

MODULE 6

Protocols and Equipment

What Does this Module Cover?

Module 6 provides instructions on how to take anthropometric measurements. This module covers:

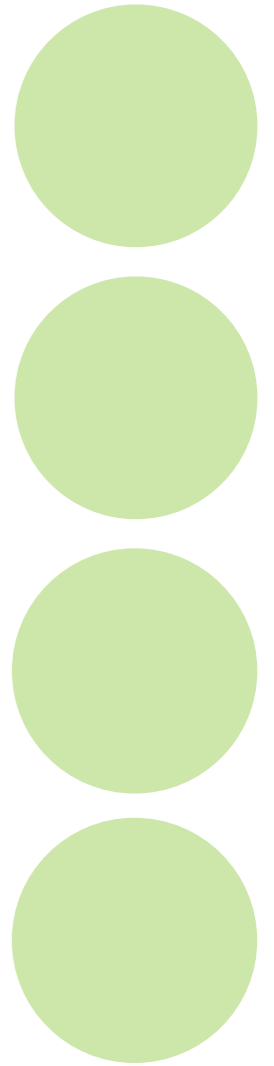
- How to plan and prepare to take anthropometric measurements
- Measurement protocols that explain how to weigh an individual and how to measure an individual's length/height (or knee height), mid-upper arm circumference (MUAC), head circumference, waist circumference, and calf circumference and assess for bilateral pitting edema. The protocols are accompanied by drawings.
- Information on anthropometric equipment, including basic information on the common types of equipment needed to conduct anthropometry, suggested basic standards to help users select appropriate equipment, and information on where to purchase equipment

This module can be used as a resource to inform the development of training materials. Users are encouraged to review Module 1 alongside this module because it explains key concepts that are relevant to all modules.

How to Plan and Prepare to Take Anthropometric Measurements

The information and tips in this section are adapted from several sources (United Nations Department of Technical Co-Operation for Development [UNDTCD] and United Nations Statistical Office [UNSO] 1986; Cogill 2003; and ICF International 2012).

This section explains key aspects of planning and preparing to take anthropometric measurements. Guidance includes personnel needed, how to set up equipment and obtain consent from the individual or parent/caregiver, and other tips to ensure measurements are taken correctly. Following these preparations helps to protect the safety of individuals being measured and ensure that the measurements are accurate. Additional tips are provided specifically for weighing and measuring children and adolescents, who can be harder to work with and may need additional support.



Recommended Personnel

The number of personnel needed varies according to the age of the person being measured and the measurement being taken. In all circumstances, measurements must be taken by trained personnel who have demonstrated the necessary skills. Cultural norms should be considered when selecting measurers. For example, a woman may be uncomfortable with having her waist circumference measured by a man; having female measurers available would be recommended in that situation.

Children from birth to 5 years of age: Ideally, two trained persons should work together to take and record all measurements. One person conducts and calls out the measurements, while the other helps to position the child being measured and records the measurements. Having two people is particularly useful for measuring length and weight of the youngest children, who cannot follow directions and may be frightened or not understand what is happening.

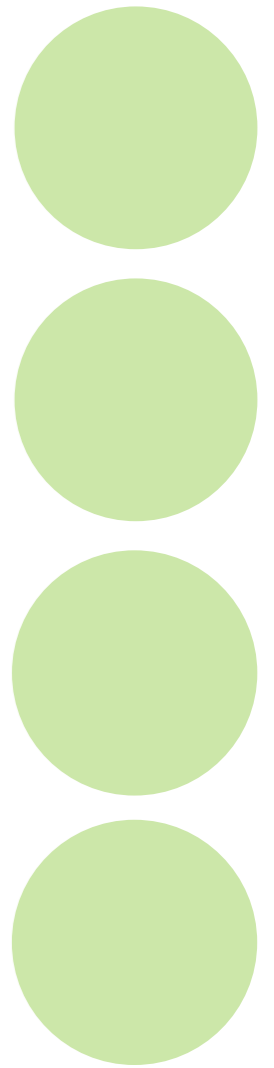
Most program and clinical settings do not have the resources for two staff people to take measurements. In this situation, an untrained assistant such as a parent/caregiver can help position the child—following instructions from the trained person—and keep the child calm while the trained person weighs or measures the child and records all measurements.

This guide focuses on the use of two trained measurers and provides guidance on what to do if there is only one trained measurer and untrained parents/caregivers are available to assist.

People 5 years of age and older: One trained person is often enough when weighing and measuring older children (although an untrained parent/caregiver may help ensure their cooperation) and is all that is required to measure an adult.

SURVEY TIP

When conducting a survey, two trained people are usually expected to take the height and weight of children from birth to 5 years of age.



Setting up the Equipment

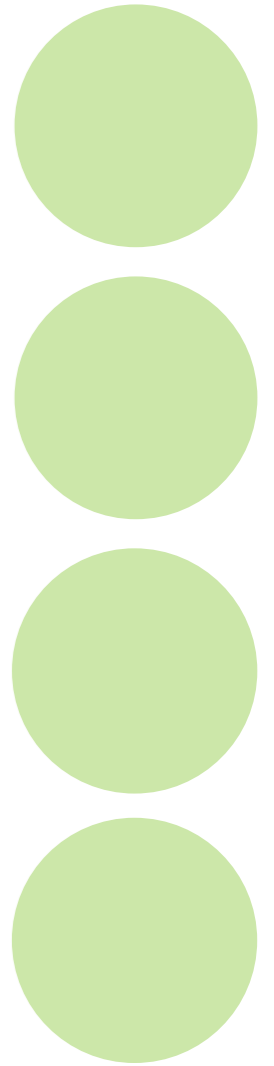
Ensure that all equipment is clean, working, and correctly calibrated (adjusted so that it measures accurately). Standing scales and measuring boards should be placed on a hard, flat, and level surface during measurement. Hanging scales should be securely hung with adequate room for taking measurements. Measuring tapes used for MUAC, waist, calf, and head circumferences should be in good condition (e.g., not stretched out and with clearly legible numbers). Different MUAC tapes are used for specific age groups, so the correct tapes should be available for the age group(s) being measured. Measurements may be taken outdoors, weather permitting. If measuring outdoors is uncomfortable due to heat, rain, or interference from other people, move indoors or to a secluded place to conduct measurements.

Greeting

Always greet and introduce yourself to the person you are going to measure as well as the parent/caregiver if a child or adolescent is being measured. Using a respectful, kind, and gentle tone, explain the reason for taking the measurement and the procedures involved and ask if the individual or parent/caregiver has any questions.

TIP

Checking the **calibration** of equipment can be done in the field by any trained person. To test whether a scale is accurately calibrated, weigh a standardized set of weights (e.g., 10 kg, 20 kg, 30 kg weights) and see whether the scale accurately measures them. If the test shows that the scale is not calibrated correctly, the scale must be sent to a technician who is trained to fix the equipment. It is helpful to have extra equipment in the field in case a scale needs to be sent off-site for calibration.



Consent

Before beginning any measurement, consent must be obtained from the individual to be weighed and measured. For children and adolescents, parental or caregiver consent as well as the child/adolescent's assent (as appropriate and required by local law) are necessary before taking any measurements. If the person refuses to participate, respect this decision and do not take any measurement. Always thank the person and parent/caregiver (if a child or adolescent is being measured).

Stop/do not measure if:

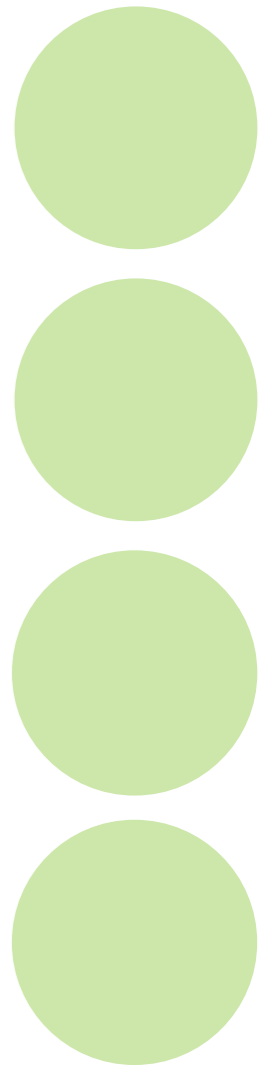
- The person being measured refuses.
- The parent/caregiver refuses.
- The person being measured is distressed or too sick.

SURVEY TIP

Ethical Approvals for Surveys

If the anthropometric data collected from individuals are part of a larger data collection effort designed to make a generalized statement about the anthropometric status of the population (e.g., as part of a population-based survey), ethical approval(s) must be obtained from an institutional review board (IRB). If the organization conducting the survey is based outside the country (e.g., an academic institution based abroad or an international nongovernmental organization), IRB approval both within and outside the country in which the data collection is planned is likely to be required.

In addition, as part of the data collection process, informed consent must be obtained from the person being measured. If the individual being measured is not old enough to give informed consent according to local law, then consent must be obtained from the individual's parent or guardian. Moreover, if a minor is of a certain age, in many cases, she/he must also provide assent for the measurement. Different countries will have different guidance on the age at which a person can legally give informed consent and on the protocol for obtaining assent from a minor who is legally unable to provide informed consent.

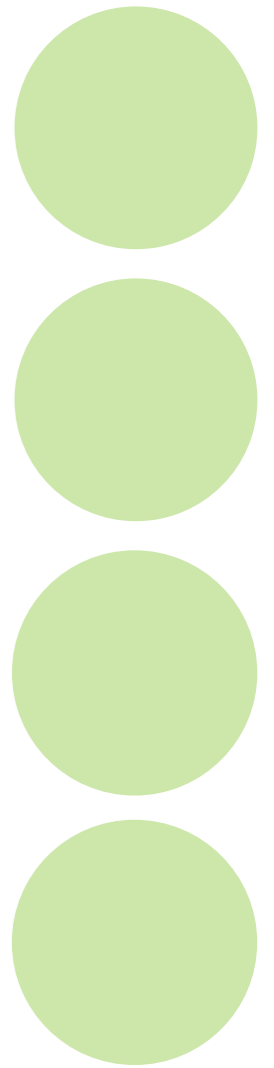


Measurer Preparation

The measurer should have clean hands before holding or positioning the person being measured. The measurer should remove any objects from her/his hands and wrists, such as big watches or bracelets, so as not to interfere with the measurement.

Individuals with Special Needs

It can be challenging to accurately and safely measure individuals with conditions that affect their ability to stand; straighten their arms, legs or back; or hold themselves steady. In these circumstances, it may be necessary to adapt measurement protocols or provide additional assistance to the individual being measured. Interpretation of measurements may also be more challenging in this population (see Module 2, **Box 2.6**). When conducting anthropometry for a survey, measurers should measure the individual and note his/her impairment or condition on the survey form. The survey management team will decide whether it is appropriate to include that data in the analysis.



Things to Keep in Mind while Measuring

Follow the protocols: Following each step of every procedure every time measurements are taken improves quality. Though some procedures may seem simple and repetitive, never take them for granted or omit any step.

Keep hands free of sharp objects: For safety, hold pencils or pens only while recording measurements, not while positioning or holding the person being measured.

Measure one person at a time: If you are measuring more than one person, it is important to complete and record all measurements for one person before beginning to measure another person. This will help prevent errors in recording measurements and respects the time of the person being measured.

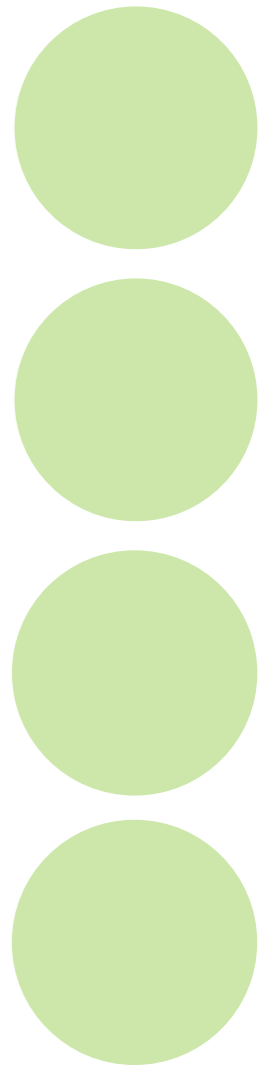
Always supervise the person being measured; do not leave him/her unattended on or near anthropometric equipment: This prevents the person from being injured (e.g., tripping on, falling off, or cutting him/herself with equipment).

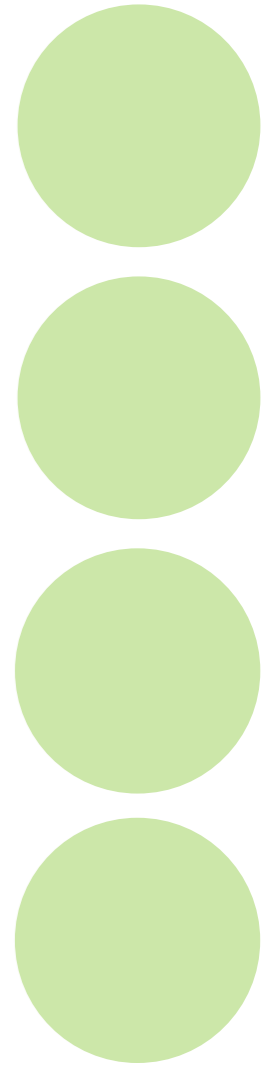
Carefully record measurements: Recording measurements in pencil allows mistakes to be easily corrected. Measurements should be recorded in the appropriate spaces as marked on the health card, questionnaire, or other relevant document. **Figure 1** shows how to correctly record measurements.

When recording an individual's age, it is best to record the exact age, if possible (see the section on estimating age for more information). However, while it is important to know and record the date of birth, the date of measurement, and the exact age of an individual (especially for children and adolescents), most growth charts use months to track growth and therefore a child's age in completed months is typically necessary when plotting his/her growth.

Measurements should be recorded clearly and accurately to the precision required for each measure. Weight should be recorded to the nearest 0.01 kg for infants and 0.1 kg for all other age groups. All other measurements should be recorded to the nearest 0.1 cm (1 mm), depending on local practice. If a mistake is made using a pencil, erase the error completely and write the correct measurement. If using a pen, cross out the error completely and write the correct measurement. When plotting growth, points should be clearly marked on the appropriate growth record (chart) for a person's sex and age, and the measurements being taken (e.g., weight-for-age) at the intersection of the two measures being taken. See **Annex 1** for more information on plotting measurements and interpreting growth patterns.

Measurements should be repeated if needed. The repeated measurement should be taken by a trained assistant (see **Box 6.1** for more information).





BOX 6.1 REPEATED MEASUREMENTS

Some research studies (e.g., the World Health Organization's Multicentre Growth Reference Study) measure each person twice, using two different measurers (e.g., the measurer and assistant switch roles for the second measurement). This can help identify any measurement problems and reduce error.

However, this is not usually done in clinics, program settings, or smaller-scale surveys because it increases the cost and time needed to measure each person. The protocols in this module do not include repeated measurements. Information on conducting repeated measurements can be found in the references near the end of this module (Cogill 2003; Global Nutrition Cluster [GNC] 2011; and World Vision 2011a). Information on using repeated measurements for standardization may be found in SMART 2006.

Tips for Successfully Measuring Children and Adolescents

(Adapted from UNDTCD and UNSO 1986; Cogill 2003; and ICF International 2012)

Children and adolescents may need additional support while being measured. These tips will help measurers to obtain accurate weights and/or measurements while minimizing stress on the child or adolescent and the parent/caregiver. These tips are especially applicable to younger children as older children are more likely to cooperate without needing a caregiver's reassurances.

Provide gentle and clear directions to the parent/caregiver and the person being measured: To ensure accurate measurements, the person being measured must be placed (or clearly instructed to place themselves) on the equipment according to the protocols in this guide (specific instructions for each measurement are in the Measurement Protocols section). A child may resist being measured if s/he is afraid or stressed. This can include kicking, crying, hitting, or biting; do not underestimate children's mobility or strength when upset. Clearly explaining the measurement process and projecting calm self-confidence may help the person being measured to be calm as well.

Involve the parent/caregiver: Being weighed and/or measured can be an uncomfortable or frightening experience for a child. The parent/caregiver can assist in positioning, carrying, and/or calming the child being measured, helping the child to feel secure and remain still. This will help achieve an accurate measurement and reduce the child's stress.

Getting Started: Determining Sex and Age

Many anthropometric measurements are interpreted based on an individual's age and/or sex because young children are smaller than older children, boys and girls grow at different rates, and men tend to be larger than women. For this reason, the 2006 WHO Growth Standards and 2007 WHO Growth Reference have sex-specific and age-specific standards and growth charts, and some anthropometric cutoffs (e.g., waist circumference) are different for men and women. It is necessary to know an individual's sex and age to compare his/her measurements with the correct growth standards, growth references, or cutoffs; determine eligibility for inclusion in surveys; and calculate the z-scores that classify nutritional status.

How to Determine the Sex of the Person Being Measured

A birth card can be reviewed to determine the sex of an infant or child. However, if no birth card is available, it is always best to ask the parent/caregiver the infant/child's sex. Do not assume the child's sex based on appearance, clothing, or name. It can be difficult to distinguish between males and females based on appearance, and some names may be used for both sexes (for example, in Ghana the name Nana is used for both males and females).

Be sure to record the individual's sex in the growth record, survey questionnaire, or other appropriate document and to select the appropriate growth chart according to the person's sex.

