refer to *standing* height only.

11. **Arm Circumference Tape:** The tape used to measure mid-upper arm circumference, graduated in 0.1 cm. or in three sections of different colours.
12. **Standardization Test:** A test to evaluate competency in anthropometric measurement.
13. **Frankfort Plane:** The line from the hole in the ear to the bottom of the "orbit", i.e. the bone, of the eye. The Frankfort Plane indicates the direction of the line of sight and the position of the child's head during standing height and recumbent length measurement procedures.
14. **Recumbent:** Lying down, on either the front or back of the body.
15. **Supine:** Lying down on the back of the body.
16. **Enumerator:** A survey worker who performs the measurements and collects data.
17. **Team:** Two enumerators who work together.
18. **Measurer:** A trained enumerator who actually measures the height, weight and arm circumference of children.
19. **Assistant:** An enumerator who assists the measurer by helping to hold the child in place during the measurement procedures and records the measurements on a questionnaire. An untrained assistant such as the mother can be used to help hold the child. If so, then the measurer measures the child and also records the measurements.
20. **Trainer:** A person who trains enumerators in anthropometric measurement.
21. **Supervisor:** A person who observes, and corrects if necessary, measurement procedures, and generally assists a team.

Annex B: Enumerator Selection and Training Notes

Careful selection and training of enumerators will facilitate data collection. The following are considerations for enumerator selection. If the nutritional status measurements are part of a larger survey, enumerators may have been selected already.

A. Enumerator Selection Considerations

1. Number of Enumerators Required

The number of enumerators will depend on the plan for data collection—either a group of enumerators who travel together as a mobile unit or enumerators who are stationed as fixed teams in specific areas throughout the entire survey. In either case, two people are required to measure height and length since children must be held in place for these measurements. An untrained assistant such as the mother may have to be used, but this is less desirable and efforts should be made to have two trained enumerators.

If there is a mobile unit of two-person teams, a maximum of 20 people, i.e. 10 teams, is recommended. More enumerators would make training as well as data collection management difficult. If a larger group of enumerators is required, they could be broken down into two or more separate groups for training which would require more administrative or training personnel. It may be useful to train more enumerators than required. The best enumerators then can be selected while the extras return to their normal jobs to be on call or used for other survey related tasks. Selection can be based on both objective anthropometric standardization tests (see Annex H) and subjective evaluations of their overall performance. The standardization test for accuracy is the most important. Consequently, the basis for enumerator selection and evaluation can be the accuracy test alone.

If enumerators have been selected already, consideration must be given as to who will be the measurer's assistant for the standing height and recumbent length measurements. If the nutritional status module is an additional part of another survey, a team of two enumerators can be formed who work in different but not too distant sections of the country. The team can then conduct the entire nutritional status module covering its two areas after the larger survey, provided that the households and children can be found and identified.

2. Enumerator Qualifications

Enumerators should have at least a primary school education and be numerate. Previous nutrition survey experience is *not* required.

3. Previous Experience and Language Capabilities

Assess if enumerators have had previous data collection experience on any surveys. Knowledge of dialects spoken within the country may be useful for geographical placement of enumerators during data collection.

4. Male or Female Enumerators

In some areas, female enumerators are more acceptable since handling of children is necessary in this type of survey.

5. Survey Schedule

Assess if enumerators are able to travel and be stationed in the countryside for extended periods. Extensive walking may be required.

6. Future Survey Work

Enumerators may be required for future survey work. This may influence enumerator selection.

7. Enumerator Attitudes

Anthropometric survey work is physically demanding and has high stress levels since children will be handled. The attitude of enumerators should therefore be carefully monitored.

8. Supervisor Selection

If supervisors are used in a survey, they can be selected from a different source of personnel from the enumerators or taken from the best-qualified enumerators, based on their performance during training.

B. Training Notes

1. Location of Training

Training for a mobile unit of ten teams or less can be done in the capital. For large groups of enumerators who may be permanently stationed throughout the country, regional training may be required.

2. Training Site

Measurement training should be done at a school or village where many young children are available. Sick children from a clinic or hospital should *not* be used. Very young children for length measurement practice can be obtained from a village, day care centre, etc.

3. Length of Training

For a mobile team, allow approximately two weeks for training which includes a one day field trial. Plan for one half-day of enumerator training per day. The other half-day will be needed for administrative duties, supervisor training,

meetings, etc. For teams stationed throughout the country, allow one week for regional training of smaller groups where more training hours per day will be possible. For both types of training, enumerators should practice approximately 20 measurements for each type of anthropometric measurement procedure. For a team training in a capital city, this may take two to three half-day visits to a school to complete. Conduct a standardization test, see Annex H, after the completion of the training for a specific measurement, followed by the training for the next measurement procedure.

4. Essential Components of Training

Training should include the following:

- a. All enumerators should be trained together from the beginning of every procedure regardless of prior experience, training or education.
- b. Sufficient practice time is required for both heavily supervised and independent practice sessions.
- c. Objective standardization tests should be administered to evaluate measurement performance (see Annex H).

5. Anthropometric Standardization Training Tips

A complete set of anthropometric tests should be administered to the enumerators during training. Each test should be administered separately after the completion of training for each measurement procedure. For each group of 20 enumerators, select ten children to be weighed or measured. Pin a number (1-10) on each child or write a number on the back of each child's hand. Use ten measuring boards or scales if available. Have each child sit near a board or scale. The enumerator should move from child to child. For arm circumference, have the children stand while the enumerators sit. Each enumerator should have an arm circumference tape.

For height or length, form two-person teams. Explain to the enumerators that only one enumerator from each team will be tested at a time for height or length. Each team partner serves as an assistant holding the child in place. After the first enumerator completes the first set of measurements, the test form is submitted to a trainer and then the team partner measures the ten children. For weight and arm circumference, enumerators work alone without assistance from their partners. For all tests, enumerators should record their own measurements. Talking should not be allowed during the test. Standardization tests are implemented most efficiently when there are organized work sequences and silence. Trainers should not correct any procedural errors seen during a standardization test.

6. Field Trial

At least one field trial should be conducted where teams practice the entire questionnaire and measurements in a nearby village all together with their team partners under the supervision of the trainers and supervisors.

7. Role Playing

Role playing is a useful training tool. Enumerators can play the roles of both the enumerator and mother being interviewed in front of the rest of the enumerators who also complete questionnaires while listening to the interview.

8. Initial Data Collection

Data collection should begin immediately after training is completed. If possible, the first few data collection sites should be close to the training site for all teams, for maximum supervision.

Annex C: Age Assessment

A. Introduction

Determining the correct age of a child is extremely important in evaluating anthropometric data since reference standards for growth are broken down into age categories by month. The age of a child should be determined as the number of years or months of life completed. For example, a child who is three years old has completed three years of life.

B. Birthdate Sources

Birthdates can best be determined by obtaining a documented record such as a birth record, clinic card, baptismal record, etc., where a birthdate is recorded. Written home records may be reliable in some settings but should be verified. A "Local Calendar of Events" can be used to estimate age or to verify stated ages, home or other records. Using this method, a child's birthdate can be estimated by relating the year and month of birth to well known local or national events.

C. How to Make a Local Calendar of Events

1. The objective of a local events calendar is to identify a discrete *monthly event* for each of the twelve months and a discrete *special event* for each of the years of age covered, i.e. below six.
2. Determine well known local or national events for a period of one year more than the upper age limit of children who will be weighed and measured in the survey. For example, if the population of children being surveyed is 3-59 months of age, then determine events for the past six years. You may have to meet with local officials, village leaders, etc. to determine events that took place in the area where the survey will be conducted. Ask about important special events that took place that everyone who lives in the area would know, such as a marriage or death of an important person, a flood, an election, etc. Begin with the current year and work backwards when you ask people to remember events. Place these events on a calendar, with the years on the top of the page and the months on one side. Try to obtain at least one special event per year.
3. In the columns marked "Repeated Annual Events", place well known events that take place each year next to the appropriate month, such as Christmas, Rainy Season, Independence Day, etc. Try to obtain at least one event per month.

Illustration 121
SAMPLE LOCAL CALENDAR OF EVENTS

Month	Repeated Annual Events	Special Annual Events					
		1981	1982	1983	1984	1985	1986
January	New Year						
February	President's Birthday						Fire In Village
March	Annual Spring Festival		Village Chief Died				
April	Easter	Flood In Village					
May	Spring Harvest			National Census			
June	School Summer Holidays						
July	Independence Day: July 21					Chief's Son Married	
August	Planting						
September	School Begins				National Elections		
October	Autumn Harvest						
November	Rains						
December	Christmas						

D. How to Use a Local Calendar of Events

1. The objective is first to locate a child's birthdate between two special events. First, select an event on the calendar, for example, the fire which took place in February 1986. Next, ask the mother, "Was your child born before or after the fire in the village?"
2. If the mother responds, "Before", identify the next special event that took place just before the fire. In this case, the event before the fire was the marriage of the village chief's son which took place in July 1985. Ask the mother, "Was your child born before or after the marriage of the village chief's son?"
3. If the mother responds, "After", then you know that the child was born between July 1985 and February 1986, which is shaded. You have just located the child's birthdate between two special events which took place in the village. If the mother responds, "Before", you should continue to search for an event where the parent will respond "After" so that the birthdate will fall between two special events.
4. Once you have located the birthdate between two special events, look at the repeated annual events which take place every year between the two identified special events, i.e. the shaded area, in this case between July and February.
5. You will now determine the exact month of birth. Choose one event that takes place every year, for example, Christmas. Follow the same procedure to locate the child's birthdate between two repeated annual events. In this case, ask the mother, "Was your child born before or after Christmas?" If the mother responds, "Before", select a repeated annual event before Christmas (within the shaded area). If she responds "After", select a repeated annual event after Christmas (in the shaded area). Continue this process until you have located the month of birth.