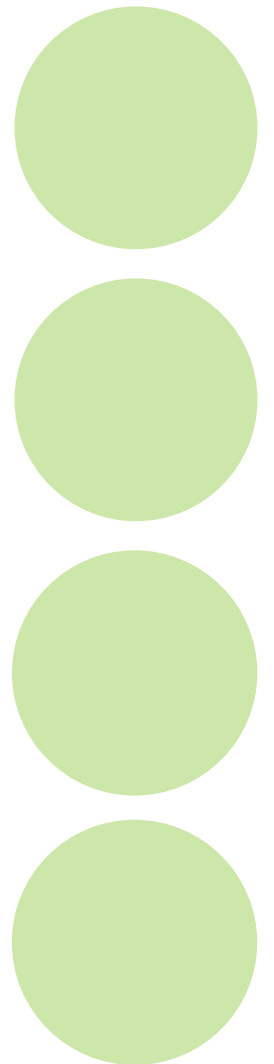
How to Determine the Date of Birth (Age) of the Person Being Measured

An individual's date of birth is used to calculate his/her exact age (see **Box 6.2**). It is preferable to have this information for all individuals being measured. For children, age in days is recommended when computer software is used for assigning z-scores.

Formal record. A written birth record, health/immunization card, or baptismal card or other religious record can be used to determine date of birth. The measurer should confirm the date with the individual (or the child's parent/caregiver) before recording it. This is the preferred method of determining date of birth.

TIP

In a clinic setting, older children or adolescents might not be accompanied by an adult. Any questions normally asked of the parent/caregiver may be directed to the older child or adolescent.



Self-report. If there is no formal record of the date of birth, ask the individual (or in the case of a child, the parent/caregiver) for his/her date of birth. Specifically ask for the person's date of birth, and not age, because self-reported age is often rounded and the date of birth will determine the exact age.

Estimate. Without a written birth record or health/immunization card or self-reported date of birth, it is necessary to estimate the date of birth to calculate an estimated age. This can be challenging, especially for older adolescents and adults, who were born many years ago, and for infants and children whose parent(s) is not present or no longer alive. In an anthropometric survey, this can be one of the most difficult aspects of data collection. Ideally, estimates should be to the day, but if that isn't possible, they should at least include the month and year of birth.

It can be very difficult to determine an adult's exact age if the person does not know his/her birth date. This is because tools and approaches (explained later in this module) that can help estimate an individual's age rely on knowledge of specific events surrounding a person's birth, which may be unclear 30–40 years later. However, while knowing an adult's exact age is often necessary when conducting a survey, an estimated age is often adequate in a clinical setting since most anthropometric indices and classifications use large age ranges (e.g., anyone over 18 years of age is considered an adult) and an adult's exact age is not necessary to determine his/her nutritional status.

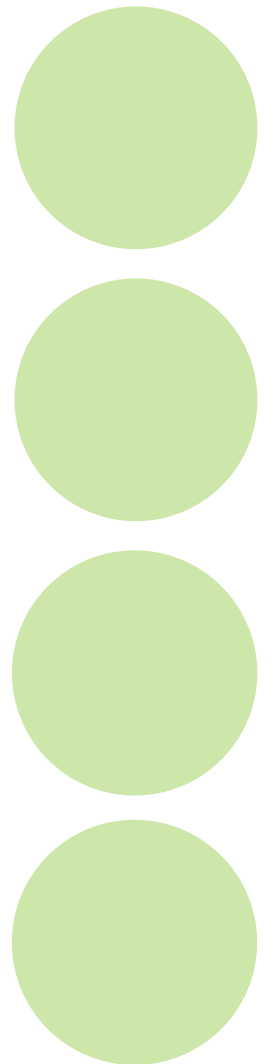
BOX 6.2 AGE CALCULATIONS: DO THEY NEED TO BE EXACT?

Clinical or Program Settings

During clinical or programmatic assessment, a child's or adolescent's measurement is written down and plotted on a growth curve according to the nearest completed month. It is important to know a child's or adolescent's precise age to correctly assess growth as measured against standards or references to inform an appropriate plan of care. If this is not possible, an estimated birth month may be used.

Surveys

For surveys, an exact date of birth is needed to calculate a z-score for a child or adolescent. If the birth date must be estimated, it should be as precise as possible, at least to the month (surveys such as Multiple Indicator Cluster Surveys and the Demographic and Health Surveys use the 15th of the month as the birth date in these circumstances). While software such as WHO Anthro and WHO AnthroPlus can accommodate estimates to the month, keep in mind that systematic inaccuracies in age can bias survey results and lead to over- or under-estimation of malnutrition prevalence.



How to Estimate Date of Birth

Local Events Calendar

(Adapted from FAO 2008)

There are several tools that can be used to help estimate an individual's date of birth. One such tool is a local events calendar that can be developed and used to estimate a person's birth date, based on the proximity of his/her birth to a major local event. While this tool can be used to determine any individual's age, it is recommended for use with children.

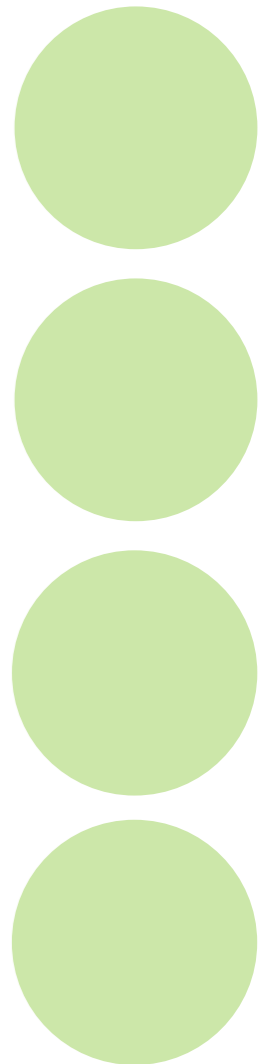
How to Develop a Local Events Calendar

- Determine the timeframe needed based on the age of your demographic group (e.g., children from birth to 5 years of age).
- Work with key informants in the community to identify important events that happened in the community in that period and when they happened. There should be at least one event per month, preferably two, and they should be meaningful to the parents/caregivers of young children (see **Box 6.3**). In addition, there should be one major event per year that can be used to verify the year of birth.
- Develop the calendar using a format appropriate to the users. This might include a horizontal timeline with graphics or a table of key events. Both pictures and words can be used to show each event. The calendar should be tested before use. An example of a local events calendar is shown on the next page.

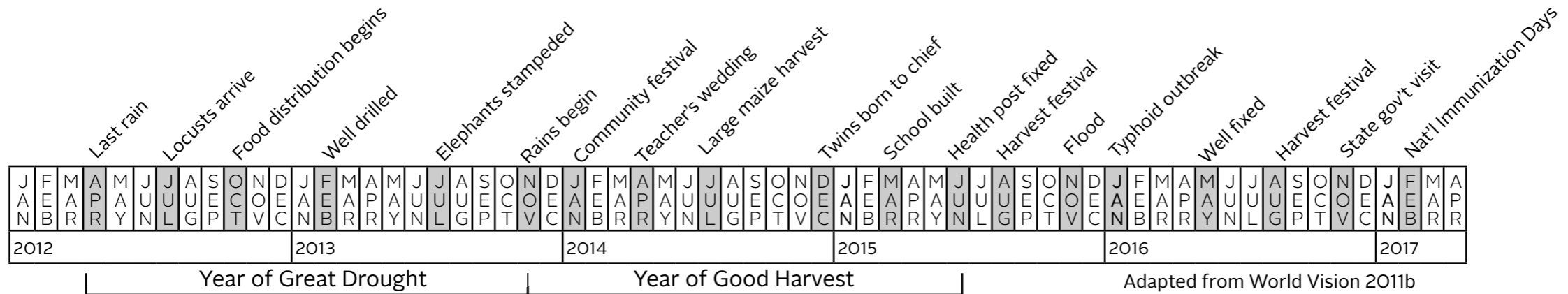
BOX 6.3 WHAT TO INCLUDE IN A LOCAL EVENTS CALENDAR

The following types of events should be included in a local events calendar:

- Harvests
- Festivals
- National and religious holidays
- Floods, droughts, other natural disasters
- Elections and major political events
- Vaccination or health campaign days
- Disease outbreaks
- Municipal events like opening of new schools, clinics, roads
- Birth or death of major figures



Community Events Timeline



How to Use the Local Events Calendar to Estimate Date of Birth

For children and adolescents: Begin by asking the parent/caregiver if she/he remembers when the person to be measured was born. If she/he does, ask her/him about that person’s birth in relation to events around that time, according to the local calendar (e.g., if she/he thinks it was about 3 years ago, begin asking about events from 3 years ago).

For everyone: Ask the individual (or if the person is a child, the parent/caregiver) to be measured about what happened before and after his/her birth. For example, you can ask: “Were you born after the elections that year?” or “Was she born before the harvest festival?” Eventually it should become clear that the person was born between two specific events, and the month of birth can be estimated. In some circumstances, it may be possible to estimate an exact date, based on the type of calendar being used.

Note: It may be particularly challenging to use a local events calendar to estimate the date of birth of an older child, adolescent, or adult, as the calendar will need to be very long. This could lead to recording and interpretation difficulties, and the parents/caregivers or individuals themselves may not be able to recall events associated with a birth that occurred many years ago.

For more detailed guidance on local calendars, please see [FAO’s guide](#).

How to Use Probing Questions to Estimate Date of Birth

Asking probing questions is a technique used in the DHS to determine an adult's age. In this approach, an individual is asked several questions about both non-personal events (e.g., natural disasters, similar to the events calendar) and significant personal events during his/her life (e.g., birth of a child) to determine his/her age.

Sample questions and examples from the 2017 DHS Interviewer's Manual (ICF 2017) include:

- 1) Ask the respondent how old she was when she got married or had her first child, and then try to estimate how long ago she got married or had her first child.

EXAMPLE

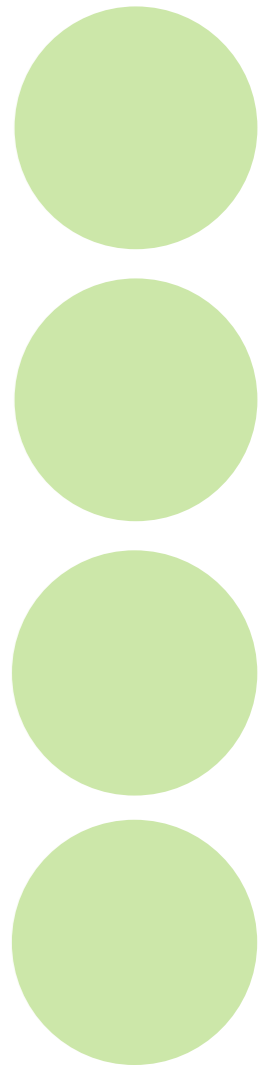
If she says she was 19 years old when she had her first child and that the child is now 12 years old, she is probably 31 years old.

- 2) Relate her age to that of someone else in the household whose age is more reliably known.
- 3) Try to determine how old she was at the time of an important event such as war, flood, earthquake, change in political regime, etc., and add her age at that time to the number of years that have passed since the event.

If, after asking the questions, the respondent's age is still unclear and date of birth is unknown, then as a last resort estimate the individual's age.

How to Calculate Age Using Date of Birth

Once the date of birth is determined or estimated, the age of the person to be measured can be calculated using one of the tools discussed below: the World Health Organization (WHO) Child Age Calculator, a child age calculation chart, and computer software programs (e.g., Epi-Info.)

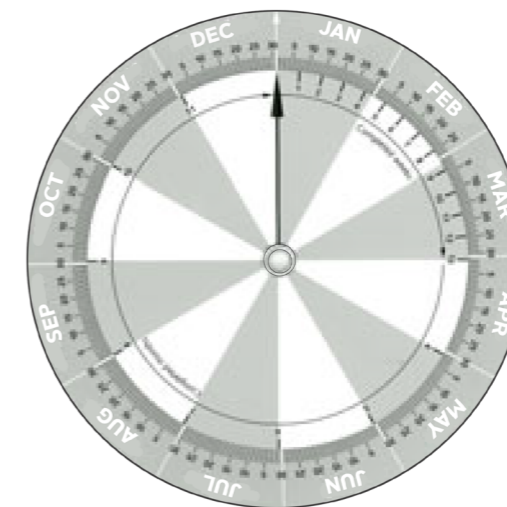


WHO Child Age Calculator

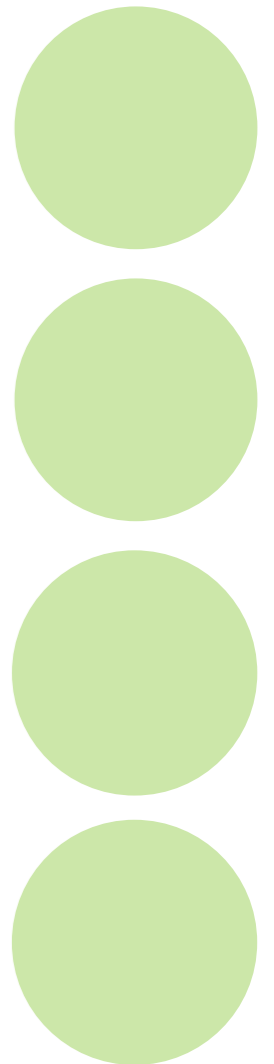
The WHO Child Age Calculator is a disk that calculates the age of a child or adolescent in completed weeks or months, using his/her date of birth. For infants under 1 year of age, the disk can be used alone to count the number of weeks (for children under 3 months) or months (children 3–11 months) of age. For children over 1 year of age, the number of years they have completed must be calculated before using the disk to calculate additional months. The calculator is part of the WHO Child Growth Standards training package, designed for children under 5 years of age. However, it could be adapted for older children and adolescents.

To Use the Child Age Calculator:

- Turn the disk until the bold arrow points to the person's birthday (month and day) on the stationary circular calendar.
- Locate today's date on the stationary calendar and count on the rotating disk how many months (or weeks for a child less than 3 months of age) the person has completed since birth or the last birthday.
- Record the person's age today. Make sure the abbreviations being used for year, month, and week have been agreed upon.



Source: WHO 2008a.



Child Age Calculation Chart

A simple way to determine age in months is to create an age calculation chart (see example in Figure 6.2).

To develop a chart:

1. Create a table with as many cells as there are months lived by the oldest person in your target age group. For example, if your target age group is children under 5 years of age, the table should have 60 cells, since 5 years equals 60 months. (Note: If the calendar is being used regularly, it will need a longer duration of months or to be updated monthly.)
2. In the last cell (bottom right), write the month and year when the weighing and measuring are being done.
3. In the first cell (top left), write the month and year of birth of a person exactly 5 years of age (i.e., whose fifth birthday would fall on the day of weighing and measuring).

4. Fill in the remaining cells with the appropriate month and year. For example, if the top left cell was labeled Jan 12, the cell immediately to the right of the top left cell (i.e., the second cell in the first row) would be Feb 12 and the cell immediately to the right of that cell would be Mar 12, and so on.

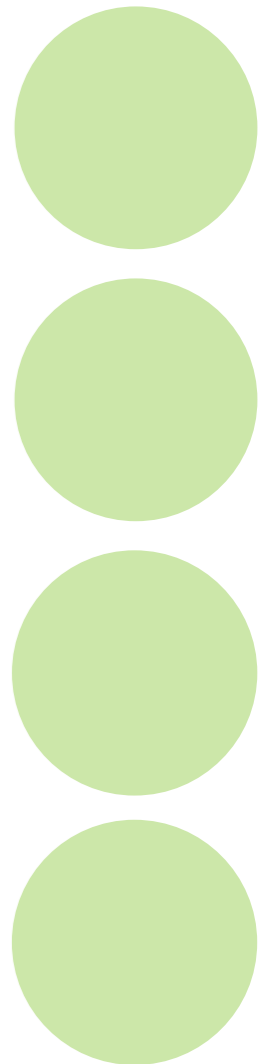
To use the chart:

1. Locate the month when the child was born.
2. Starting with the month after the child was born, count the cells/months from left to right in each row until (and including) the current month.
3. The number of cells you counted is the child's age in months.

Figure 6.2 Child Age Calculation Chart

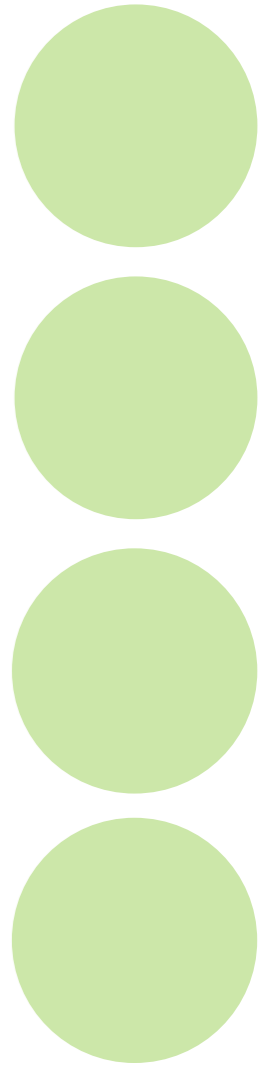
To Use: Circle the birth month and circle the current month. Count the months starting with the birth month through to the current month.											
Jan 2012	Feb 12	Mar 12	Apr 12	May 12	Jun 12	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12
Jan 2013	Feb 13	Mar 13	Apr 13	May 13	Jun 13	Jul 13	Aug 13	Sep 13	Oct 13	Nov 13	Dec 13
Jan 2014	Feb 14	Mar 14	Apr 14	May 14	Jun 14	Jul 14	Aug 14	Sep 14	Oct 14	Nov 14	Dec 14
Jan 2015	Feb 15	Mar 15	Apr 15	May 15	Jun 15	Jul 15	Aug 15	Sep 15	Oct 15	Nov 15	Dec 15
Jan 2016	Feb 16	Mar 16	Apr 16	May 16	Jun 16	Jul 16	Aug 16	Sep 16	Oct 16	Nov 16	Dec 16
Jan 2017	Feb 17	Mar 17	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17

Source: Adapted from World Vision International 2011a; World Vision International 2011b.



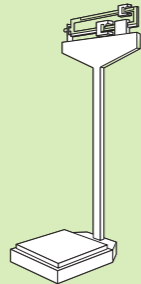
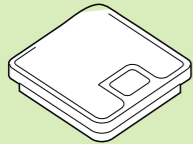
Calculating Age with Electronic Applications and Computer Software

It is increasingly common to calculate a person's age electronically, such as on a computer or a mobile device like a tablet or smartphone. Software such as [Epi-Info](#), [WHO Anthro](#) (children under 5 years of age), and [WHO AnthroPlus](#) (children 5–19 years of age) can be installed on an electronic device to calculate a person's age (in completed months) instantly when the date of birth and date of measurement are entered.



Protocols

WEIGHT



[Preparing to Measure](#)

[Weighing Infants Using an Electronic Scale](#)

[Weighing Infants Using a Beam Scale](#)

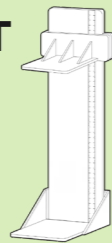
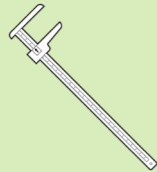
[Weighing Children under 5 Years of Age with a Hanging Scale](#)

[Weighing Children Who Cannot Stand Alone on a Standing Scale](#)

[Weighing Children Who Can Stand, Adolescents, and Adults on an Electronic Scale](#)

[Weighing Children Who Can Stand, Adolescents, and Adults on a Beam Scale](#)

LENGTH & HEIGHT



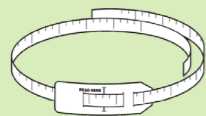
[Preparing to Measure](#)

[Measuring Length in Children 0–2 Years of Age](#)

[Measuring Height in Children 2 Years of Age and Older, Adolescents, and Adults](#)

[Measuring Knee Height](#)

CIRCUMFERENCE



[Measuring Mid-Upper Arm Circumference](#)

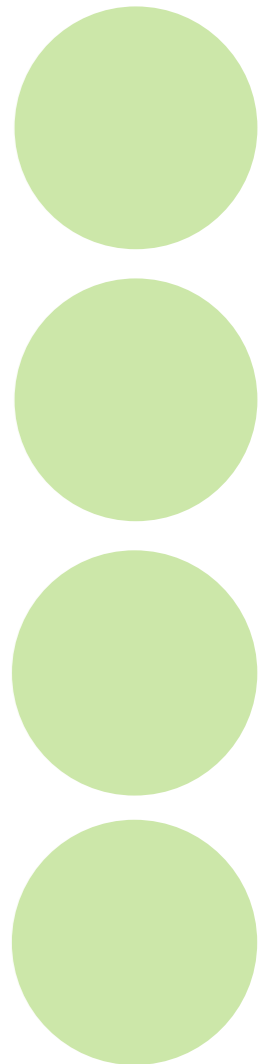
[Measuring Head Circumference](#)

[Measuring Waist Circumference](#)

[Measuring Calf Circumference](#)

BILATERAL PITTING EDEMA

[Assessing Bilateral Pitting Edema](#)



Measurement Protocols: Weight

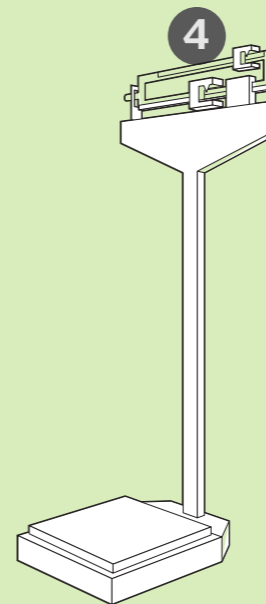
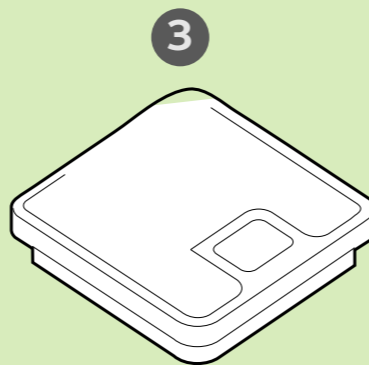
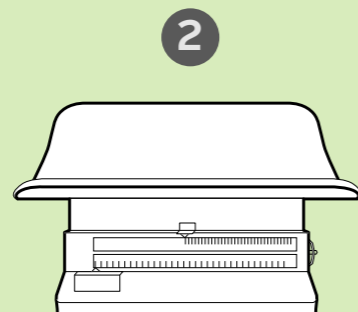
(Adapted from UNDTCD and UNSO 1986; Cogill 2003; U.S. Centers for Disease Control and Prevention [CDC] 2016; Division of Women, Infants, and Children [WIC] 2010; WHO 2008a; World Vision International 2011; ICF 2012)

This section provides basic instructions for weighing:

- Infants with an infant scale
- Children under 5 years of age with a hanging scale
- Infants, children, adolescents, and adults with a standing scale:
 - Children under 2 years of age or who cannot stand, using a scale with a taring feature
 - Children who can stand, adolescents, and adults

Already familiar with measurement protocols? Jump ahead to the **Equipment** section.

EQUIPMENT USED TO MEASURE WEIGHT



1. Infant electronic scale 2. Infant beam scale 3. Electronic scale 4. Beam scale 5. Hanging scale with pants

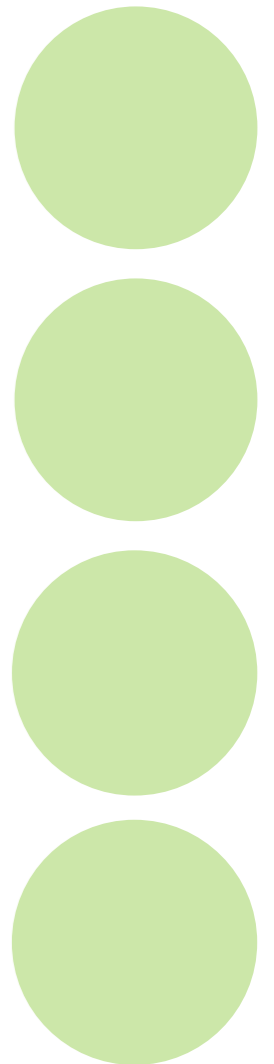
Preparing to Measure Weight

1. Show the scale to the person being weighed and/or the person's parent/caregiver and explain that it will be used to weigh him/her. For young children, inform the parent/caregiver that her/his help may be needed.
2. Place the scale on a hard, flat (level) surface. Make sure there is enough light to read the display on the scale, but do not place it under direct heat, which may damage the scale. If a hanging scale is used, make sure the scale is securely attached to a stable object and hung at eye level. In addition, make sure that the scale surfaces, slings, or pants are clean before weighing each person. When not in use, make sure the scale is covered and protected from dust and damage.
3. Ask the person being weighed to remove his/her socks, shoes, and any heavy clothing. Adults being weighed should be wearing only light clothing when the measurement is taken.
4. For children under 5 years of age, ask the parent/caregiver to undress the child (or help him/her undress) just before weighing, leaving on only the child's underpants, to ensure that clothing does not add weight.

Because of cultural preferences or climate, some parents/caregivers may not allow the child to be measured without clothing. To accommodate this preference and maintain accuracy, the undressed child may be weighed while wrapped in a blanket using a taring scale (discussed below) or weighed clothed, but only wearing light clothing.

To use blankets and a taring scale: First ask the adult to stand on a scale with the blanket and tare the scale, so that the weight of the blanket used to cover the child while weighing will not be included when measuring the child's weight. Next, have the adult hold the child, wrapped in the blanket, while standing on the scale for measurement.

To adjust for light clothing: Compile a list of the weights of common local clothes and based on that list, estimate how much weight to subtract from the child's measured weight.



Weighing Infants with Specialized Infant Scales

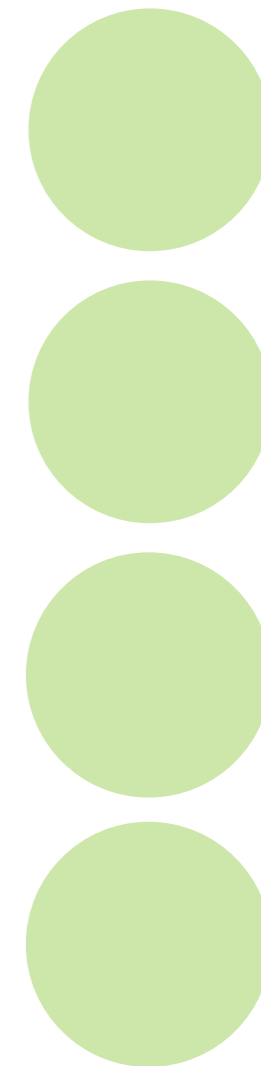
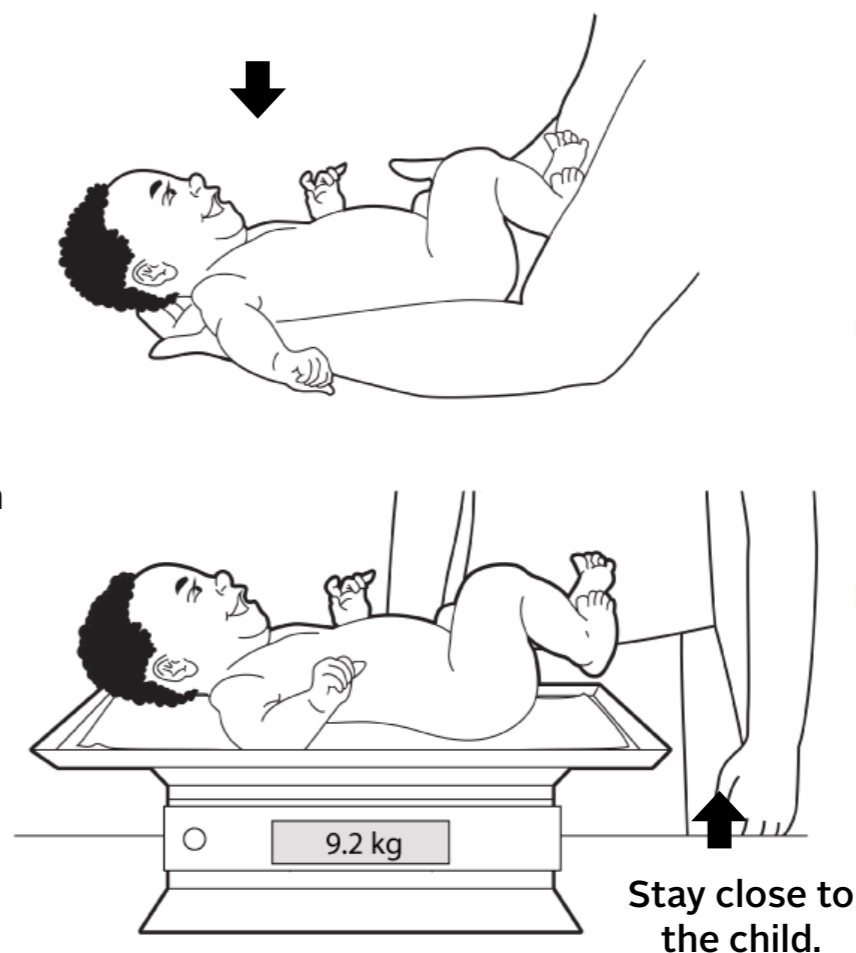
Using an Electronic Infant Scale

(Adapted from: Lee 1996; Gibson 2005; WHO 1995)

There are a variety of electronic scales that can be used to weigh infants. Because infants are so small, the electronic scales used to weigh them must be more precise than scales used to measure older children or adults (the scales must be able to detect changes as small as 10 g). Below are the general steps for operating common electronic infant scales; there may be slight variations.

Procedure

1. Turn on the scale by pressing the START button (or follow instructions for that scale). Wait until 0.000 appears.
2. Gently place the infant on his/her back on the center of the scale pan with the help of the trained assistant or parent/caregiver, who should help calm and secure the infant if he/she starts crying or moving. Stay close to and observe the infant to ensure he/she does not roll or fall off the scale.
3. Read the weight aloud when the infant is still and the digital display is no longer changing.
4. The trained assistant should record and/or plot the infant's weight to the nearest 0.01 kg (10 g) clearly and accurately on the health card, questionnaire, or other relevant document. If no trained assistant is available, record and/or plot the weight yourself.
5. Check the recorded or plotted weight for accuracy and legibility.



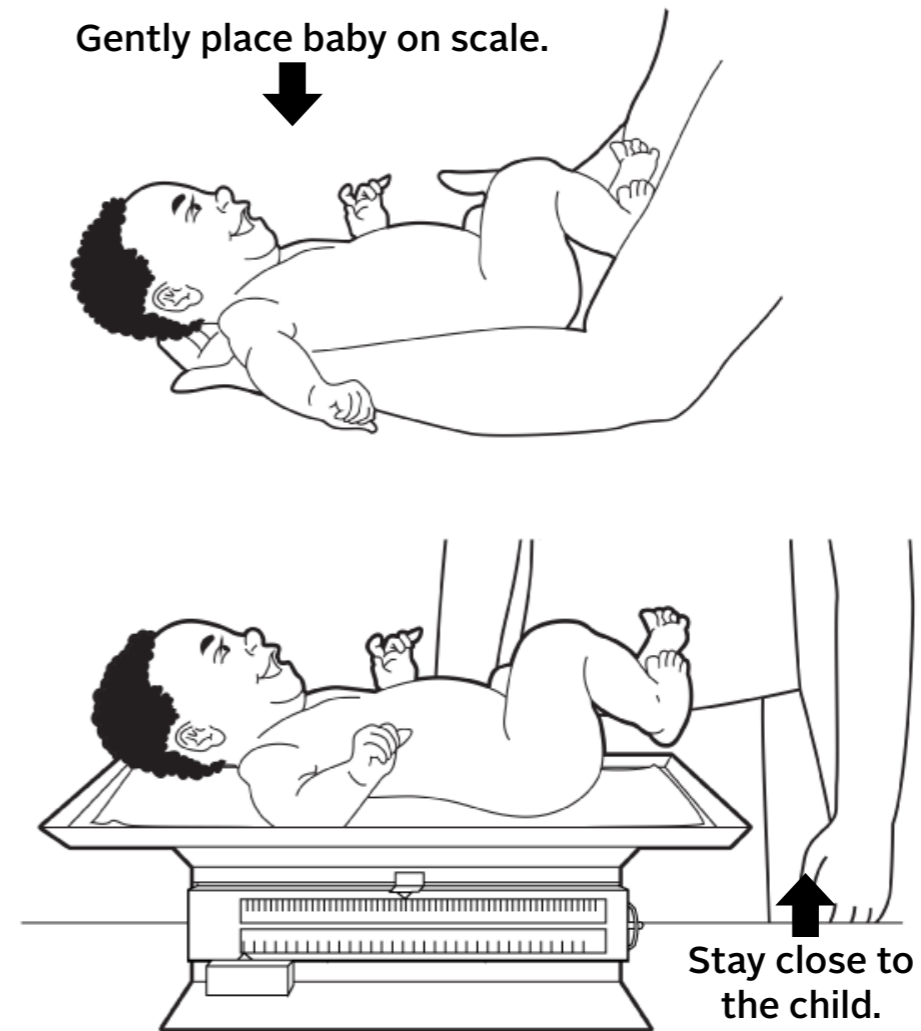
FOR ACCURATE MEASUREMENT, REMEMBER:

- Place the scale on a hard, flat (level) surface.
- Remove footwear and all clothing except clean/dry diapers or underpants.
- Wait until the child is still before reading and recording the child's weight. Stay close to the child.
- Read, record, and plot measurements carefully.

Using a Beam Scale for Infants

Procedure

1. Balance the scale at zero before each use. To do this, move both weights left to zero. If the scale does not balance at the midpoint, the counterweight must be adjusted.
2. Gently place the infant on his/her back on the center of the scale pan with the help of the trained assistant or parent/caregiver, who should help calm and secure the infant (without touching the child or the scale) if he/she starts crying or moving. Stay close to and observe the infant to ensure he/she does not roll or fall off the scale.
3. With the small weight at zero, move the large weight to the right until the indicator arrow drops below the midpoint.
4. Move the large weight back to the left one segment to raise the arrow just above the midpoint.
5. Move the small weight slowly to the right until the indicator arrow points directly at the midpoint.
6. Read the weight aloud when the infant is still and the indicator arrow steadily points at the midpoint.
7. The trained assistant should record and/or plot the infant's weight to the nearest 0.01 kg (10 g) clearly and accurately on the health card, questionnaire, or other relevant document. If no trained assistant is available, record and/or plot the weight yourself.
8. Check the recorded or plotted weight for accuracy and legibility.