Here is the same example in dialogue (follow the Sample Local Calendar of Events):

Enumerator: *"Was your child born before or after the fire in the village?"*

Mother: *"Before."*

Enumerator: *"Was your child born before or after the marriage of the chief's son?"*

Mother: *"After."*

NOTE: The birthdate has been located between July 1985 and February 1986 (shaded area).

Enumerator: *"Was your child born before or after Christmas?"*

Mother: *"Before."*

Enumerator: *"Was your child born before or after the autumn harvest?"*

Mother: *"After."*

NOTE: The birthdate has been located between two repeated annual events, i.e. between October and December 1985.

Enumerator: *"Was your child born before or after the rainy season?"*

Mother: *"During the rainy season, just after harvest."*

NOTE: The child's birthdate is November 1985.

REMEMBER:

- a. Locate the birthdate between two special annual events.
- b. Next, locate the birthdate between two repeated annual events until the exact month of birth is determined.
- c. Use the question, "Was your child born before or after _____?"
(select an event)

E. Training for Age Assessment

Role playing is a useful training tool to practice using a local calendar of events. Sketch the calendar of events on a blackboard in front of the enumerators. Have two enumerators sit in front of the room. One plays the role of a mother, the other plays the role of the enumerator. Write down a fictitious birthdate of the "mother's" child on a piece of paper. Show it to the "mother" so the mother will know how to respond to the questions. Show the birthdate to the rest of the enumerators in the training room so they can follow the questioning. DO NOT show the birthdate to the person playing the role of the enumerator.

Annex D: Sample Field Equipment Check List

Equipment	Quantity	Description
WEIGHING	1	Hanging scale (25 kg. capacity, graduated in 0.1 kg.)
	3	Scale pants
	1	Infant sling
	1	5-foot piece of rope
	1	Pant and scale storage bag/box
MEASURING	1	Height measuring board (130 cm., graduated in 0.1 cm.)
	1	Measuring board carrying bag, shoulder strap
	2	Knee pads or pieces of cloth or plastic
	2	Arm circumference tapes (25 cm.) or if screening, three-coloured band
MISCELLANEOUS	1	Clipboard
	5	Pencils (medium dark point, #2)
	1	Soft pencil eraser
	1	Pencil sharpener
	2	Pens (ball point, black)
	1	Stapler (with box of staples)
	1	Equipment bag/pack (e.g. backpack, shoulder bag or vinyl/plastic bag that closes)
	1	Pencil case
	1	Flashlight (torch) with batteries
	2	Umbrellas
		Questionnaires and envelopes

Survey Equipment

Illustration 122



Illustration 123



Illustration 124

Survey Team Carrying Equipment in Field



Annex E: Equipment Standardization

Weighing and measuring equipment must be regularly checked during data collection, approximately twice a month, since weather changes, humidity and continued use may affect measurement reliability. If the enumerators on the survey travel together as a mobile unit, a survey administrator can check all the equipment together. Enumerators should check their own equipment if they are collecting data in separate areas where survey administrators cannot visit frequently.

A. Measuring Board

1. For each measuring board, measure an object of known height such as a pole, twice for each board.
2. If the board is in two sections, measure two different poles. The first pole should be less than the height of the lower section of the board. The second pole should be less than the total height of the board when both sections are together. Measure each pole twice for each board.
3. If there is 0.3 cm. or more difference between the known height of the pole and its height when measured on the board, then check the measuring tapes and the boards in question.
4. Check each board for the following:
 - a. Loose screws.
 - b. Broken or loose parts.
 - c. Rough edges that may need sanding.
 - d. Sliding headpiece/footpiece:
 - (1) Less than 0.2 cm. lateral wobble, i.e. that it is not too loose a fit when on the board.
 - (2) Moves smoothly up and down the board.
 - (3) Runners are straight and secure.
 - e. Measuring tape:
 - (1) Numbers and all lines on tape are clear and not scratched.
 - (2) Flat on board—not buckled.
 - (3) In correct position; "0" cm. is at the base of board.
 - f. Carrying bag in good condition

B. Scale

1. For each scale, weigh three objects of different known weights. Repeat this procedure a second time. A large plastic bottle with different marks on the outside of the bottle can be used for this purpose. Weigh the bottle after filling it to each line with water and record the weights.
2. If there is a 0.1 kg. or more difference between repeated weights on the same scale or between weights on different scales, check that the scale was zeroed, and reweigh each of the weights.
3. Check the scale for the following:
 - a. Scale 'zeros' properly.
 - b. Stitching of weighing pants and infant slings to make sure they are not torn.
 - c. Outside scale case for any breakage.
 - d. Missing scale hooks.
 - e. Dial of the scale is straight.

C. Arm Circumference Tape

1. Measure the circumference of three different solid objects three times. Metal tubing can be used for this purpose which can be transported easily. If there is more than 0.1 cm. difference between measurements, check the tape and remeasure the object.
2. Check the tape for the following:
 - a. Tape is straight and not stretched.
 - b. No rips in the tape.
 - c. Numbers and lines are clear and not scratched.

Annex F: Sources and Types of Measuring Equipment

A current list of selected measuring equipment suitable for field use can be obtained by writing to:

UNICEF Supply Division
New York, New York 10017
Reference: "Nutritional Status
Measuring Equipment"

The following is a description of the desirable features of measuring equipment suitable for field use.

Equipment should be light enough to be carried by enumerators on foot; it should be strong and durable to withstand repeated use outdoors under extreme climactic conditions; it should be low cost so that sufficient equipment can be obtained for large scale surveys and replacements will be affordable. In general, three types of equipment will be needed to carry out the procedures described in this manual.

A. Hanging Scales

Scales should be of 25 kg. capacity, graduated in 0.1 kg., with several pairs of weighing pants, and infant slings where required. The weight of each scale should be approximately 1 kg. (2.2 lbs.).

B. Height Measuring Boards

Measuring boards should weigh approximately 7 kg. or 15 pounds, be portable, and constructed to measure young children lying down or standing up. The board can be one solid piece or be a collapsible two-piece construction. For further details of one suitable design refer to Annex G.

C. Arm Circumference Tapes

The tape should be at least 25 centimetres long. The tape can be marked in centimetres with 0.1 cm. divisions for an exact measurement or it can be marked in zones, i.e. normal, sub-optimal and danger or in appropriate colours, usually green, yellow or red. A window display is a common feature.

Annex G: Guidelines For Construction of a Height Measuring Board

A good quality height measuring board can be locally made from readily available materials. The board should be constructed to measure both standing height and recumbent length. The weight and overall construction will depend on the terrain, mode of transportation, distance to and between selected households, field assistance, etc. Allow 2-4 weeks to obtain materials, employ the services of a carpenter, and supervise construction. The following are guidelines for constructing a height measuring board:

A. The board should be **strong and durable**. Good quality cured wood that will not warp should be used. An application of varnish or polyurathane will help make the board water resistant. Metal should **not** be used as it would be too heavy, costly and difficult to produce and repair. The board should be one solid piece, if possible, with a movable headpiece/footpiece, and have a **minimum of moving parts**. If the board must be in two pieces to be more compact, use a 'tongue and groove' construction or pegs with clasps on the back of the board to keep the two pieces in place. The lower piece, i.e. closest to the base of the board, should be approximately 75 cm. long. Avoid using hinges which would decrease overall stability, add to the board's weight, and make accurate alignment of a split measuring tape difficult.

1. The **back of the board** should be wider than the width of the shoulders of a five year old child so the child can be positioned flat against the board. The underside of the back of the board should be reinforced for stability, which should help prevent warpage. The underside should be flat so that the board can be laid down on the ground or floor for length measurements.
2. The **base of the board** should be strong enough for the board to stand on its own. The base can be constructed to store the movable piece when not in use, which protects the runners.
3. The **movable headpiece/footpiece** should weigh approximately 0.5-1.0 kg., for a board with a total weight of approximately 7 kg. It should slide smoothly up and down the entire board either in one or two tracks or recessed grooves. Two tracks will make the piece more stable with less lateral wobble. The piece should not wobble any more than 0.2 cm. Recessed grooves are more difficult to construct precisely. Any slight warpage due to minimal weather changes such as humidity, will cause the piece to stick in the tracks. A simpler alternative which is easier to construct is to use the outside of the board itself as 'open' tracks.

4. The movable piece can be either permanently fixed in the grooves on the back of the board or can be removable. There are advantages and disadvantages to both types. A movable piece which is permanently fixed in the track or groove is very stable and remains perpendicular to the back of the board during the measurement. However, it must be supported by the measurer using one hand during the entire height measurement so it will not fall on a child's head. It is generally more difficult to construct and repair since a recessed inwardly bevelled groove is often used to hold the movable piece in place in this type of fixed construction.

5. A movable piece that can be removed from the board allows greater flexibility. During standing height, the piece can be placed on the ground or floor while positioning the child, which often requires both hands, until the child is securely in place. Since the piece is not held by the measurer while the child is being positioned, it cannot fall on the child's head or cause fatigue to the measurer. During recumbent length measurement a movable footpiece can be lifted from the board, placed against the child's feet and lowered to the board. With this type of construction, there is a chance for the piece to be placed on the board in such a way that it is not perpendicular to the back of the board.