FOR ACCURATE MEASUREMENT, REMEMBER:

- Place the scale on a hard, flat (level) surface.
- Remove footwear and all clothing except clean/dry diapers or underpants.
- Wait until the child is still before reading and recording the child's weight. Stay close to the child.
- Read, record, and plot measurements carefully.

Weighing Children under 5 Years of Age with a Hanging Scale

(Adapted from: UNDTCD and UNSO 1986; Cogill 2003; World Vision 2011a; World Vision 2011b; CDC 2016)

Using a Hanging Scale

Hanging scales can be used to weigh children under 5 years of age (see the **Equipment** section for more information). Young infants (less than 3 months of age) are usually weighed in a sling (which provides more head support) while older infants (3 months of age and older) are weighed in weighing pants. Hanging scales are less reliable than other infant scales, especially when weighing an agitated child (WHO 2008a). Below are the general steps for operating common hanging scales. However, there may be slight variations.

Procedure

1. Hang the scale by putting a rope through the upper hook of the scale; looping the rope around a post, beam, or branch of a tree; and tying it securely. Make sure the scale is at eye level so that the weight can be read correctly and that the scale is not too high from the ground, to avoid injury to the child in case of a fall.
2. Adjust the scale to zero with the weighing pants/sling attached.

(continued on next page)

FOR ACCURATE MEASUREMENT, REMEMBER:

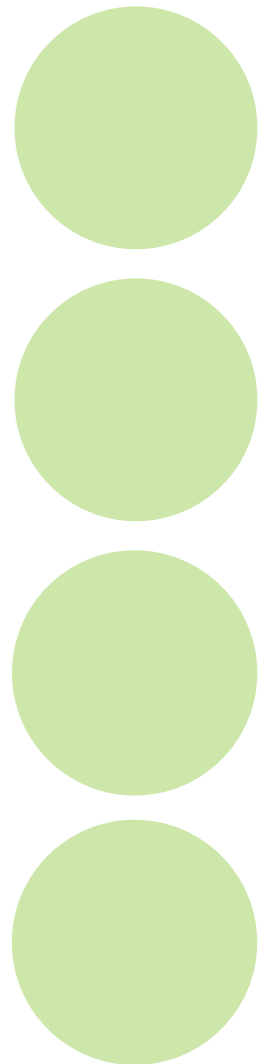
- Hang the scale securely.
- Do not let the child hold onto anyone else.
- Remove footwear and all clothing except clean/dry diapers or underpants.
- Wait until the child is still and the needle is steady before reading the weight.
- Read, record, and plot measurements carefully.

EQUIPMENT



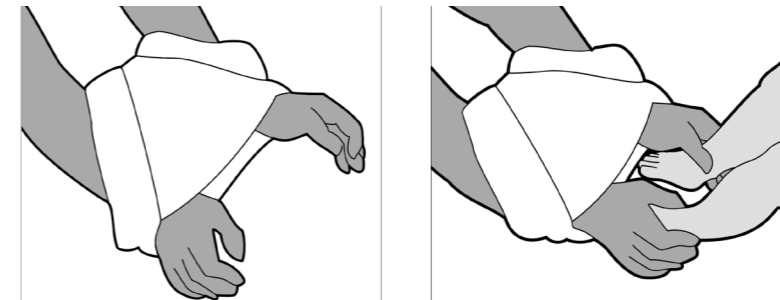
TIP

Hanging scales can be used for children weighing up to 25 kg; over 97 percent of children age 5 years weigh less than 25 kg. However, as children grow with age, it may become increasingly difficult to use hanging scales. A standing scale may be preferred for older preschool children.

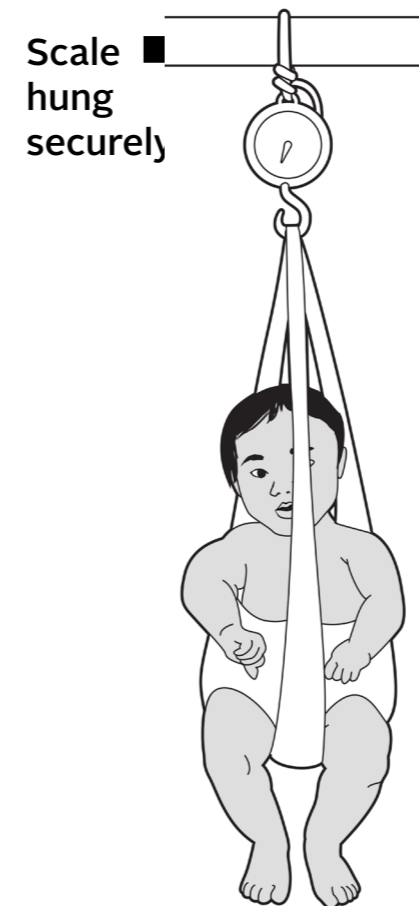


Procedure for Using a Hanging Scale (continued)

3. Remove the weighing pants/sling from the scale.
4. Place the child in the weighing pants/sling with the help of the trained assistant or parent/caregiver and make sure the child is secure. If using the weighing pants, ensure that the strap of the pants is in front of the child, with his/her arms on either side. For the sling, ensure the child is sitting or lying in the center with both arms in the sling.
5. Lift the child up in the pants/sling carefully with the help of the trained assistant or parent/caregiver—do not carry the child by the straps only—and hold him/her securely.
6. Place the strap onto the scale’s hook and carefully let go of the child. Allow the child to hang freely on the scale.
7. Check the child’s position and ensure that he/she is not touching or holding anything. Have the trained assistant or parent/caregiver ensure the child is secure and still (without touching the child or scale).
8. Stand facing the front of the scale to read the measurement when the child is still and the needle is steady (not fluctuating).
9. Read the weight aloud to the trained assistant, who should record and/or plot the child’s weight to the nearest 0.1 kg (100 g) clearly and accurately on the health card, questionnaire, or other relevant document. If no trained assistant is available, record and/or plot the weight yourself.
10. With both hands on the child’s body, lift the child and pants/sling off the hook with the help of the trained assistant or parent/caregiver, and then remove child from the pants/sling. If an assistant is not available when using the pants, use one arm to lift the child by the body and the free hand to release the strap of the pants from the hook. Hold him/her securely; never carry the child by the straps only.
11. Check the recorded or plotted weight for accuracy and legibility.

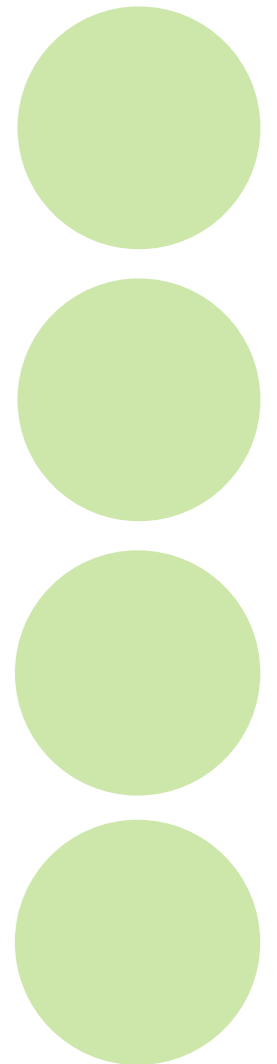


Hands through leg holes of weighing pants. Grasp child’s feet and pull through pants.



Scale hung securely

Child hangs freely (not touching anything) with strap between arms.



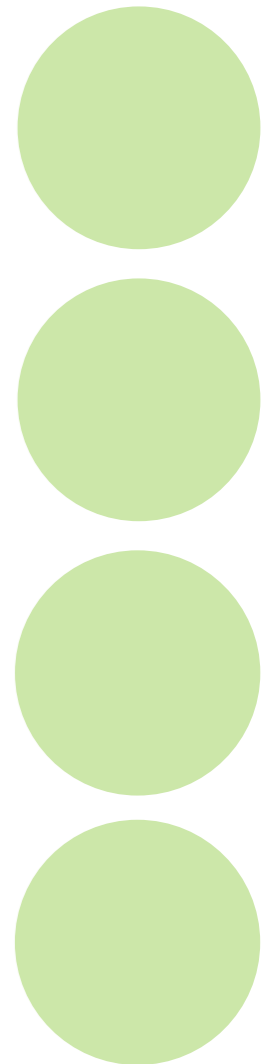
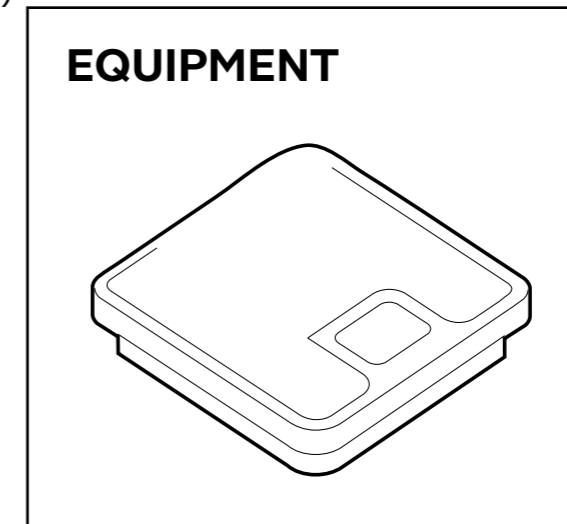
Weighing Infants, Children, Adolescents, and Adults with Standing Scales

(Adapted from WHO 2008a; Cogill 2003; World Vision 2011a; World Vision 2011b; ICF 2012)

Children Who Cannot Stand Alone

Standing Scale with Taring Feature

Various types of electronic standing scales have a taring feature that can be reset to zero (zeroed or tared) while a person is standing on it. With the taring feature, when a child is placed in a parent/caregiver's arms, the weight of the child registers, rather than the combined weight. These scales are commonly used in clinical/programmatic settings and surveys to weigh children who cannot stand without assistance. Each type of scale has a specific procedure for weighing. The procedure discussed here is the general method for using a typical electronic standing scale with the taring feature.



TIP

If there is no taring scale, a standing scale can be used:

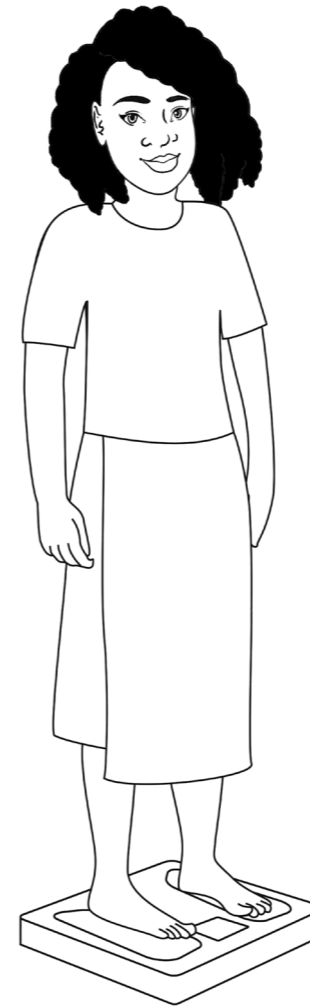
- Weigh the parent/caregiver alone and record the weight.
- Have the parent/caregiver hold the child while standing on the scale. Write down their combined weight.
- Subtract the parent/caregiver's weight from the combined weight of the child and the parent/caregiver. This is the child's weight.
- Record the calculated weight of just the child on the health record, questionnaire, or other relevant document.

Procedure for Using a Taring Scale

1. Zero the scale. The method used to zero the scale depends on the type of scale being used. Some scales can be zeroed by covering the solar panel for 1 second. When the readout says 0.0 and an image of a mother and baby is displayed, the scale is ready to be used. Other scales require that someone step on the scale.
2. Ask the parent/caregiver to step onto the center of the scale and stand still. Wait until the weight of the parent/caregiver displays and remains fixed in the display panel. If no parent/caregiver is available, a trained assistant or another adult may play this role.
3. Tare the scale while the parent/caregiver is on it, following the appropriate method for that scale.
4. Place the child in the parent/caregiver's arms and ask the parent/caregiver to remain still. The parent/caregiver should try to calm the child and prevent him/her from moving.
5. The child's weight will appear in the display.
6. Read the child's weight aloud. The trained assistant should record and/or plot the child's weight to the nearest 0.1 kg clearly and accurately on the health card, questionnaire, or other relevant document. If no trained assistant is available, record and/or plot the measurement yourself.
7. Check the recorded or plotted weight for accuracy and legibility.

TIP

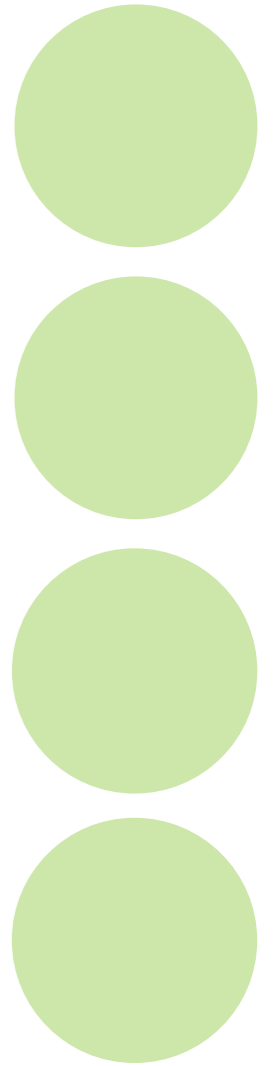
When using a taring scale, if the parent/caregiver is relatively heavy (over 100 kg) and the child is small, the child's weight may not register on the display panel. In this circumstance, ask a smaller person to be weighed with the child.



**First, weigh adult.
Feet centered on
scale.**



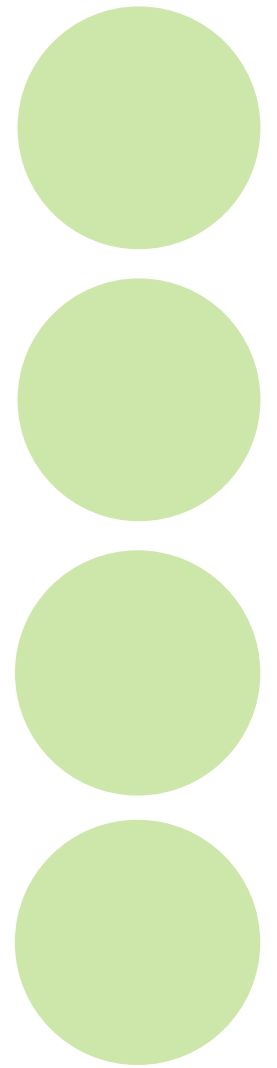
**Second, adult holds
child securely.**



Weighing Children Who Can Stand, Adolescents, and Adults on a Standing Scale

(Sources: ICF International 2012; CDC 2016; WIC 2010)

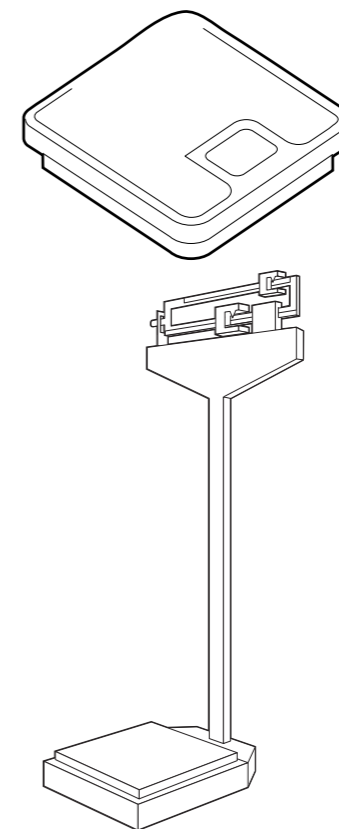
Several types of standing scales can be used to weigh those who can stand, although it is important to note that a common household/bathroom scale is not recommended (see the **Equipment** section for more information on specific scales). Each type of standing scale has a specific procedure for weighing. Below are the general steps for weighing a person on a typical electronic standing scale and a beam scale.



FOR ACCURATE MEASUREMENT, REMEMBER:

- Place the scale on a hard, flat (level) surface.
- Remove the child's footwear and all clothing, except clean/dry diapers or underpants.
- Properly tare the scale.
- Wait until the child is still and the weight is not fluctuating before reading the weight.
- Read, record, and plot measurements carefully.

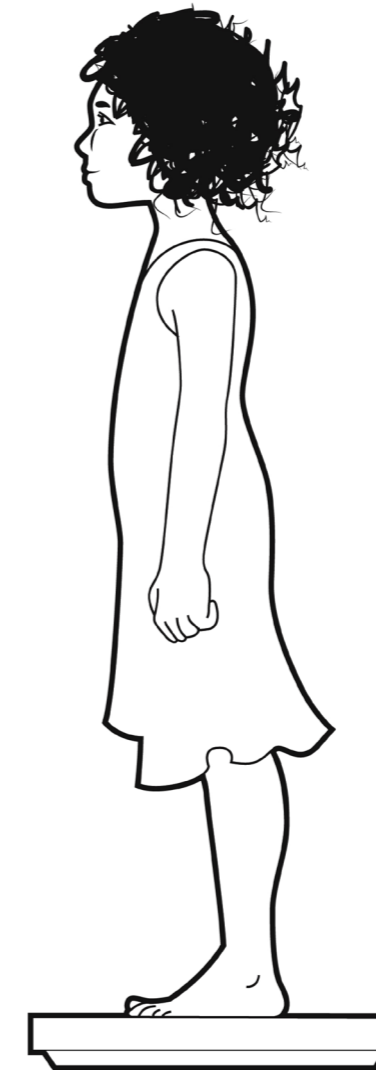
EQUIPMENT



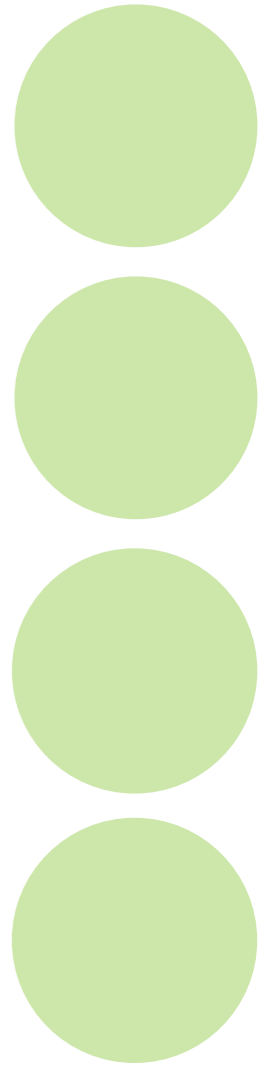
Using an Electronic Standing Scale

Procedure

1. Zero the scale, following the appropriate method for the scale being used. For example, to zero commonly used solar-powered scales, cover the solar panel for 1 second. When the readout says O.O, the scale is zeroed and ready to be used. Other scales can be zeroed by standing/stepping on them.
2. Ask the person to step onto the center of the scale and to stand still. For children, the trained assistant or parent/caregiver should help position the child on the center of the scale and assist in keeping the child calm and still without touching the child.
3. Wait until the weight displays and remains fixed in the display panel.
4. Read aloud the weight to the nearest 0.1 kg. The trained assistant should record and/or plot the person's weight clearly and accurately on the health card, survey form, or other relevant document. If no trained assistant is available, record and/or plot the weight yourself.
5. Gently help the person to get off the scale. Return a child to his or her parent/caregiver.
6. Check the recorded or plotted weight for accuracy and legibility.



↑
Feet should be
centered on scale.



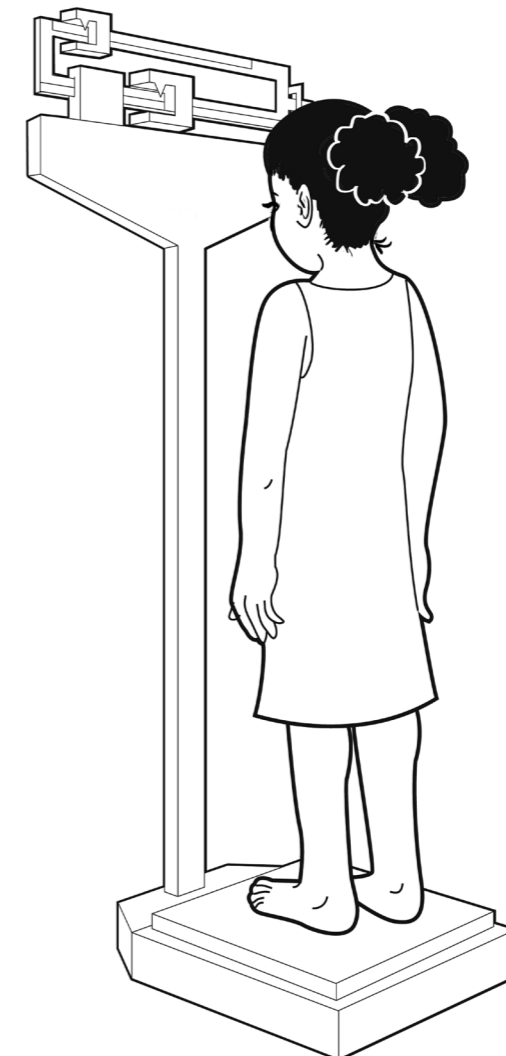
Using a Beam Scale

Procedure

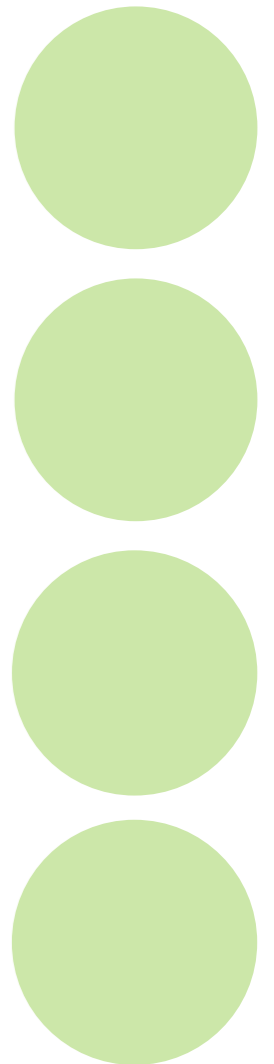
1. Balance the scale at zero before each use. To do this, move both weights left to zero. If the scale does not balance at the midpoint, the counterweight must be adjusted.
2. Ask the person to step onto the center of the scale and to stand still. For children, the trained assistant or parent/caregiver should help position the child on the center of the scale and assist in keeping the child calm and still without touching the child.
3. Move the larger weight to the right until the indicator arrow drops below the center.
4. Move the larger weight back to the left one segment to move the indicator arrow slightly above the midpoint.
5. Move the smaller weight to the right until the indicator arrow points directly at the midpoint.
6. Read aloud the weight to the nearest 0.1 kg. The trained assistant should record and/or plot the person's weight clearly and accurately on the health card, survey form, or other relevant document. If no trained assistant is available, record and/or plot the weight yourself.
7. Gently help the person to get off the scale. Return a child to his or her parent/caregiver.
8. Check the recorded or plotted weight for accuracy and legibility.

FOR ACCURATE MEASUREMENT, REMEMBER:

- Ensure scale is placed on a hard, flat, surface
- Remove footwear and all heavy outer clothing.
- Ensure that the person stands in the center of the scale's platform, is stable, and is not holding onto anyone else.
- Wait until the weight is no longer fluctuating before reading.
- Read, record, and plot measurements carefully.



↑
**Feet should be
centered on scale.**



Measurement Protocols: Length and Height

(Adapted from UNDTCD and UNSO 1986; Cogill 2003; Westat 1988; CDC 2016; ICF International 2012; Nestle 2009; WHO 2008a; WHO and UNICEF 2009; World Vision International 2011)

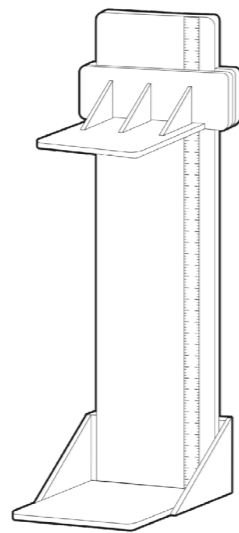
This section provides basic instructions for measuring:

- Length in children under 2 years of age
- Height in children 2 years of age and older, adolescents, and adults
- Knee height (a proxy for height)

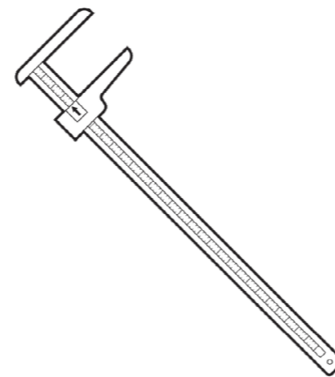
A length/height board is used to measure the length/height of an individual and a caliper is used to measure knee height.

Already familiar with measurement protocols? Jump ahead to the **Equipment** section.

EQUIPMENT TO MEASURE LENGTH/HEIGHT AND KNEE HEIGHT



Length/height board



Knee calipers

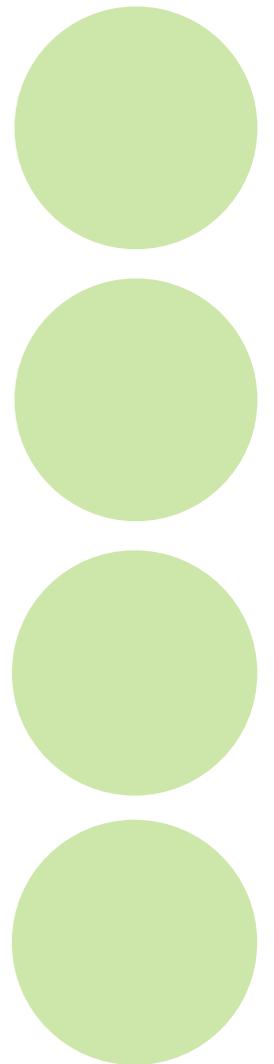
Preparing to Measure Length/Height

1. Show the measuring board to the person being measured and/or his or her parent/caregiver and explain that the board will be used to measure the person's length/height. If measuring a child, inform the parent/caregiver that her/his help may be needed.
2. Ask the person being measured or the parent/caregiver to remove the person's shoes and anything on her/his head or hair, such as a hat or hair ornament, that may interfere with the length/height measurement.
3. Make sure the surface of the measuring board is clean before placing the person on it.
4. Measure children under age 2 (under 24 months) while they are lying down. This measurement is known as "length" or "recumbent length." Children 2 years (24 months) of age or older, adolescents, and adults who can stand on their own without assistance should be measured while standing. This measurement is known as "height" or "standing height."

TIPS

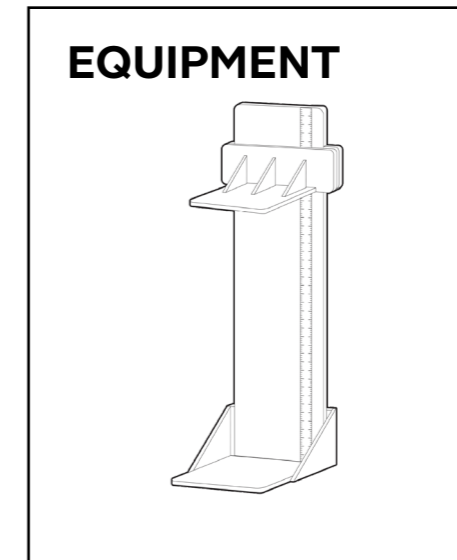
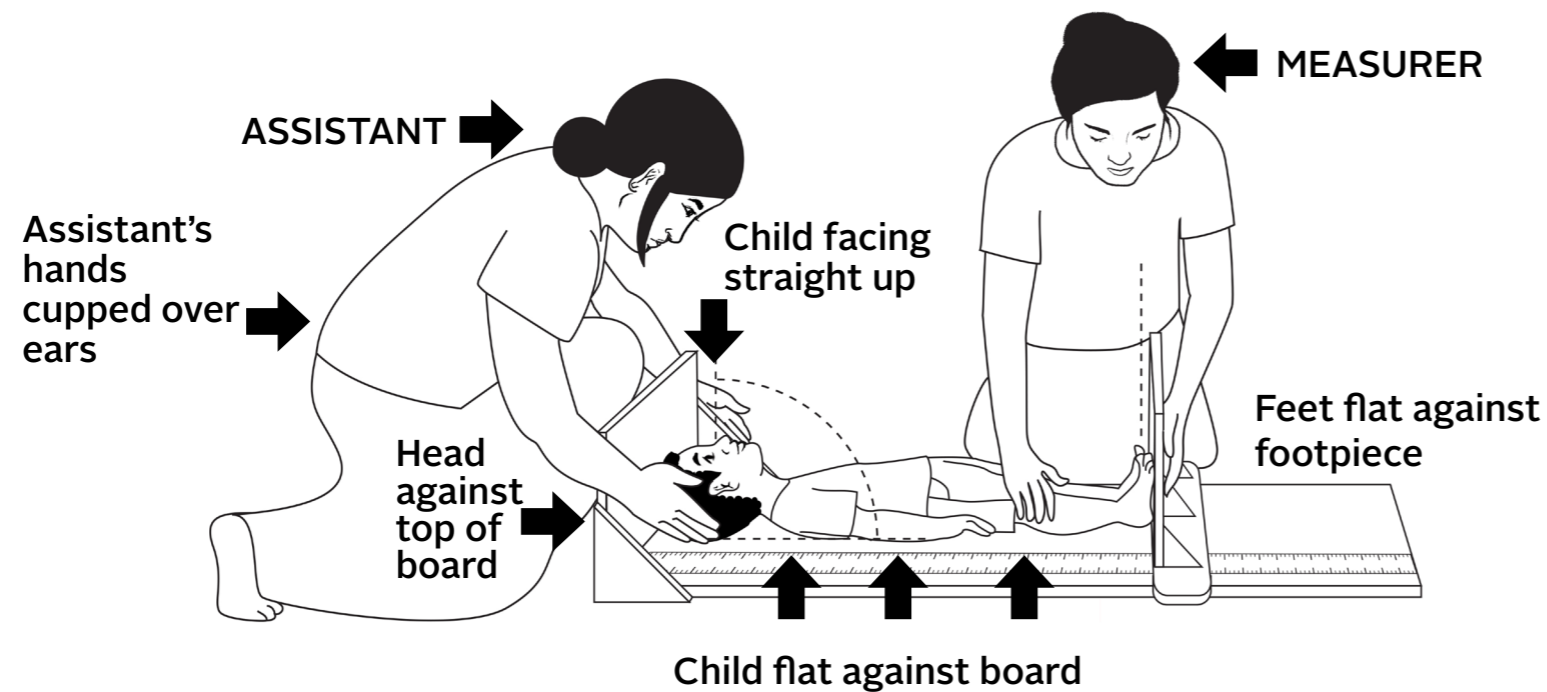
- If the child's exact age cannot be determined, measure length in children less than 87 cm and height in children 87 cm or taller (WHO and UNICEF 2009). (Some surveys, such as DHS and MICS use 85 cm as the cutoff.)
- Measure length in children 2 years (24 months) of age and older who cannot stand and height in children under 2 years (24 months) of age who refuse to lie down and note it in your reporting.

Standing height is about 0.7 cm less than recumbent length. This difference was taken into account in developing the WHO Growth Standards. Therefore, it is important to adjust the measurements if length is taken instead of height, and vice versa. If a child under 2 years of age will not lie down, measure standing height and add 0.7 cm to convert it to length. If a child 2 years of age or older cannot stand, measure recumbent length and subtract 0.7 cm to convert it to height. If the measurement is part of a survey, record the measurement according to instructions, including method of measurement, which will be reviewed and corrected as needed during data analysis. In a programmatic setting, note both the measured length and the adjusted length.



Measuring Length in Children 0–2 Years of Age

(Adapted from: UNDTCD and UNSO 1986; Cogill 2003; WHO 2008a; ICF International 2012; CDC 2016)

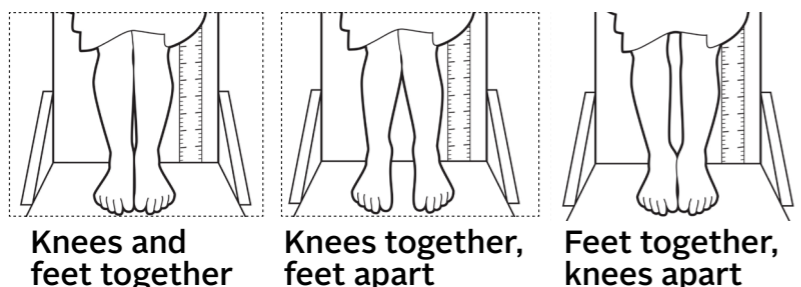


FOR ACCURATE MEASUREMENT, REMEMBER:

- Place the measuring board on a hard, flat, surface.
- Place the footboard firmly against the heels of both of the child's feet.
- Ensure that the child's legs are straight at the knees and that the knees are positioned correctly.
- Check the child's position to ensure that she/he is lying straight just before taking length measurement.
- Read, record, and plot measurements carefully.

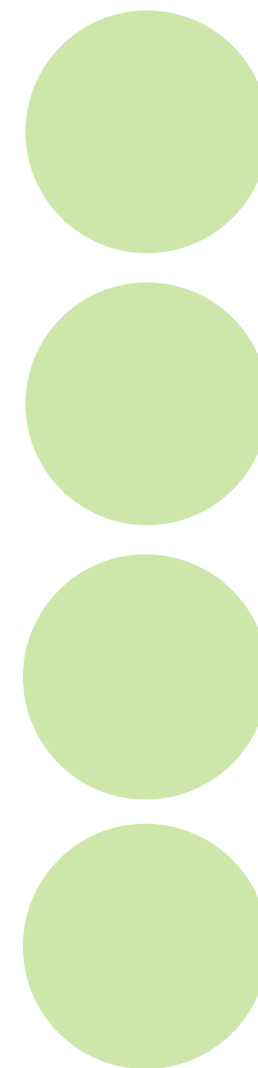
Procedure

1. Before beginning measurement, place the measuring board horizontally on a hard, flat (level) surface such as the ground, floor, or a sturdy table. Make sure the measuring board is stable.
2. If the measuring board is on the ground or floor, kneel on the right side of the bottom of the board (where the child's feet will be) so that you can hold the footboard with your right hand. Ask the trained assistant or parent/caregiver to kneel with both knees behind the base of the board (where the child's head will be).
3. Ask the trained assistant or parent/caregiver to lower the child gently onto the board and to support the back of the child's head with his/her hands. The measurer should support the trunk of the child's body.
4. Place the child's head against the base of the board so that the child is looking straight up. Ask the trained assistant or parent/caregiver to gently cup his/her hands over the child's ears and, with arms straight, to then place the child's head in the correct position, with the top of the child's head touching the base of the board. The head of the trained assistant or parent/caregiver should be directly over the child's head.
5. The child's shoulders should touch the board and the spine should not arch. The child's line of sight (i.e., the Frankfort plane) should be perpendicular (i.e., 90°) to the ground so that the child is looking straight up.
6. Watch the child's head to make sure it is in the correct position against the base of the measuring board. If the child moves, the trained assistant or parent/caregiver should inform the measurer and readjust the child.
7. Make sure the child is lying flat in the center of the board and then place the child's knees and feet in the correct position. There are three possible correct positions for the knees and feet:



Generally, when a child lies down, his/her knees and feet will be in one of those correct positions, with at least the knees or the feet touching each other. The first position the child assumes is generally the correct position for measuring the child's length, as long as either the knees or the feet are touching.