6. The board can be constructed to store the movable piece in its base with a spring loaded mechanism or a simple wooden peg which protects the runners of the piece. Alternatively, the board can be constructed so that the piece can be stored separately in an equipment pack. Care must be taken with the exposed runners if the movable piece is stored separately from the board. Extra runners should be made for the movable piece at the same time as the original runners are constructed so that they will all have exactly the same fit.

B. The board should be **easy to reproduce**. Construction should be understood easily by a local carpenter so that the boards can be reproduced in 2-4 weeks.

C. The board should be **easy to repair**. The board should be simple and constructed from wood with few moving parts. A survey administrator should carry a repair kit in the field at all times that contains a hammer, nails, screws, screwdriver, glue, sandpaper, extra measuring tape, etc.

D. The board must be able to give **accurate** readings. Accurate low cost measuring tapes should be used and carefully placed at the zero cm. mark at the base of the board. A measuring tape should have only one type of scale on it, preferably metric, since international reference standards for child growth are in metric units. If there are both English and metric scales on a tape, paint over the English scale with black paint. There is an increased chance for measurement reading error if two different scales are on a tape. The metric

tape should be graduated in 0.1 cm. with numbers at each centimetre. The numbers should be continuous after the first metre, i.e. 101, 102, 103, etc. rather than beginning the second metre with 1, 2, 3, etc. The tape should be placed on one side of the board so that a child being measured will not obstruct it.

E. The board should be **lightweight**. It should weigh approximately 7 kg. or 15 pounds so it can be carried in the field by either a man or a woman.

F. The board should be **portable**. There should be a large carrying handle cut into the board which should be placed at the centre of gravity and should be large enough so that one's hand can move a few centimetres in either direction to find the best balance point. The hole for the handle should be large enough so that the centre of gravity can be found when the movable piece is placed either at the base of the board for storage while carrying the board, or taken out and placed in a separate equipment bag. A shoulder strap, preferably an adjustable one, made from nylon or rope, will greatly assist portability. A canvas cover with a carrying handle or shoulder strap will provide extra protection. The cover should be closed with laces rather than zippers, which tend to break.

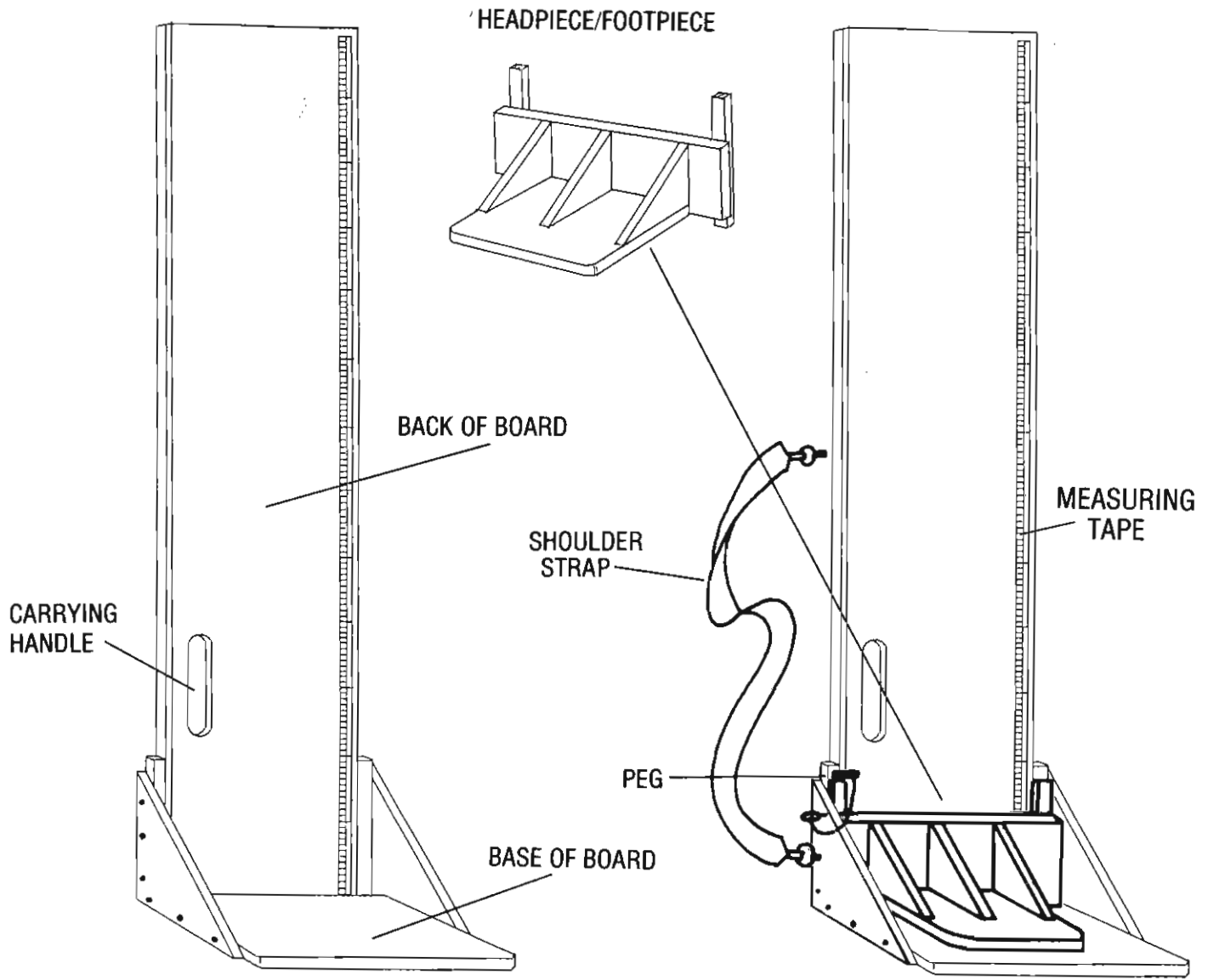
G. All parts of the board should be held together with **glue and screws**, preferably 'star' or 'Phillip's Head' screws, with the exception of the runners of the movable piece which should be attached with screws only for ease of replacement if damaged. Do not use nails which will jar loose. Recess all the screws which should be flat-headed. All corners of the board should be rounded and smooth.

H. The board should be **low cost**. In most countries, wood is the cheapest material available. The cost of labour and raw materials will determine the cost of construction. Early planning will determine the need for imported materials that may not be readily available.

I. The boards should be **well cared for**, periodically **standardized** and examined for damage.

J. Approximately **one extra board** should be made for every ten required for a survey in case an immediate replacement is necessary. The extra boards should be made at the same time as the boards used in the survey.