(continued on next page)

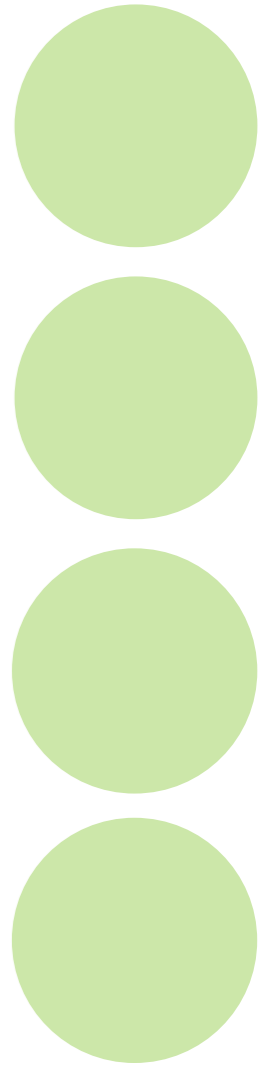


Measuring Length (continued)

8. Place your left hand on the child's knees and press down gently but firmly against the measuring board to straighten the legs as much as possible without injuring the child. Your hand should be flat; do not wrap your hand around the knees or squeeze them together. Be very careful not to press too hard, as it may not be possible to straighten the knees of some newborns or very frail children.
9. Check the child's position and make any necessary readjustments. When the child's position is correct, move the footboard firmly against the child's heels. Make sure the soles of the feet are flat against the footboard with toes pointing upward. If the child bends his/her foot or toes either forward or backward and prevents the footboard from touching the soles, stroke the soles slightly and slide the footboard in quickly to touch the heels when the child straightens his/her toes.
10. Read aloud the length to the nearest 0.1 cm.
11. The trained assistant should record and/or plot the child's length clearly and accurately on the health card, questionnaire, or other relevant document. If no trained assistant is available, record and/or plot the length yourself.
12. Lift or help the child to get off the board and return the child to his or her parent/caregiver.
13. Check the recorded or plotted length for accuracy and legibility.

TIP

Gently tickling the bottom of a child's feet can help to straighten them before pressing the footboard against the heels.



Measuring Height in Children 2 Years of Age and Older, Adolescents, and Adults

(Adapted from UNDTCD and UNSO 1986; Cogill 2003; WHO 2008a; ICF International 2012; CDC 2016.)

Procedure

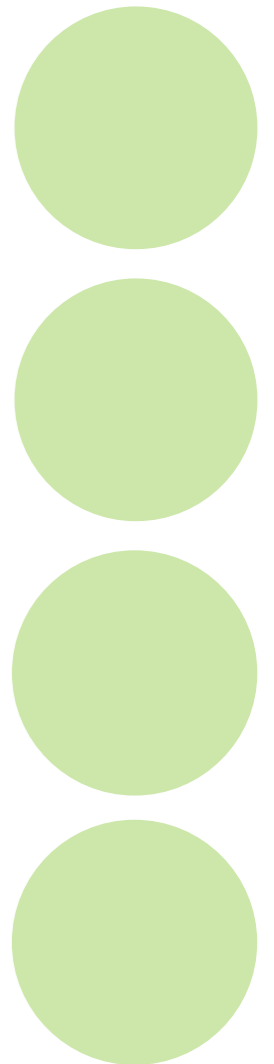
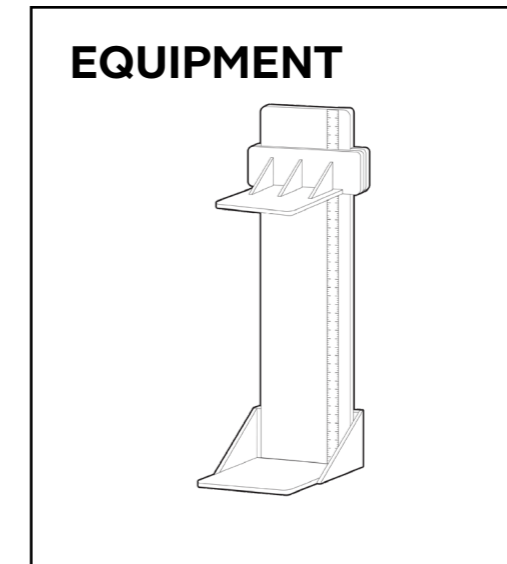
1. Place the measuring board on a hard, flat (level) surface vertically against a wall, table, tree, etc. Make sure the board is stable.
2. Ask the person being measured to stand in the center of the measuring board, with his/her feet flat on the ground and his/her back against the board.

When measuring a child, ask the parent/caregiver to place the child on the board and kneel in front of the child. The measurer should kneel on the left side of the child, with the trained assistant kneeling on the child's right (or the parent/caregiver moving to that position).

(continued on next page)

FOR ACCURATE MEASUREMENT, REMEMBER:

- Place the measuring board on a hard, flat (level) surface.
- Ensure that the person's feet and knees are in the correct position.
- Ensure that the person is standing straight by assessing the mid-axillary line.
- Ensure that the person is lifting his/her chin properly and looking straight ahead.
- Read, record, and plot measurements carefully.



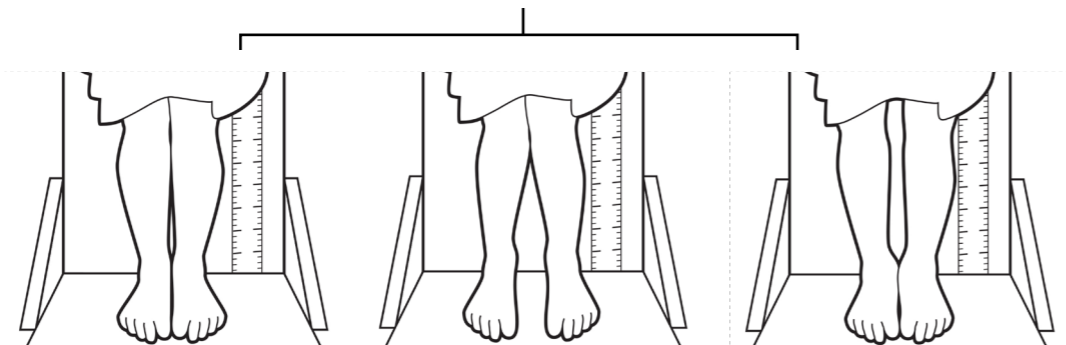
Measuring Height (continued)

- Determine whether the person's heel should be against or away from the back of the measuring board by drawing an imaginary line from the tip of the shoulder to the heel (called the "mid-axillary line"). This line should be perpendicular (90°) to the base of the measuring board where the person is standing.

For almost all adults, you will have to move the person's feet away from the back of the measuring board to put them in the proper position.

- Lift the person's chin so his/her eyes look straight ahead. Make sure the person's line of sight (i.e., the Frankfort plane) is parallel to the ground and perpendicular (i.e., 90°) to the back of the measuring board. For a child, squat in front of him/her at eye level and gently hold the child's head in position.
- There are three possible correct positions for the knees and feet:

Whichever seems most natural



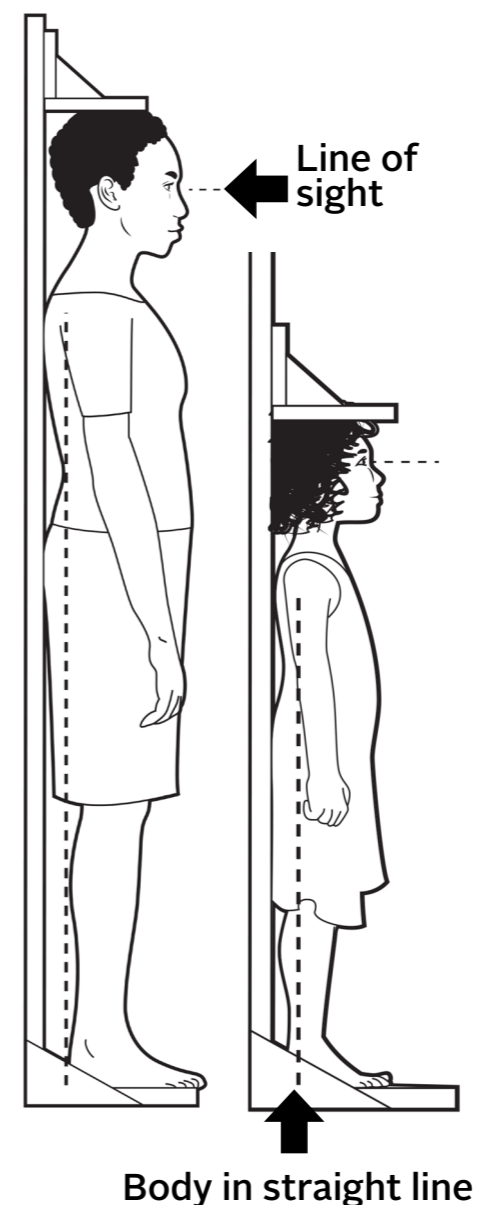
Knees and feet together

Knees together, feet apart

Feet together, knees apart

The first position the person assumes is generally the correct position for measuring that person's height, as long as either the knees or the feet are touching each other.

(continued on next page)



Measuring Height (continued)

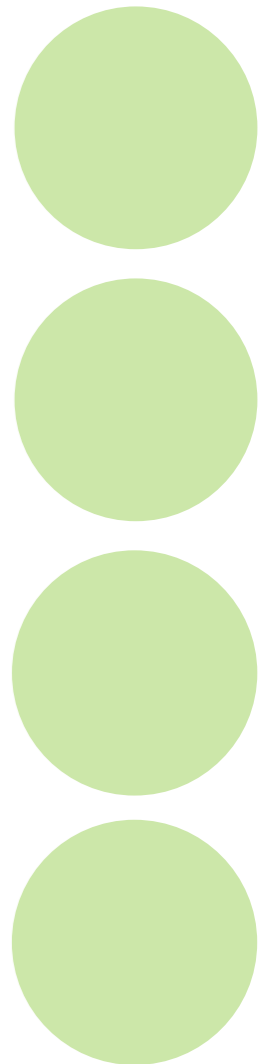
6. With the help of the trained assistant or parent/caregiver, ensure that:
 - The person's arms hang down at his/her sides and the shoulders are level.
 - The person's weight is distributed evenly on both feet.
 - The person's buttocks touch the back of the board. In addition:

For most preschool-age children who are underweight or normal weight, the back of the head, shoulder blades, calves, and heels will touch the back of the measuring board.

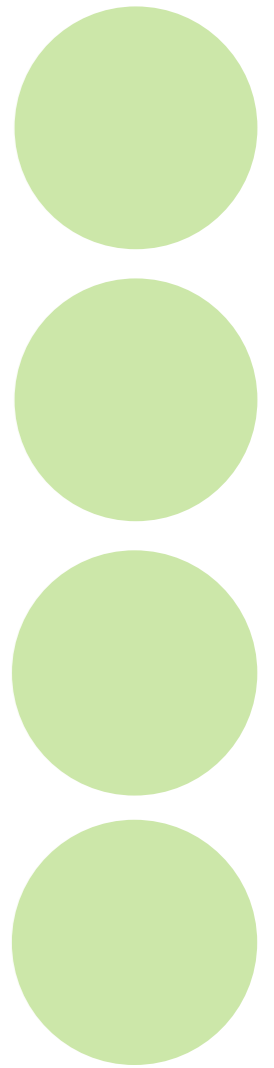
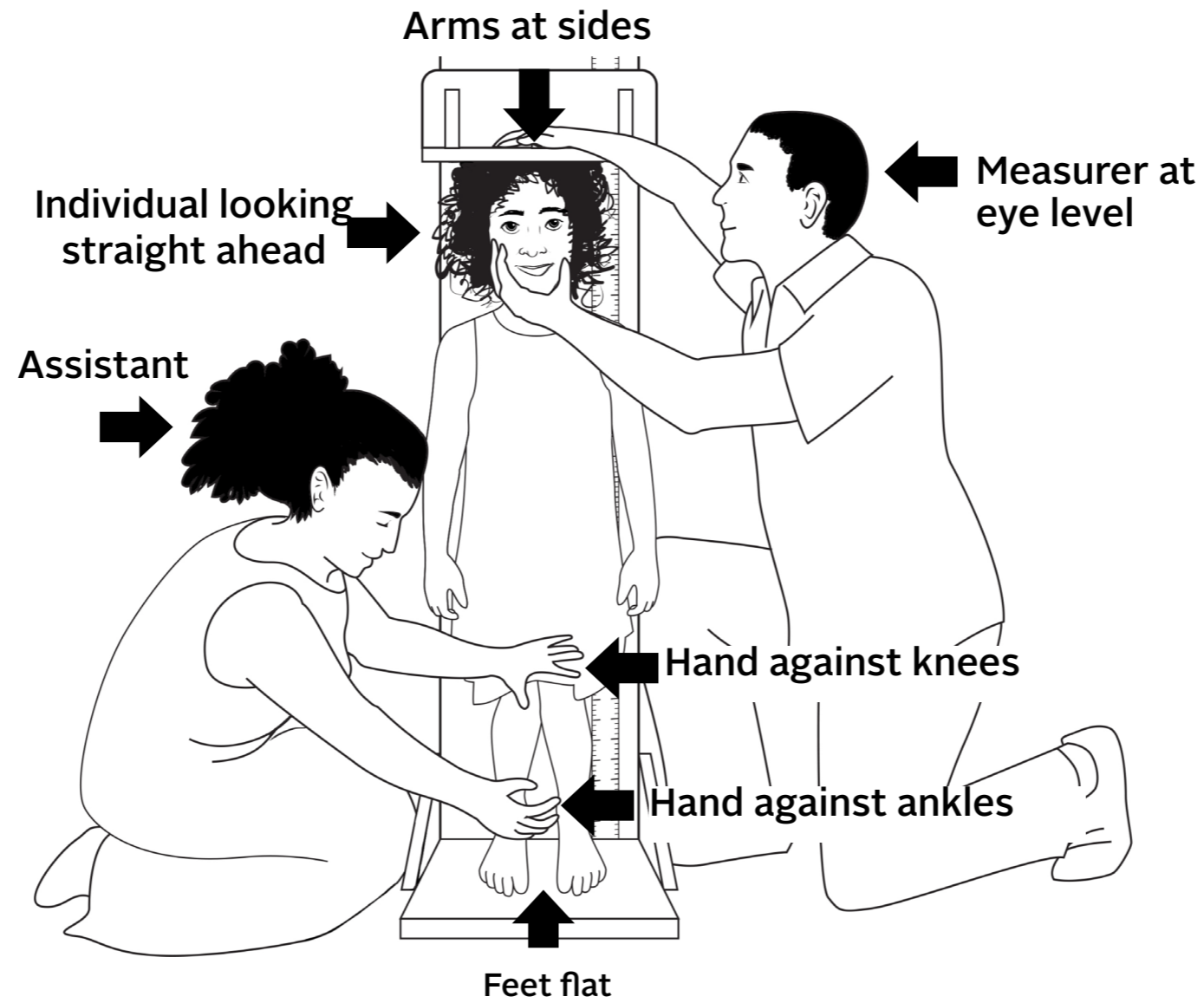
For heavy or obese children, the shoulder blades and back of the calves will probably not touch the back of the measuring board, and the back of the head and heels also might not touch it.

For most adults, the back of the head will probably not touch the measuring board and the shoulder blades may touch the measuring board.
7. Check the person's position and readjust as necessary.

For children who have difficulty standing fully straight, gently pushing the stomach can help them stand straight.
8. Ask the trained assistant to gently and firmly slide the measuring board's moveable headpiece down until it touches the crown of the person's head (compresses the hair). If no trained assistant is available, slide the headpiece down yourself.
9. Read aloud the height indicated by the headpiece to the nearest 0.1 cm.
10. The trained assistant should record and/or plot the height clearly and accurately on the health card, questionnaire, or other relevant document. If no trained assistant is available, record and/or plot the height yourself.
11. Remove the headpiece from the person's head, and gently help him/her to get off the board. Return a child to the parent/caregiver.
12. Check the recorded or plotted height for accuracy and legibility.



Measuring Height (continued)



Measuring Knee Height

(Adapted from Westat 1988 and Nestle 2009)

Knee height is used to estimate height in people whose height cannot be measured directly, often because they cannot stand or have severely curved spines.

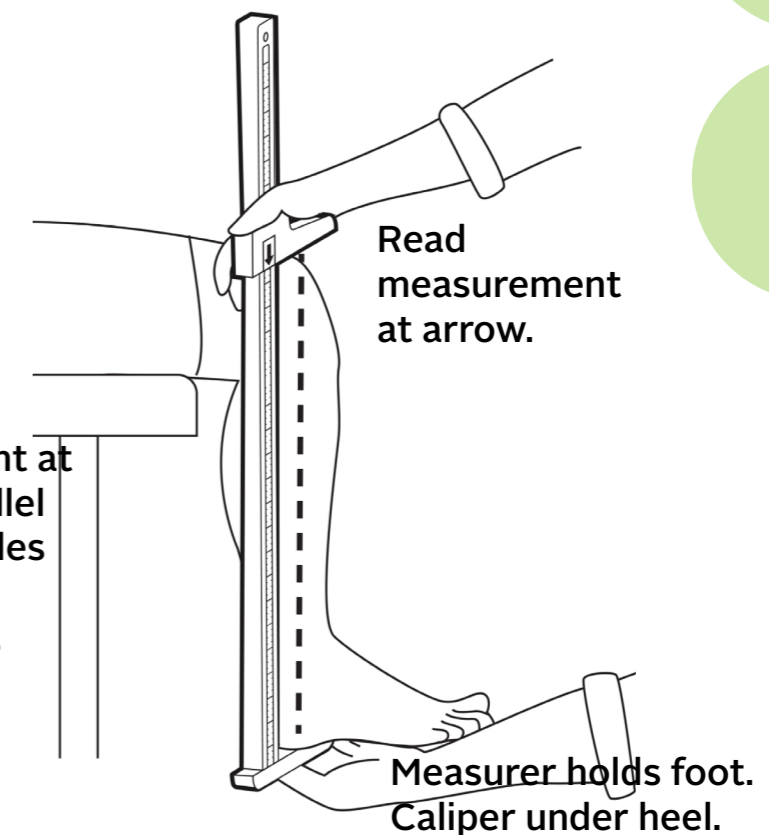
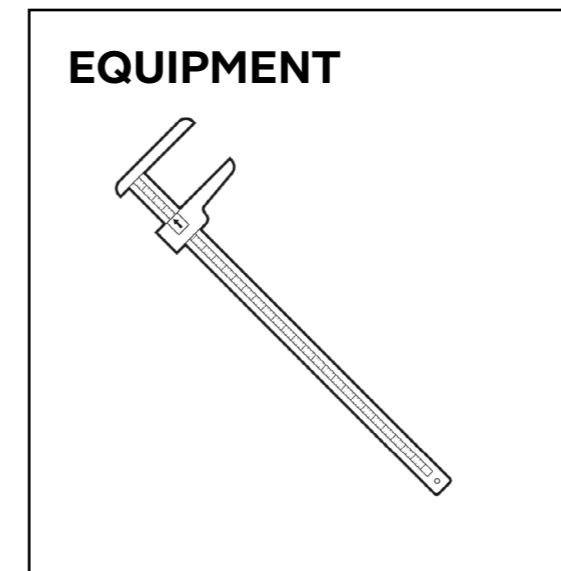
Procedure

1. Ask the person being measured to sit upright on the measuring table with both legs dangling (i.e., hanging over the edge of the table). Any table strong enough to hold an adult and tall enough for an adult to sit on it with legs dangling freely can be used.
2. Kneel at the side of the leg to be measured. The individual's knee should be bent 90° and the ankle bent so the foot is parallel to the floor. Resting the person's foot in the palm of the measurer's hand can help position the individual being measured.
3. Place the fixed blade of the large sliding caliper under the heel. Position the other blade on the thigh, about 4.0 cm from the kneecap.
4. Hold the shaft of the caliper parallel to the lower leg and gently apply pressure to compress the tissues.
5. The trained assistant should record the knee height clearly and accurately on the health card, questionnaire, or other relevant document. If a trained assistant is not available, record the knee height yourself.
6. Check the recorded knee height for accuracy and legibility.

FOR ACCURATE MEASUREMENT, REMEMBER:

- Ensure that the knee and ankle are bent 90° .
- Carefully position the caliper.
- Read and record measurements carefully.

Knee and ankle bent at 90° with foot parallel to floor. Foot dangles loosely and caliper held parallel to leg.

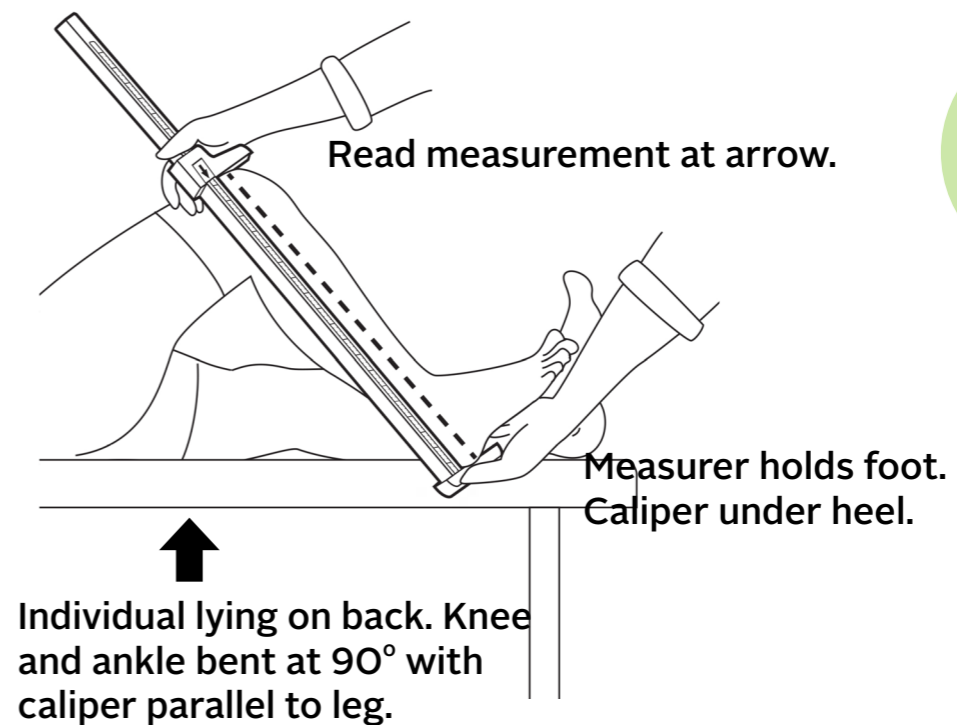


For adults in a wheelchair:

1. Support the person's leg so that the knee is bent 90° and the ankle is bent so the foot is parallel to the floor. An assistant should help support the leg.
2. Kneel at the outside of the leg to be measured and place the fixed blade of the caliper under the person's heel.
3. Position the other blade on the thigh, about 4.0 cm from the kneecap.
4. Hold the shaft of the caliper parallel to the lower leg and gently apply pressure to compress the tissues.
5. The trained assistant should record the knee height clearly and accurately on the health card, questionnaire, or other relevant document. If a trained assistant is not available, record the knee height yourself.
6. Check the recorded knee height for accuracy and legibility.

For bedridden adults:

1. Have the person lie on his/her back with the knee and ankle of one leg bent 90°. The assistant should help the person keep the knee and ankle at a 90° angle.
2. Stand to the outside of the leg to be measured and place the fixed blade of the caliper under the person's heel.
3. Position the other blade on the thigh, about 4.0 cm from the kneecap.
4. Hold the shaft of the caliper parallel to the lower leg and gently apply pressure to compress the tissues.
5. The trained assistant should record the knee height clearly and accurately on the health card, questionnaire, or other relevant document. If a trained assistant is not available, record the knee height yourself.
6. Check the recorded knee height for accuracy and legibility.



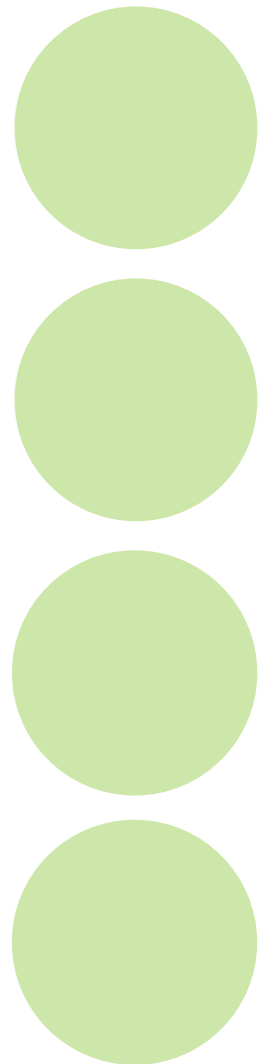
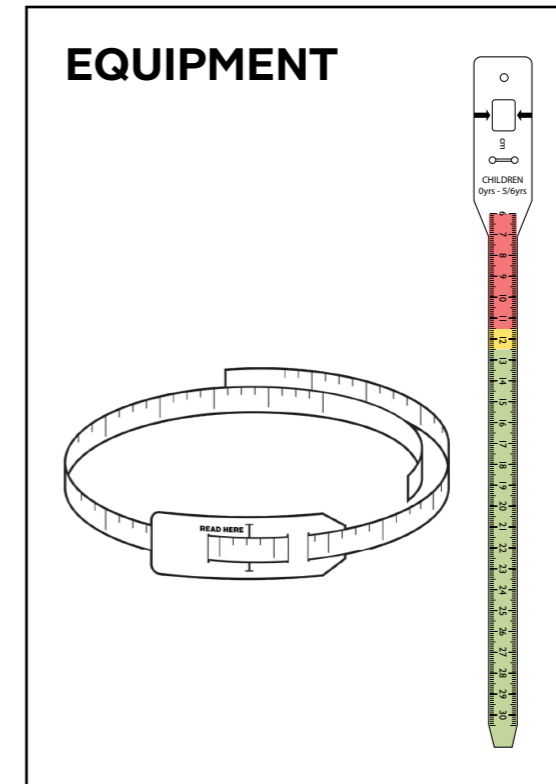
Measuring Mid-Upper Arm Circumference

(Adapted from: Cogill 2003; FANTA 2008; World Vision International 2011; de Onis 2004)

This section provides guidance on measuring MUAC in all demographic groups. MUAC is measured using a MUAC tape. There are specific tapes for various demographic groups (e.g., children 6–59 months of age). Many of these tapes are color-coded according to the cutoffs used for that group. More information on types of MUAC tapes can be found in the **Equipment** section.

Preparing to Measure MUAC

1. Make sure the appropriate MUAC tape is being used (colored and numbered or numbered alone) for the specific age or target groups (e.g., children 6–59 months of age, pregnant and postpartum women).
2. Show the MUAC tape to the person being measured or to his or her parent/caregiver and explain the MUAC measurement. If measuring a child, inform the parent/caregiver that her/his help may be needed.
3. Ask the person being measured or the parent/caregiver to remove any clothing covering the left arm.
4. For a person who can stand upright, take the MUAC measurement standing.
5. If measuring a child who cannot stand but can sit quietly on a chair or stool, ask the parent/caregiver to kneel by the child so the child will be calm, still, and secure. Otherwise, ask the parent/caregiver to sit on a chair or stool and place the child on her/his lap.



Procedure for Measuring MUAC

1. Work at eye level. Stand, sit, or kneel, if necessary.
2. Locate the midpoint of the person's upper left arm, which is between the shoulder tip and the tip of the elbow:
 - Locate the tip of the person's shoulder with your fingertips.
 - Find the tip of the elbow by bending the person's elbow so the arm makes a right angle.
 - Use a MUAC tape to measure the full length between the shoulder tip and the elbow tip.
 - The trained assistant marks the midpoint (half of the measured full length) on the person's arm with a pen. If a trained assistant is not available, mark the midpoint yourself.
3. Straighten the arm after marking the midpoint. The trained assistant or parent/caregiver can help straighten the arm of the person being measured.
4. Wrap the MUAC tape around the person's arm at the midpoint mark and slide the end of the tape through the window and into the slit on the other side.

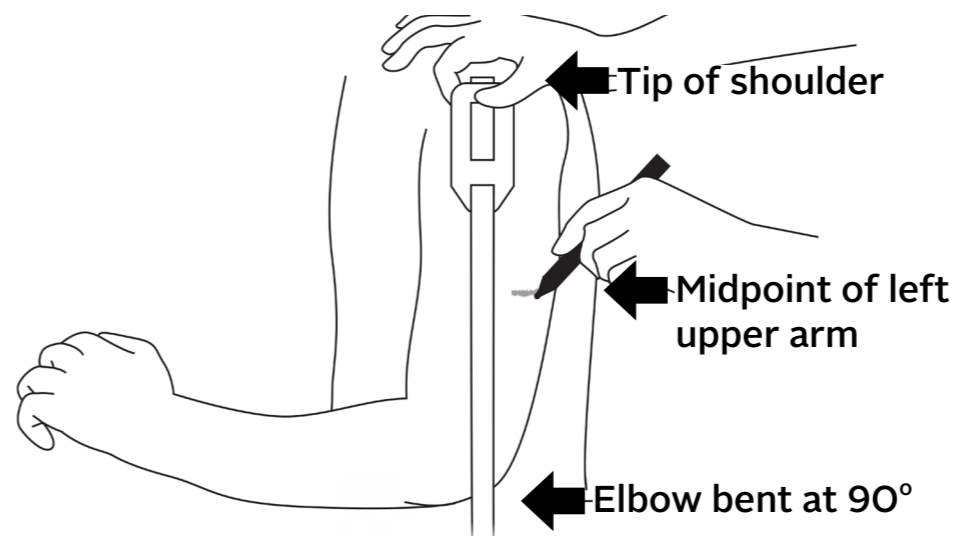
(continued on next page)

TIP

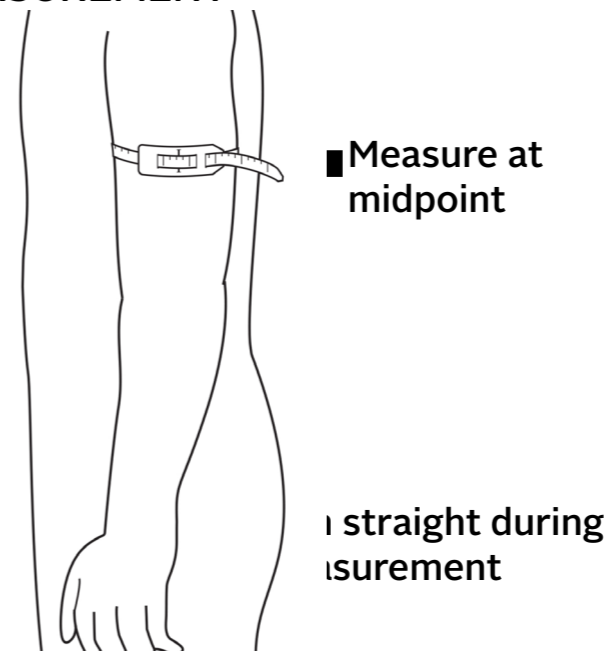
Either arm can be used to take the measurement (accuracy and precision are not highly influenced); however, the left arm is most often used (de Onis et al. 2004).

* Some developing countries have a slightly different procedure to identify the midpoint of the upper arm. For example, in Malawi, the full length from the shoulder tip to the tip of the elbow is measured using the MUAC tape. Then, the MUAC tape is folded into half while still on the upper arm to determine its midpoint.

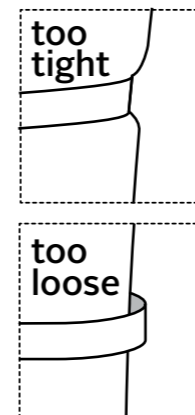
FINDING MIDPOINT



MEASUREMENT

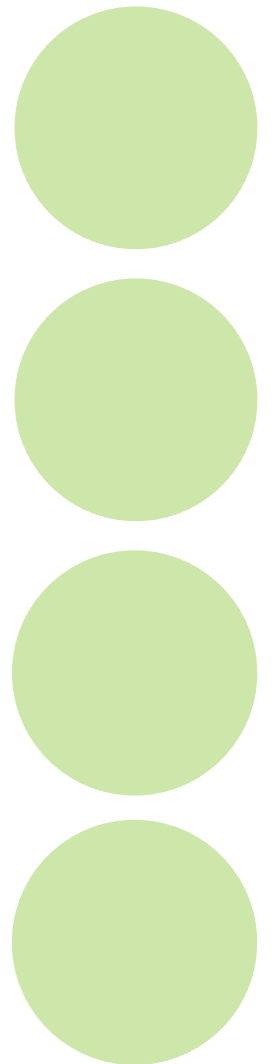


5. Adjust the tape's tension so that the tape is flat against the skin. The measurement will be inaccurate if the skin is pinched (tape is too tight) or if the tape isn't touching the skin (tape is too loose).
6. The arrow on the tape points at the measurement. Read aloud the number to the nearest 0.1 cm (1 mm) (for number-only tape) where the arrow points and the associated color (for numbered and colored tape). For tapes that use only color, note the color indicated by the arrow.
7. The trained assistant should record the person's MUAC to the nearest 0.1 cm (1 mm) clearly and accurately on the health card, questionnaire, or other relevant document. If no trained assistant is available, record the MUAC yourself.
8. Check the recorded MUAC for accuracy and legibility.