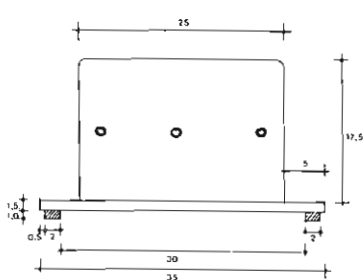
Illustration 125
Height Measuring Board



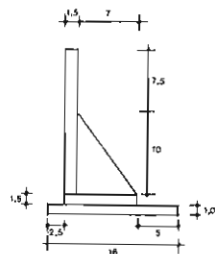
0 5 10 15 20 25

HEADPIECE/FOOTPIECE

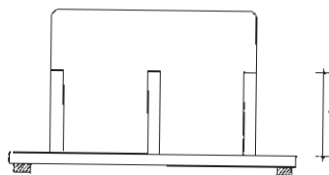
SCALE IN CENTIMETRES



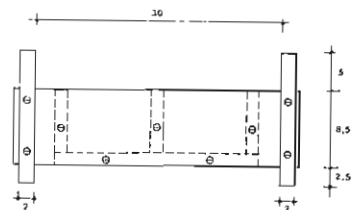
BOTTOM



SIDE

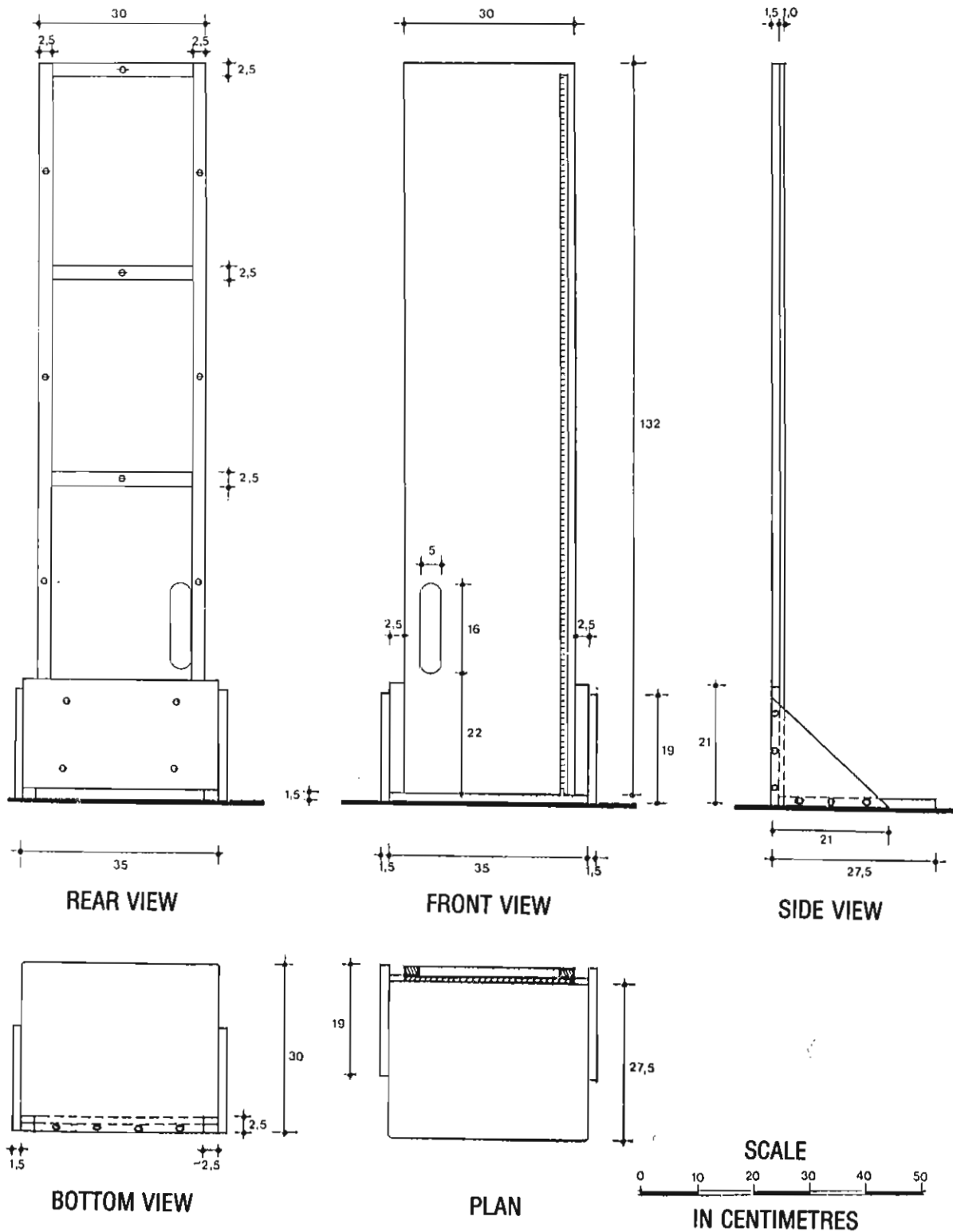


TOP



BACK

Illustration 125, cont'd.
Height Measuring Board, cont'd.



Annex H: Procedures for Standardizing The Collection of Anthropometric Data in the Field

Standardization is the process of teaching the survey team how to take measurements by checking the precision and accuracy of each enumerator. PRECISION is defined here as the ability to repeat a measurement of the same subject with a minimum variation. ACCURACY is defined here as the ability to obtain a measurement which will duplicate as closely as possible the 'true' value. The 'true' value can be considered either the average of the measurements made by all the enumerators or the measurement made by the trainer/supervisor. The test for accuracy is the more important of the two, so the basis for enumerator selection and evaluation may be the accuracy test alone.

Method A: Using the Supervisor as the Standard*

1. Data Collection

Ten subjects are usually required for standardization procedures. Each enumerator measures each subject twice, but the enumerator should not be allowed to see the first measurement when taking the second. The results of the initial measurements *of all children* are noted on an appropriate record form and put aside until the second set of measurements of the same children is taken. A suitable record form would be as follows:

Illustration 126

Sample Standardization Test Form

STANDARDIZATION FORM			
DATE	DAY	MONTH	YEAR
	<input type="text"/>	<input type="text"/>	<input type="text"/>
NAME			<input type="text"/>
			I. D.
HEIGHT/LENGTH/WEIGHT/ARM CIRC. (Circle one)			
MEASURE 1/2 (Circle one)			
CHILD No.			
1	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>
4	<input type="text"/>	<input type="text"/>	<input type="text"/>
5	<input type="text"/>	<input type="text"/>	<input type="text"/>
6	<input type="text"/>	<input type="text"/>	<input type="text"/>
7	<input type="text"/>	<input type="text"/>	<input type="text"/>
8	<input type="text"/>	<input type="text"/>	<input type="text"/>
9	<input type="text"/>	<input type="text"/>	<input type="text"/>
10	<input type="text"/>	<input type="text"/>	<input type="text"/>
COMMENTS:			

* Adapted from "Measuring Change in Nutritional Status", WHO, Geneva 1983

The result of this standardization procedure, using the heights of children as an illustration is shown in Table 1. (In practice, half of the children measured should be under two years and half over two years of age.)

Table 1: Raw Data in a Standardization Test for Measurements of Height of Children (in millimetres).

Child No.	Trainer/Supervisor		Enumerators											
	a	b	U		V		W		X		Y		Z	
1	828	822	819	826	841	834	833	828	838	825	842	837	836	819
2	838	846	846	846	842	854	849	856	850	856	861	854	860	845
3	860	856	863	861	856	866	875	853	882	872	862	858	873	860
4	862	860	862	850	866	855	854	864	856	869	875	865	874	854
5	820	820	825	823	827	826	826	822	836	828	826	827	818	827
6	856	854	857	862	855	860	856	864	862	873	864	860	858	856
7	823	824	824	825	826	824	827	826	832	825	820	835	818	827
8	876	876	880	875	877	875	873	878	879	887	884	882	876	874
9	801	806	810	804	811	810	809	808	811	800	820	815	800	797
10	853	865	858	852	859	860	857	860	856	856	866	870	852	856

Column a = first measurement

Column b = second measurement, independently made and recorded

□ = examples of inadequate measurements in terms of precision

2. Step-by-Step Calculations

Table 2: Calculations of a Standardization Test Using the Data of Enumerator Y in Table 1.

Child No.	Step 1		Step 2		Step 3	Step 4	Step 5	
	1st(a)	2nd(b)	PRECISION		Enumerator's (a + b) (5)	Trainer/ Supervisor's (a + b) (6)	ACCURACY	
	measurement		cols. 1 - 2	cols. (1 - 2) ²			cols. 5 - 6	cols. (5 - 6) ²
	(1)	(2)	(3)	(4)			(7)	(8)
1	842	837	+5	25	1679	1650	+29	841
2	861	854	+7	49	1715	1684	+31	961
3	862	858	+4	16	1720	1716	+4	16
4	875	865	+10	100	1740	1722	+18	324
5	826	827	-1	1	1653	1640	+13	169
6	864	860	+4	16	1724	1710	+14	196
7	820	835	-15	225	1655	1647	+8	64
8	884	882	+2	4	1766	1752	+14	196
9	820	815	+5	25	1635	1607	+28	784
10	866	870	-4	16	1736	1718	+18	324
Totals				477				3875

As shown in Table 2, the following calculations are carried out.

- Step 1 - The two measurements are entered in the first two columns.
- Step 2 - The second measurement is subtracted from the first measurement, and the result, i.e. **precision**, is entered in the third column with its appropriate sign, and then the square of that figure is entered in the fourth column.
- Step 3 - The sum of the enumerator's two measurements of each child is entered in the fifth column.
- Step 4 - The sum of the trainer/supervisor's two measurements of each child is entered in the sixth column.
- Step 5 - The sum of the trainer/supervisor's measurements (column 6) is subtracted from the sum of the enumerator's measurements (column 5) and the result, i.e. **accuracy**, is entered in the seventh column with its appropriate sign, and then squared in the eighth column.
- Step 6 - Total the figures in column 4 and the figures in column 8 for all children. These totals of column 4 (**precision**) and column 8 (**accuracy**) of each enumerator (i.e. 477 and 3875 in the case of enumerator Y) are then transferred to a single sheet of paper as in the following Table 3.

Table 3: Summary of Findings from the Standardization Tests.

Measurers	PRECISION		ACCURACY		Observations (by Supervisor)
	Totals (col. 4)	Signs* (col. 3)	Totals (col. 8)	Signs* (col. 7)	
Trainer/ Supervisor	294**	4/8	NA	NA	Best precision, as expected
Enumerators					
U	324	6/9	524	7/10	Both precision and accuracy satisfactory
V	431	6/10	1195	8/9	Precision satisfactory. Accuracy deficient; values too great by 3.8 mm. Re-examine same children under supervision, with instruction.
W	774	5/10	1024	7/10	Poor precision due to one poor repeated measurement; accuracy approaching the adequate. With better precision, accuracy would be expected to be adequate.
X	893	5/9	3655	9/10	Overall poor precision: measures 7.4 mm. too long; poor attitude and carelessness observed. Need to talk to enumerator and restandardize.
Y	477	7/10	3875	10/10	Precision satisfactory; doing something wrong systematically. 8.9 mm. too long. On repeating measurement, enumerator is observed to stretch children while measuring them.
Z	1278	7/10	1040	6/10	Poor precision and accuracy due to faulty first four measures, thereafter satisfactory. Remeasure.

* The sum of the most frequently occurring sign is the numerator, the total number of signs is the denominator. Zeros are ignored.

**The sum of the squared differences of the two measurements of the trainer/supervisor shown in the first two measurement columns of Table 1, i.e. $(a - b)^2$.

3. Evaluation of Results

In evaluating the results in Table 3, the following *general rules* apply:

- a. The trainer/supervisor's precision will usually be the greatest because of expected greater competence and, therefore, the sum of the trainer/supervisor's column 4 will correspondingly be the smallest. Ideally, this should be equal to zero for both the trainer/supervisor and the enumerator. In practice, for adequate precision, it is considered acceptable if the sum of the enumerator's column 4 (magnitude being inversely related to precision) is arbitrarily no more than twice the sum of the trainer/supervisor's column 4, i.e. 588 (294×2).
- b. An enumerator's column 8 should ideally be equal to zero. In practice, for adequate accuracy, it is considered acceptable if the enumerator's column 8 (magnitude being inversely related to accuracy) is arbitrarily no more than three times the sum of the trainer/supervisor's column 4, i.e. 882 (294×3).
- c. An enumerator's column 8 should be larger than his column 4. If it is not, the result should be closely scrutinized and measurements retaken as is recommended in the case of enumerator Z in Table 3.

One weakness of these arbitrary rulings is that they result in different levels of acceptability in an enumerator's measurements depending on the quality of the measurements of the trainer/supervisor. An enumerator working with a poor trainer/supervisor will be allowed a greater margin of error than an enumerator working with an expert trainer/supervisor. Clearly, if the quality of the trainer/supervisor is not considerably better than that of the average enumerator or there is a wide variation among supervisors, this method of comparison should not be used.

The summary of the results as they are presented in Table 3 are then examined bearing in mind the three rules listed above. When inadequacies are revealed by applying these rules, the next step is to examine the signs of the differences which can show if an enumerator is making a *systematic error* or not. If, with ten duplicate measurements, 9 out of 10 differences have the **same** sign, there is a very high probability that *a systematic error is being made*. If this type of systematic error is discovered when checking for *precision*, i.e. col. 4, then it is probable that the two rounds of measurements were different due to different measuring techniques of the enumerator who might have been overtired during the second round; to problems with the measuring equipment between rounds as when the scales are not properly zeroed; to an actual difference in the child, when the child eats or goes to the toilet between weighings; or to some other similar systematic problem.

If this type of systematic error is discovered in calculating for *accuracy*, i.e. col. 8, then there is a very high probability that the *enumerator has a systematic bias*. In this case the measuring should be observed for such errors as incorrect reading of the scale or stretching of the child while taking length measurements. On the other hand, inaccuracy where less than 9 out of 10 difference signs are the same suggests the need for the enumerator to take greater general care during measuring.

To sum up: a large column 4 total, i.e. poor precision, indicates careless measuring, or fatigue, or changes in the subject over a period of time to be determined by an inspection of signs or single differences.

A large column 8 total, i.e. poor accuracy, indicates carelessness, or a systematic bias if the signs indicate this, or lapses in performance revealed by large single differences.

Once the nature of the error is identified, correction is usually simple.

Method B: Using the Average of the Group as the Standard*

The following test evaluation should be used when the trainer/supervisor's measurements are not expected to be any more accurate or precise than those of the enumerators. The illustration given here is for height/length, but this method could also be used for weight and other anthropometric measurements with appropriate cut-off values. A suggested cut-off value for weight is 0.1-0.2 kg., with 0.1 kg. being used for very young children, i.e. under 2 years of age. A suggested cut-off value for height/length is 0.5 cm.

1. Data Collection

Same as with Method A.

2. Step-by-Step Calculations

**Table 4: Calculations of a Standardization Test:
Heights of Children (in centimetres).**

Child No. 1

Enumerator	Step 1		Step 2	Step 3	Step 4	Step 5
	1st(a)	2nd(b)	PRECISION	Sum of Enumerator	Average of	ACCURACY
	Measurement		cols. 1 - 2	Measurements	the Group	cols. 4 - 5
	(1)	(2)	(3)	cols. 1 + 2	(5)	(6)
U	108.2	107.8	0.4	216.0	215.0	1.0
V	108.1	107.5	0.6	215.6	215.0	0.6
W	107.6	107.3	0.3	214.9	215.0	0.1
X	107.0	107.0	0.0	214.0	215.0	1.0
Y	108.0	107.4	0.6	215.4	215.0	0.4
Z	107.3	107.2	0.1	214.5	215.0	0.5

* Adapted from "Weighing and Measuring Children", Centers for Disease Control, Atlanta, Ga., 1982.

As shown in Table 4, the following calculations are carried out.

- Step 1 - The two measurements of all enumerators, separately for each child, are entered in the first two columns.
- Step 2 - The difference between the two measurements, i.e. precision, is entered in the third column, ignoring the sign.
- Step 3 - The sum of the two measurements is entered in the fourth column.
- Step 4 - The average of the sums of the enumerators' measurements, i.e. col. 4, is entered in the fifth column. The average is calculated by adding together all the sums in column 4 and dividing the result by the number of enumerators.
- Step 5 - The difference between column 5 and column 4, i.e. accuracy, is entered in the sixth column, ignoring the sign.

3. Evaluation of Results

a. Pass or fail approach

In evaluating the results it is suggested that a cut-off value of 0.5 cm. for height or length be used, i.e. any difference between the two measurements of 0.5 cm. or greater, means that the measurement should be considered unsatisfactory. The evaluation for precision and accuracy is, therefore, as follows:

Enumerator	Precision	Evaluation	Accuracy	Evaluation
U	0.4	Satisfactory	1.0	Unsatisfactory
V	0.6	Unsatisfactory	0.6	Unsatisfactory
W	0.3	Satisfactory	0.1	Satisfactory
X	0.0	Satisfactory	1.0	Unsatisfactory
Y	0.6	Unsatisfactory	0.4	Satisfactory
Z	0.1	Satisfactory	0.5	Unsatisfactory

b. Ranking approach

Each enumerator can also be assigned an overall accuracy and precision score based on the measurements of all ten children in the test using the following ranges and assigned points.

Precision/Accuracy Range (cm.)	Points
0.0 - 0.4	3
0.5 - 0.9	2
1.0 - 1.4	1
1.5 +	0

Using the previous example, the following would be the scores for the six enumerators for Child No. 1 with enumerator W ranking best overall and enumerators U, V and X ranking worst.

Enumerator	Precision	Precision Score	Accuracy	Accuracy Score	Total Score
U	0.4	3	1.0	1	4
V	0.6	2	0.6	2	4
W	0.3	3	0.1	3	6
X	0.0	3	1.0	1	4
Y	0.6	2	0.4	3	5
Z	0.1	3	0.5	2	5

Each enumerator will receive points for each child's measurement and the points for all ten children are then added together for a final precision score, a final accuracy score and a total score. The enumerators can then be given a ranking based on precision, accuracy or a complete overall ranking based on their total scores for all ten children.

Organizing the Test

1. Introduction

Standardization tests should be administered once during training and, if possible, once during data collection. During training, they should be administered separately after the completion of training for each measurement procedure. During data collection, they should be administered together. It takes approximately one to two hours for 20 enumerators to complete a test using ten children. For larger groups of enumerators, more children will be needed. If convening for a test is logistically difficult during data collection, enumerators can be tested in small groups using "Method A" Standardization Test.

2. Test Implementation Suggestions

- Pin a piece of paper with a number (1-10) on each child, or write the number on the back of each child's hand.
- Pick places, preferably in the shade, for measuring boards or scales, providing sufficient working room between each board or scale. Use ten standardized boards or scales if available. For the arm circumference test, each enumerator should have a tape.
- Have each child sit near a specific board or scale. During the test, the enumerators should move from child to child. If less than ten boards or scales are used, assign more than one child to each board or scale. For arm circumference, have the children stand while the enumerators sit so that the child's arm will be at the enumerator's eye level.

- d. Distribute standardization test forms and instruct the enumerators to fill in the identification information. Instruct the enumerators to record their own measurements for all of the standardization tests, and not to show them to their team partners.
- e. For height or length, form two-person teams. Explain to the enumerators that only one enumerator from each team will be tested at a time for height or length. Each team partner serves as an assistant holding the child in place. After the first enumerator completes the first set of measurements, the test form is submitted to a trainer and then the team partner measures the ten children. For weight and arm circumference, enumerators work alone without assistance from their partners.
- f. For weight, a child should be taken off the scale after each measurement. A pair of weighing pants should be left on each child for the whole test. The scale should be adjusted to zero after each measurement using a separate pair of pants before weighing a child.

After a child has been weighed or measured, the child should be returned to a chair or immediately weighed or measured by another enumerator. A child should never be left alone on a board or scale.
- g. Since this is a test, talking should *not* be allowed between enumerators. Standardization tests are implemented most efficiently when there are organized work sequences and silence. Corrections of enumerators' measurement procedures should *not* be done during a standardization test by a survey administrator or trainer.
- h. Identify and make note of any children who were particularly unruly and difficult to weigh or measure. Measurement error may be attributed to a child's unruliness where all the enumerators may have difficulty in weighing and measuring such a child accurately and precisely.

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Annex I
Summary Procedures

HOW TO WEIGH AND MEASURE CHILDREN

Assessing the Nutritional Status
of Young Children in Household Surveys



United Nations
Department of Technical
Co-operation for Development
and Statistical Office

New York, 1986

THIS DOCUMENT MAY BE REPRODUCED
WITH ACKNOWLEDGEMENT TO THE UNITED NATIONS

I. Procedures and Precautions Before Measuring

A. Layout of the Procedures

Each step of the measurement procedures is directed at specific participants, who are named in bold letters at the beginning of each step: e.g. "**Measurer**", "**Assistant**", etc.

B. Two Trained People Required

Two trained people are required to measure a child's height and length. The measurer holds the child and takes the measurements. The assistant helps hold the child and records the measurements on the questionnaire. If there is an untrained assistant such as the mother, then the trained measurer should also record the measurements on the questionnaire. One person alone can take the weight or arm circumference of a child and record the results if an assistant is not available.

C. Measuring Board and Scale Placement

Begin to observe possible places where the board can be positioned and the scale hung as soon as you walk towards a sample household. Be selective about where you place the measuring board and scale. It is best to measure outdoors during daylight hours. If it is cold, raining or if too many people congregate and interfere with the measurements, it may be more comfortable to weigh and measure a child indoors. Make sure there is adequate light.

D. Age Assessment

Before you measure, determine the child's age. If the the child is less than two years, measure length. If the child is two years of age or older, measure height (see Annex C). If accurate age is not possible to obtain, measure length if the child is less than 85 cm. Measure height if the child is equal to or greater than 85 cm.

E. When to Weigh and Measure

Weigh and measure after verbal information has been recorded on the questionnaire. This will allow you to become familiar with the members of the household. DO NOT weigh and measure at the beginning of the interview, i.e. as soon as you enter a household, which would be more of an upsetting intrusion.

F. Weigh and Measure One Child at a Time

If there is more than one eligible child in a household, complete the entire questionnaire, including the weighing and measuring of one child. Then proceed with the next eligible child's questionnaire in the household. DO NOT weigh and measure all the children together. This can easily cause confusion and will create a greater chance for error such as recording one child's measurements on another child's questionnaire. Return measuring equipment to their storage bags immediately after you complete the measurements for each household.

G. Control the Child

When you weigh and measure, you must control the child. The strength and mobility of even very young children should not be underestimated. Be firm yet gentle with children. Your own sense of calm and self confidence will be felt by the mother and the child.

When a child has contact with any measuring equipment, i.e. on a measuring board, in the weighing pants or with an arm circumference tape, you must hold and control the child so the child will not trip or fall. Never leave a child alone with a piece of equipment. Always have physical contact with the child except when you must let go of a child for a few seconds while taking the weight.

H. Coping With Stress

Since weighing and measuring requires touching and handling children, normal stress levels for this type of survey work are higher than for surveys where only verbal information is collected.

Explain the weighing and measuring procedures to the mother, and to a limited extent, the child, to help minimize possible resistance, fears or discomfort they may feel. You must determine if the child or mother is under so much stress that the weighing and measuring must stop. Remember, young children are often uncooperative; they tend to cry, scream, kick and sometimes bite. If a child is under severe stress and is crying excessively, try to calm the child or return the child to the mother for a moment before proceeding with the weighing and measuring.

Do not weigh or measure a child if:

- a. The mother refuses.
- b. The child is too sick or too distressed.
- c. The child is physically deformed which will interfere with or give an incorrect measurement. To be kind, you may want to measure such a child and make a note of the deformity on the questionnaire.

I. Recording Measurements and Being Careful

Record the measurements in pencil. If you make an error, completely erase the error and rewrite the correct numbers. Keep objects out of your hands and pencils out of your mouth, hair or breast pocket when you weigh and measure so that neither the child nor you will get hurt due to carelessness. When you are not using a pencil, place it in your equipment pack, pencil case or on the survey form. Make sure you do not have long fingernails. Remove interfering rings and watches before you weigh and measure. Do not smoke when you are in a household or when you weigh and measure.

J. Strive for Improvement

You can be an expert measurer if you strive for improvement and follow every step of every procedure the same way every time. The quality and speed of your measurements will improve with practice. You may be working with a partner to form a team. If so, you will be responsible for not only your own work, but also for the quality of work of your team.

You will be required to weigh and measure many children. Do not take these procedures for granted even though they may seem simple and repetitious. It is easy to make errors when you are not careful. Do not omit any steps. Concentrate on what you are doing.

II. Nutritional Status Measurement

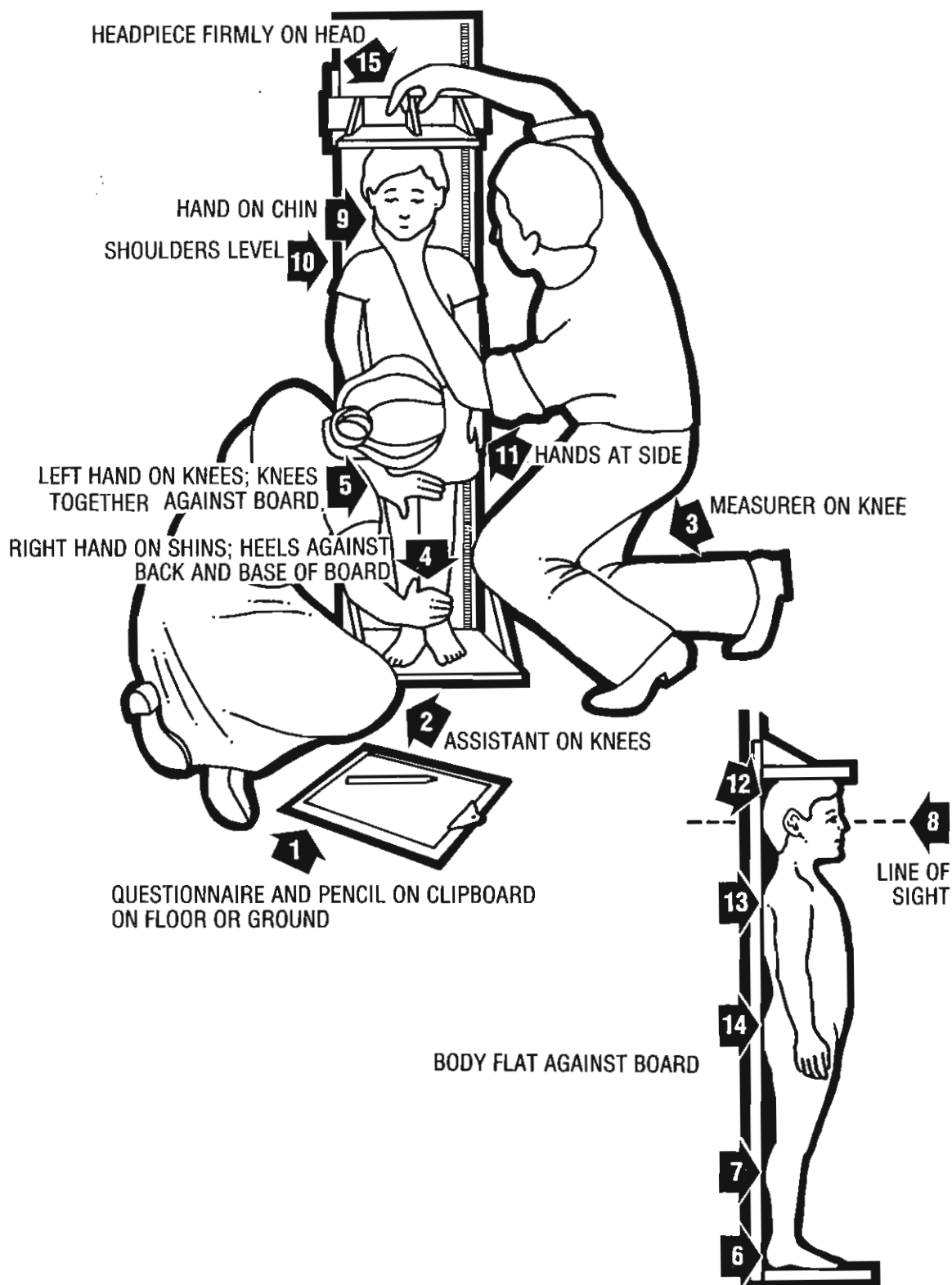
Summary Procedures

A. Child Height Summary Procedure (Illustration 1)*

1. **Measurer or Assistant:** Place the measuring board on a hard flat surface against a wall, table, tree, staircase, etc. Make sure the board is stable.
2. **Measurer or Assistant:** Ask the mother to remove the child's shoes and unbraided any hair that would interfere with the height measurement. Ask her to walk the child to the board and to kneel in front of the child (if she is not the assistant).
3. **Assistant:** Place the questionnaire and pencil on the ground (Arrow 1). Kneel with both knees on the right side of the child (Arrow 2).
4. **Measurer:** Kneel on your right knee only, for maximum mobility, on the child's left side (Arrow 3).
5. **Assistant:** Place the child's feet flat and together in the centre of and against the back and base of the board. Place your right hand just above the child's ankles on the shins (Arrow 4), your left hand on the child's knees (Arrow 5) and push against the board. Make sure the child's legs are straight and the heels and calves are against the board (Arrows 6 and 7). Tell the measurer when you have completed positioning the feet and legs.
6. **Measurer:** Tell the child to look straight ahead at the mother if she is in front of the child. Make sure the child's line of sight is level with the ground (Arrow 8). Place your open left hand on the child's chin. Gradually close your hand (Arrow 9). Do not cover the child's mouth or ears. Make sure the shoulders are level (Arrow 10), the hands are at the child's side (Arrow 11), and the head, shoulder blades and buttocks are against the board (Arrows 12, 13, and 14). With your right hand, lower the headpiece on top of the child's head. Make sure you push through the child's hair (Arrow 15).
7. **Measurer and Assistant:** Check the child's position (Arrows 1-15). Repeat any steps as necessary.
8. **Measurer:** When the child's position is correct, read and call out the measurement to the nearest 0.1 cm. Remove the headpiece from the child's head, your left hand from the child's chin and support the child during the recording.
9. **Assistant:** Immediately record the measurement and show it to the measurer.
NOTE: If the assistant is untrained, the measurer records the height.
10. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to erase and correct any errors.

*If the assistant is untrained, e.g. the mother, then the measurer should help the assistant with the height procedure.

Illustration 1 Child Height Measurement

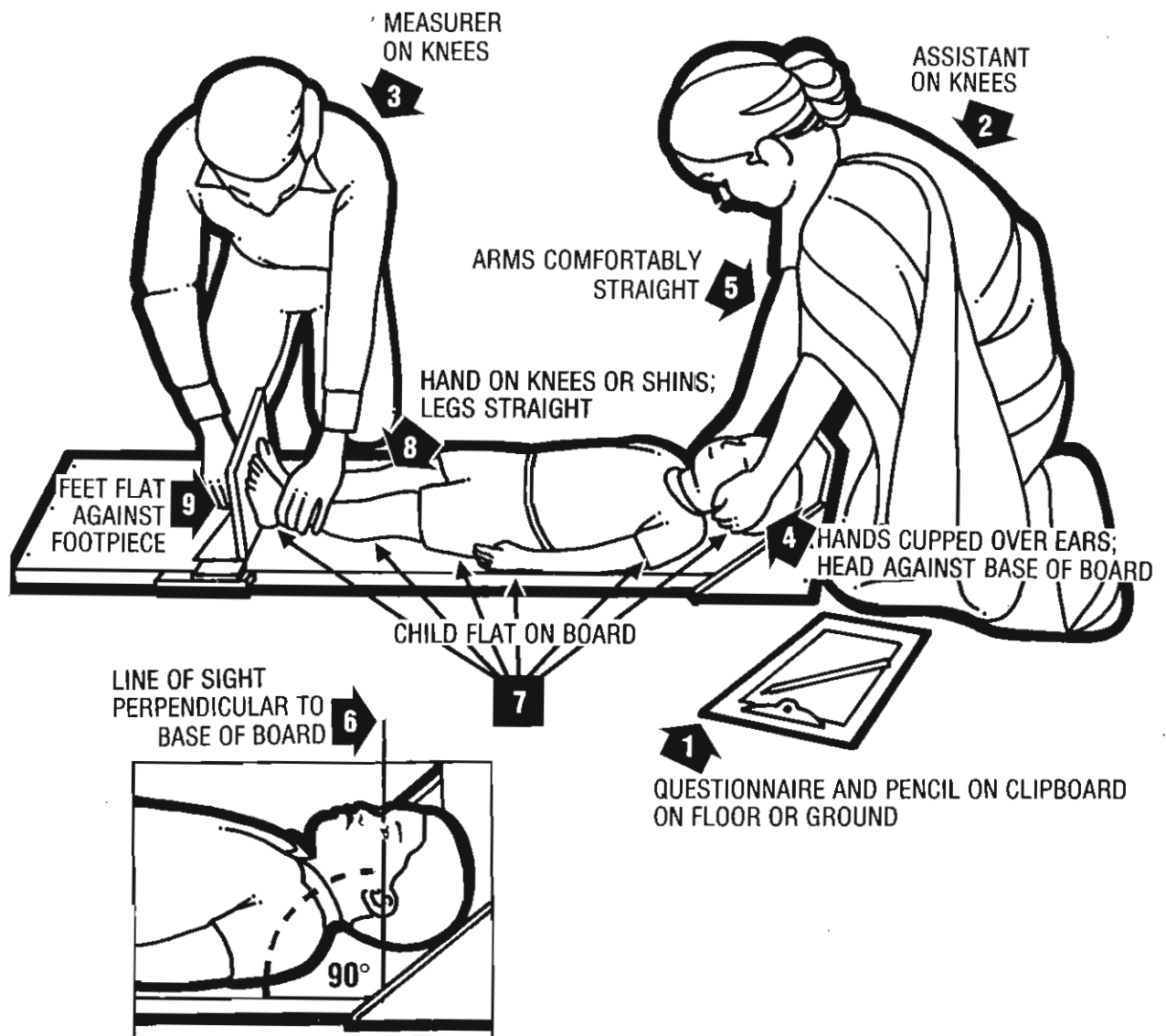


B. Child Length Summary Procedure (Illustration 2)*

1. **Measurer or Assistant:** Place the measuring board on a hard flat surface, i.e. ground, floor or steady table.
2. **Assistant:** Place the questionnaire and pencil on the ground, floor or table (Arrow 1). Kneel with both knees behind the base of the board, if it is on the ground or floor (Arrow 2).
3. **Measurer:** Kneel on the right side of the child so that you can hold the footpiece with your right hand (Arrow 3).
4. **Measurer and Assistant:** With the mother's help, lay the child on the board by doing the following:
 - Assistant:** Support the back of the child's head with your hands and gradually lower the child onto the board.
 - Measurer:** Support the child at the trunk of the body.
5. **Measurer or Assistant:** If she is not the assistant, ask the mother to kneel on the opposite side of the board facing the measurer to help keep the child calm.
6. **Assistant:** Cup your hands over the child's ears (Arrow 4). With your arms comfortably straight (Arrow 5), place the child's head against the base of the board so that the child is looking straight up. The child's line of sight should be perpendicular to the ground (Arrow 6). Your head should be straight over the child's head. Look directly into the child's eyes.
7. **Measurer:** Make sure the child is lying flat and in the centre of the board (Arrows 7). Place your left hand on the child's shins (above the ankles) or on the knees (Arrow 8). Press them firmly against the board. With your right hand, place the footpiece firmly against the child's heels (Arrow 9).
8. **Measurer and Assistant:** Check the child's position (Arrows 1-9). Repeat any steps as necessary.
9. **Measurer:** When the child's position is correct, read and call out the measurement to the nearest 0.1 cm. Remove the footpiece, release your left hand from the child's shins or knees and support the child during the recording.
10. **Assistant:** Immediately release the child's head, record the measurement, and show it to the measurer.
 - NOTE:** If the assistant is untrained, the measurer records the length on the questionnaire.
11. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to erase and correct any errors.

* If the assistant is untrained, e.g. the mother, then the measurer should help the assistant with the length procedure.

Illustration 2
Child Length Measurement

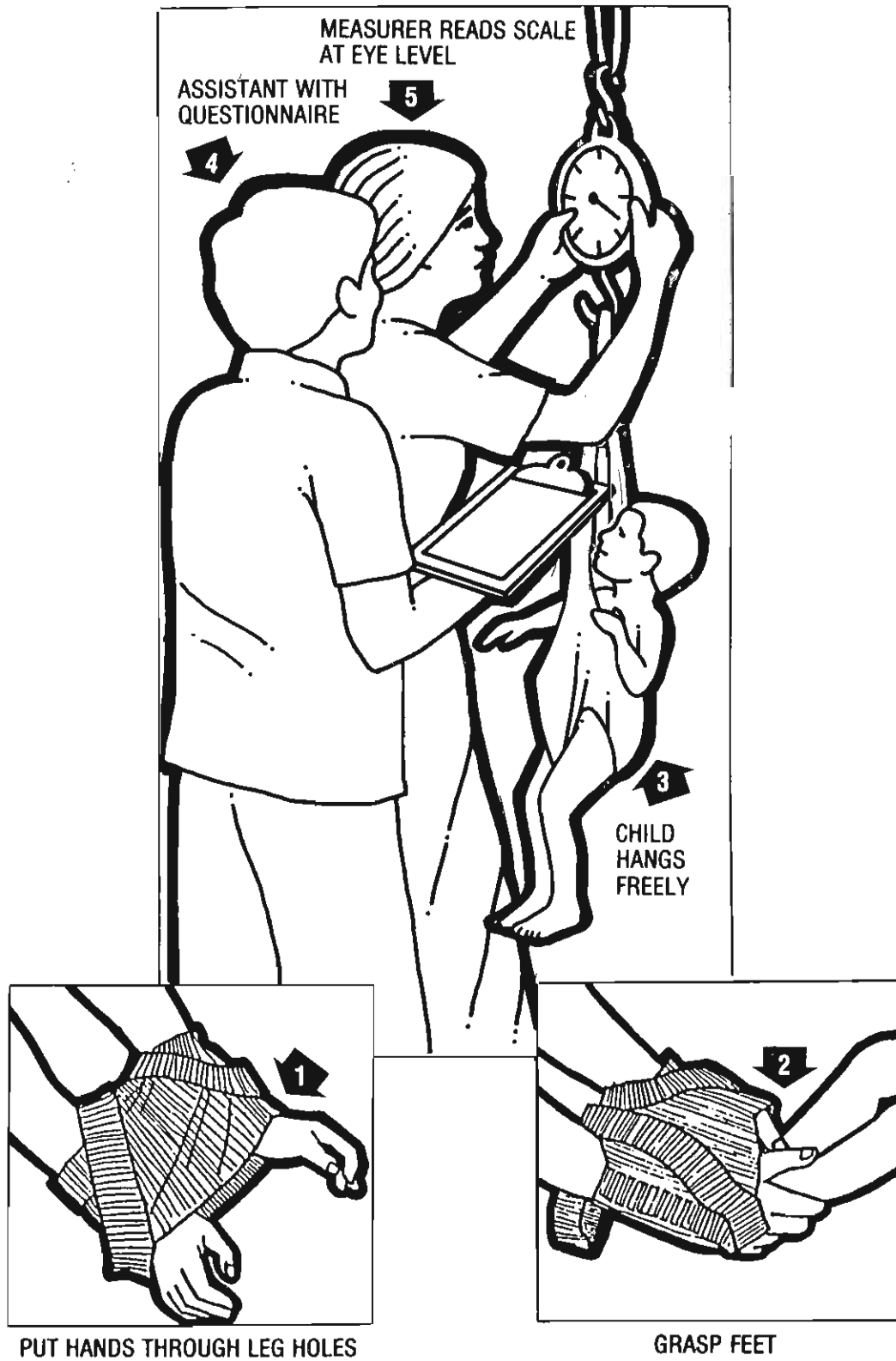


C. Child Weight Summary Procedure (Illustration 3)*

1. **Measurer or Assistant:** Hang the scale from a tree branch, ceiling beam, tripod or pole held by two people. You may need a piece of rope to hang the scale at eye level. Ask the mother to undress the child.
2. **Measurer:** Attach a pair of the empty weighing pants, infant sling or basket to the hook of the scale and adjust the scale to zero, then remove from the scale.
3. **Measurer:** Have the mother hold the child. Put your arms through the leg holes of the pants (Arrow 1). Grasp the child's feet and pull the legs through the leg holes (Arrow 2). Make certain the strap of the pants is in front of the child.
4. **Measurer:** Attach the strap of the pants to the hook of the scale. DO NOT CARRY THE CHILD BY THE STRAP ONLY. Gently lower the child and allow the child to hang freely (Arrow 3).
5. **Assistant:** Stand behind and to one side of the measurer ready to record the measurement. Have the questionnaire ready (Arrow 4).
6. **Measurer and Assistant:** Check the child's position. Make sure the child is hanging freely and not touching anything. Repeat any steps as necessary.
7. **Measurer:** Hold the scale and read the weight to the nearest 0.1 kg. (Arrow 5). Call out the measurement when the child is still and the scale needle is stationary. Even children who are very active, which causes the needle to wobble greatly, will become still long enough to take a reading. WAIT FOR THE NEEDLE TO STOP MOVING.
8. **Assistant:** Immediately record the measurement and show it to the measurer.
9. **Measurer:** As the assistant records the measurement, hold the child in one arm and gently lift the child by the body. DO NOT LIFT THE CHILD BY THE STRAP OF THE WEIGHING PANTS. Release the strap from the hook of the scale with your free hand.
10. **Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to erase and correct any errors.

*If the assistant is untrained, e.g. the mother, then weight should be taken by one person only, the trained measurer, who should also record the measurement on the questionnaire.

Illustration 3 Child Weight



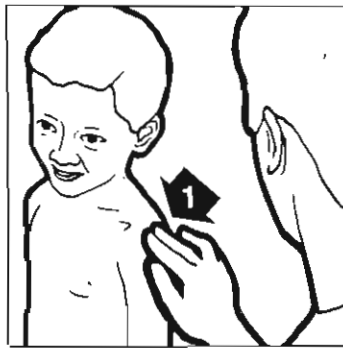
D. Child Mid-Upper Arm Circumference Summary Procedure (MUAC) (Illustration 4)*

- 1. Measurer:** Keep your work at eye level. Sit down when possible. Very young children can be held by the mother during this procedure. Ask the mother to remove clothing that may cover the child's left arm.
- 2. Measurer:** Calculate the midpoint of the child's left upper arm by first locating the tip of the child's shoulder (Arrows 1 and 2) with your finger tips. Bend the child's elbow to make a right angle (Arrow 3). Place the tape at zero, which is indicated by two arrows, on the tip of the shoulder (Arrow 4) and pull the tape straight down past the tip of the elbow (Arrow 5). Read the number at the tip of the elbow to the nearest centimetre. Divide this number by two to estimate the midpoint. As an alternative, bend the tape up to the middle length to estimate the midpoint. A piece of string can also be used for this purpose. Either you or an assistant can mark the midpoint with a pen on the arm (Arrow 6).
- 3. Measurer:** Straighten the child's arm and wrap the tape around the arm at the midpoint. Make sure the numbers are right side up. Make sure the tape is flat around the skin (Arrow 7).
- 4. Measurer and Assistant:** Inspect the tension of the tape on the child's arm. Make sure the tape has the proper tension (Arrow 7) and is not too tight or too loose (Arrows 8-9). Repeat any steps as necessary.
- 5. Assistant:** Have the questionnaire ready.
- 6. Measurer:** When the tape is in the correct position on the arm with the correct tension, read and call out the measurement to the nearest 0.1 cm. (Arrow 10).
- 7. Assistant:** Immediately record the measurement on the questionnaire and show it to the measurer.
- 8. Measurer:** While the assistant records the measurement, loosen the tape on the child's arm.
- 9. Measurer:** Check the recorded measurement on the questionnaire for accuracy and legibility. Instruct the assistant to erase and correct any errors.
- 10. Measurer:** Remove the tape from the child's arm.

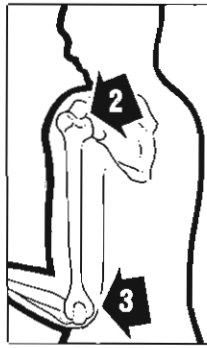
*If the assistant is untrained, e.g. the mother, then arm circumference should be measured by one person only, the trained measurer, who should also record the measurement on the questionnaire.

Illustration 4

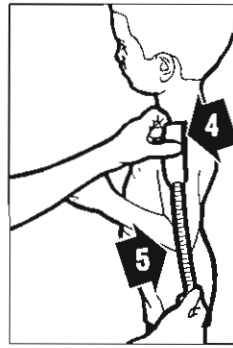
Child Mid-Upper Arm Circumference Measurement



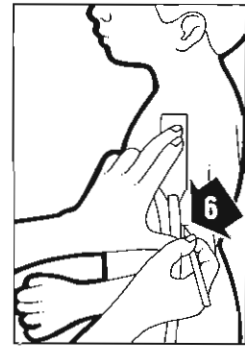
1 LOCATE TIP OF SHOULDER



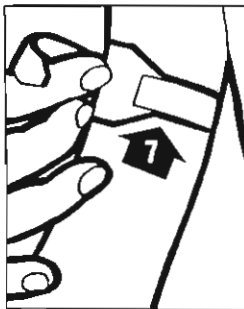
2 TIP OF SHOULDER
3 TIP OF ELBOW



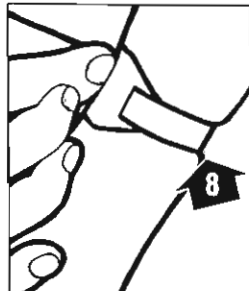
4 PLACE TAPE AT TIP
OF SHOULDER
5 PULL TAPE PAST
TIP OF BENT ELBOW



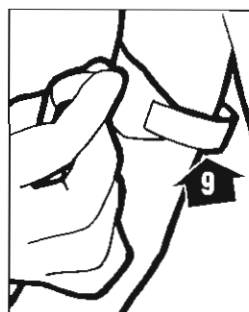
6 MARK MIDPOINT



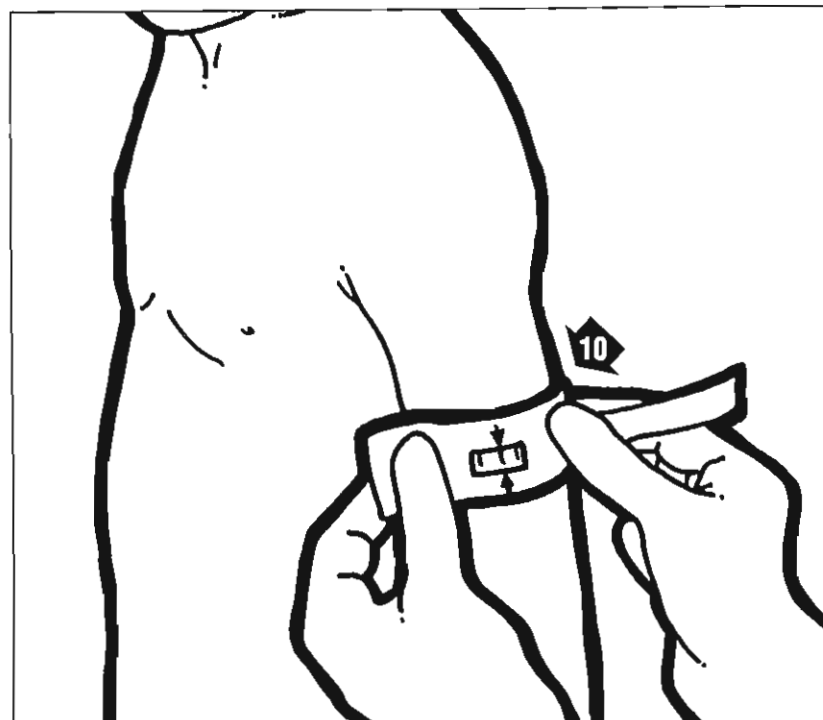
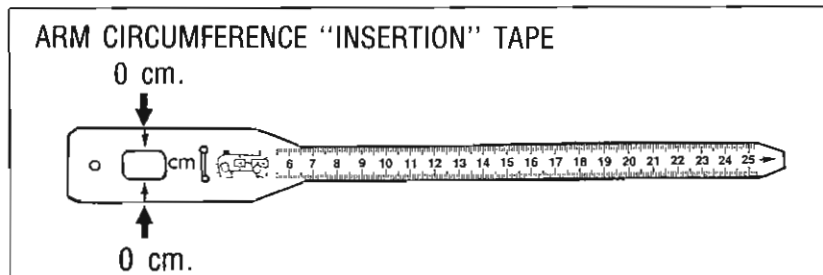
7 CORRECT TAPE
TENSION



8 TAPE TOO TIGHT



9 TAPE TOO LOOSE



10 CORRECT TAPE POSITION FOR ARM CIRCUMFERENCE