**FOR ACCURATE
MEASUREMENT, REMEMBER:**

- Use the correct MUAC tape for the age group of the person being measured.
- Carefully identify the midpoint of the upper arm.
- Pull the tape flat against the skin, not too tight or loose.
- Read and record measurements carefully.



Measuring Head Circumference

(Adapted from CDC 2016; University of Oxford 2012; de Onis et al. 2004.)

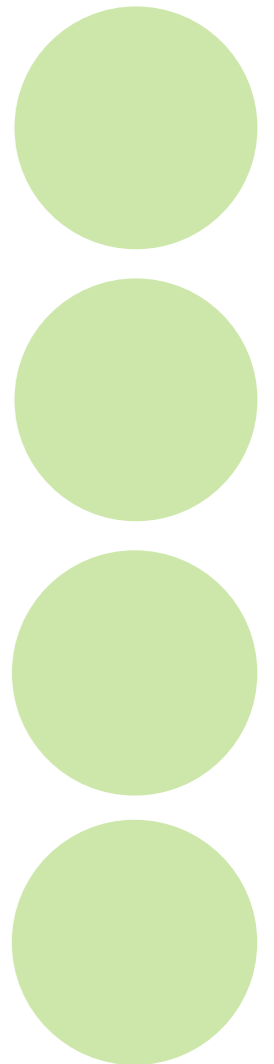
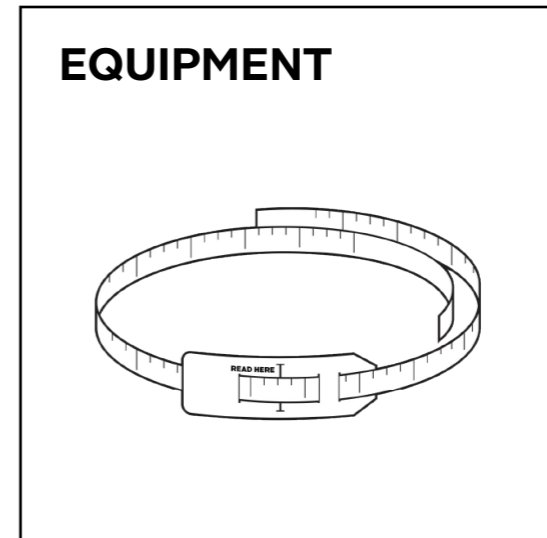
This section provides guidance on measuring head circumference in children under 5 years of age. Head circumference is measured using a head circumference tape. More information on head circumference tapes can be found in the **Equipment** section.

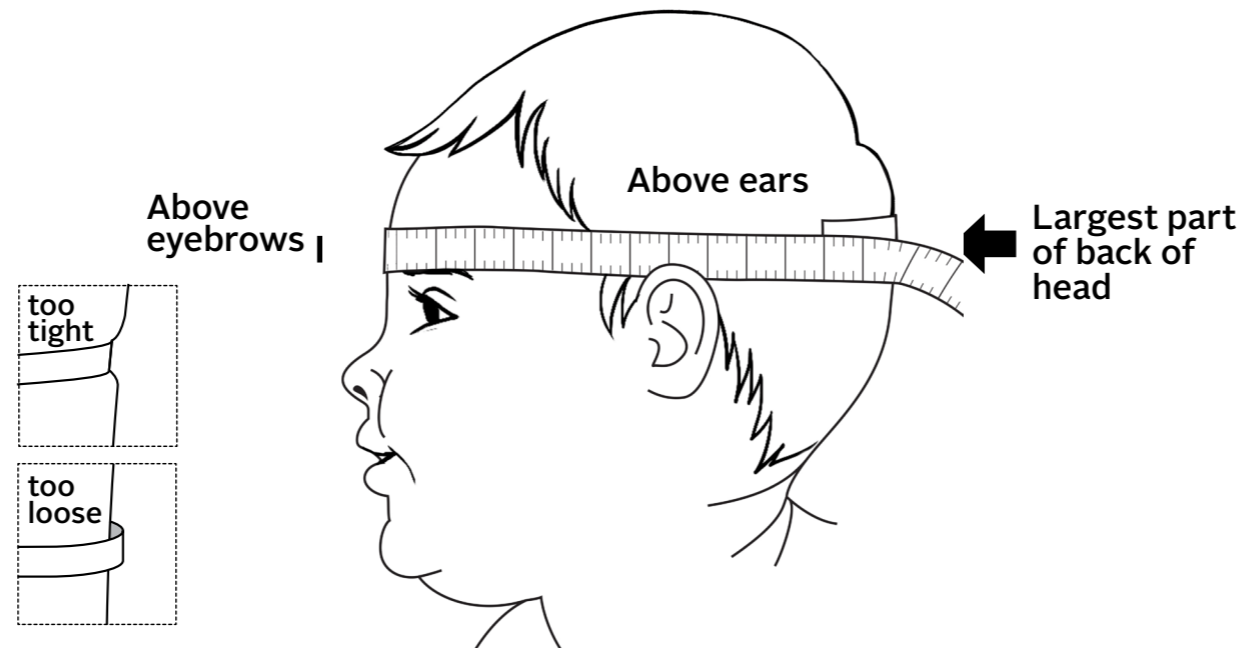
Preparing to Measure Head Circumference

1. Show the head circumference tape to the parent/caregiver and the child. Explain that the child will be measured using the tape. Inform the parent/caregiver that her/his help may be needed.
2. Ask the parent/caregiver to remove any hats, hairpins, bands, or other ornamental head coverings on the child.
3. If the child can sit quietly on a chair or stool, ask the parent/caregiver to kneel by the child so the child will be still and secure. Otherwise, ask the parent/caregiver to sit on a chair or stool and place the child on her/his lap.

FOR ACCURATE MEASUREMENT, REMEMBER:

- Position the tape around the largest part of the head.
- Pull the tape flat against the head, not too tight or loose.
- Read, record, and plot measurements carefully.





PROCEDURE FOR MEASURING HEAD CIRCUMFERENCE

1. Sit next to the child (or his/her parent/caregiver, if the child is being held). Since some children (especially older children) find this measurement uncomfortable, the parent/caregiver should hold the child or kneel next to him/her to help keep the child still and secure.
2. Adjust the head circumference tape so it is easy to place around the child's head and to read correctly when taking the measurement.
3. Place the tape around the child's head so that the tape lies across the frontal bones of the skull, slightly above the eyebrows and over the fullest protuberance of the skull at the back of the head.
4. Move the tape up and down over the back of the head to locate the maximum circumference, then tighten the tape to gently compress the hair and underlying skin, making sure that the measuring tape is snug but not tight enough to compress the skin.
5. Read aloud the head circumference measurement to the nearest 0.1 cm (1 mm).
6. The trained assistant should record the child's head circumference to the nearest 0.1 cm (1 mm) clearly and accurately on the health card, questionnaire, or other relevant document. If no trained assistant is available, record the head circumference yourself.
7. Check the recorded head circumference for accuracy and legibility.

Measuring Waist Circumference

This section provides guidance on measuring waist circumference in adults. Waist circumference is measured using a measuring tape. More information on waist circumference tape can be found in the **Equipment** section.

Several methods may be used to measure waist, or abdominal, circumference. The procedure described in this section is the method agreed upon in a 2008 WHO expert consultation (WHO 2008b; WHO 2008c).

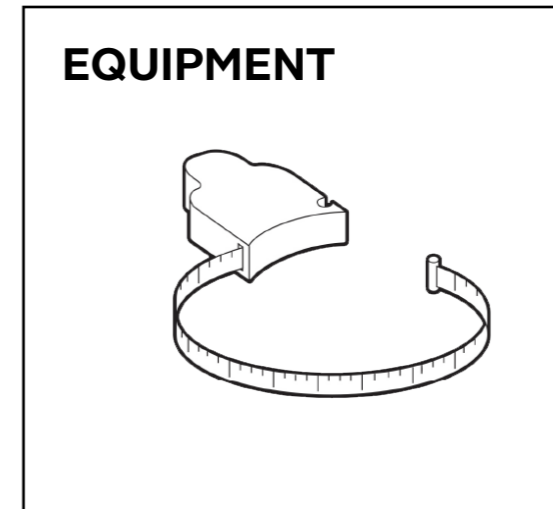
Note: This measurement is not used for pregnant and postpartum women and girls.

Preparing to Measure Waist Circumference

1. Waist circumference tapes come in different sizes; make sure the tape you are using is long enough for the target group you are about to measure.
2. Show the waist circumference tape to the person being measured. Explain that you will use it to measure his/her waist and that you will make some markings on her/his body to ensure that the tape is in the correct position to get an accurate measurement.
3. Explain that you must place the tape directly against the skin and ask the person to adjust her/his clothing (e.g., slightly lower her/his pants and underclothing and slightly lift up his/her shirt) so that the waist is showing.

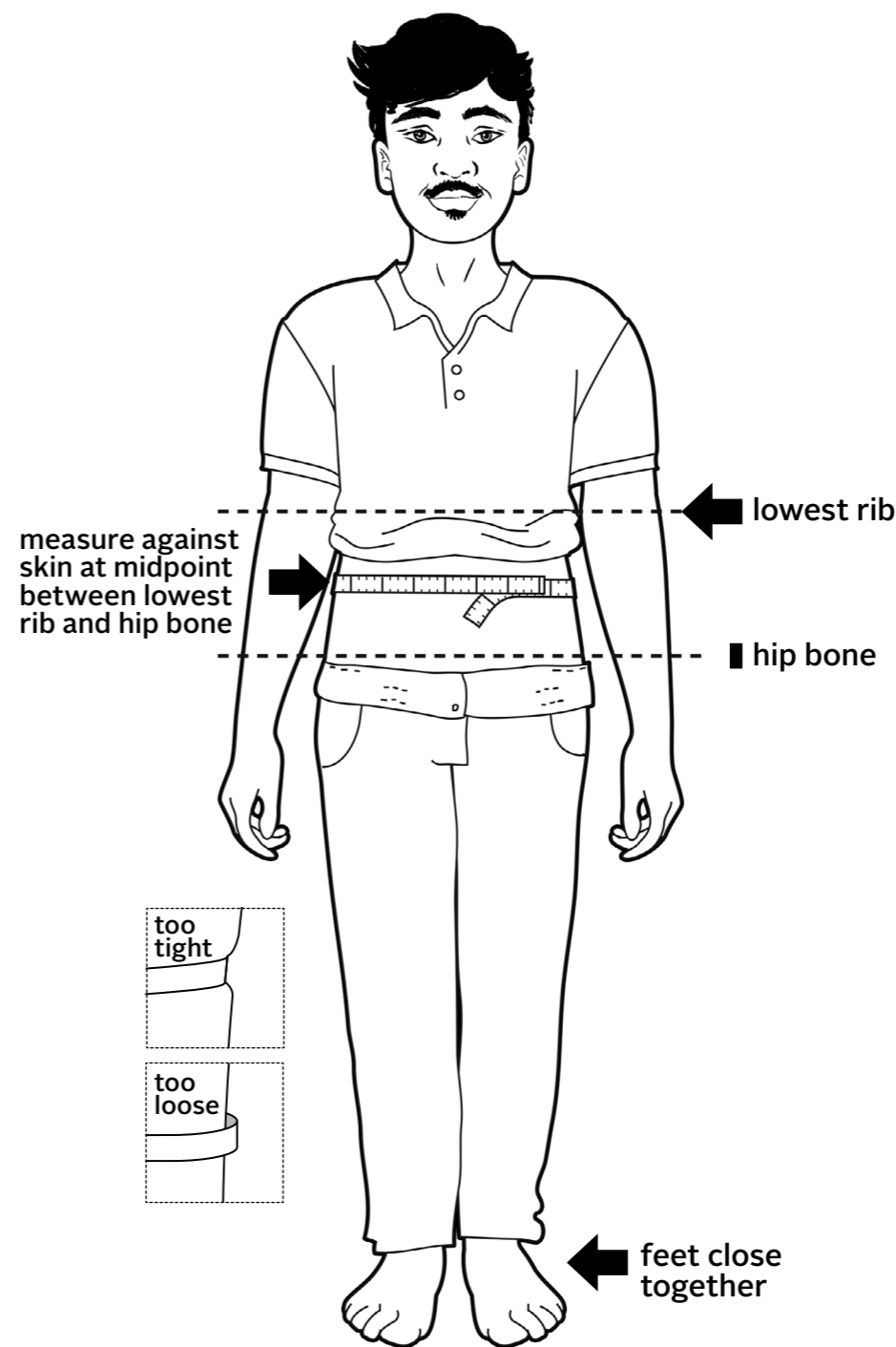
FOR ACCURATE MEASUREMENT, REMEMBER:

- Measure the midpoint between lowest rib and the top of the hip bone.
- Ensure the tape lies flat and is not too loose or tight.
- Measure against the skin, not over clothing.
- Read and record measurements carefully.



Procedure for Measuring Waist Circumference in Adults

1. Stand to the side of the person being measured and locate his/her lowest rib and the top of her/his hip bone. You may ask the person to help you find these points on her/his body.
2. Ask the person to wrap the waist circumference tape around him/herself and to position the tape at the midpoint between her/his lowest rib and the top of her/his hip bone (i.e., the waist), making sure that the tape is in the same spot on the opposite side. Note: Check that the tape is horizontal across the back and front of the person and as parallel as possible to the floor.
3. Ask the person to:
 - Stand erect, with her/his feet positioned close together and his/her weight evenly distributed on both feet.
 - Relax her/his arms at the sides.
 - Breathe out gently and relax while being measured.
4. Make sure the measuring tape is snug but not tight enough to compress the skin. Measure the person's waist circumference and bend down to the level of the tape so that you can read aloud the measurement to the nearest 0.1 cm (1 mm).
5. The trained assistant should record the person's waist circumference to the nearest 0.1 cm (1 mm) clearly and accurately on the health card, questionnaire, or other relevant document. If a trained assistant is not available, record the measurement yourself.
6. Check the recorded waist circumference for accuracy and legibility.



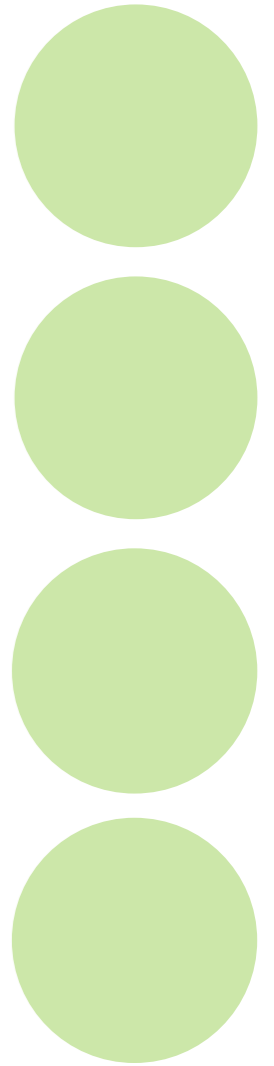
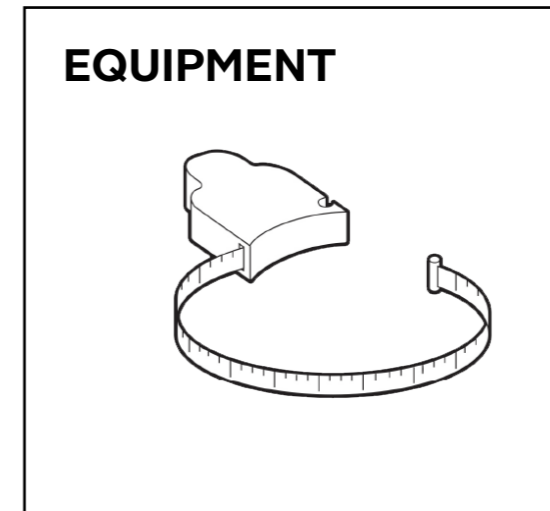
Measuring Calf Circumference

(Adapted from WHO 1995.)

This section provides guidance on measuring calf circumference. Calf circumference is measured around the widest part of the calf using a measuring tape. More information on calf circumference tape can be found in the **Equipment** section.

Preparing to Measure Calf Circumference

1. Make sure the calf circumference tape is long enough for the person you are about to measure.
2. Show the calf circumference tape to the person being measured and explain that you will use it to measure his/her calf.
3. If the person is wearing pants, ask him/her to roll up the pants leg to uncover the calf.

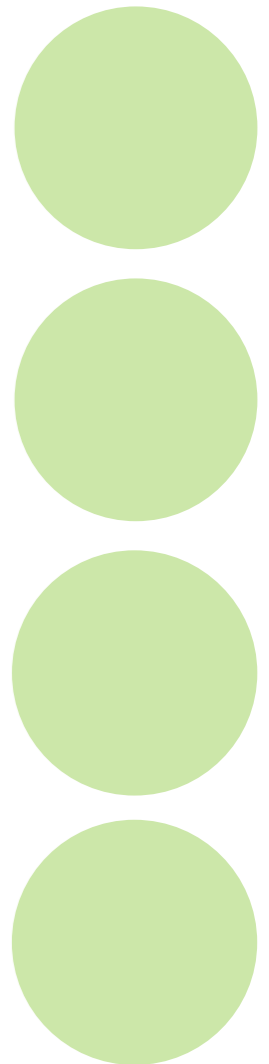
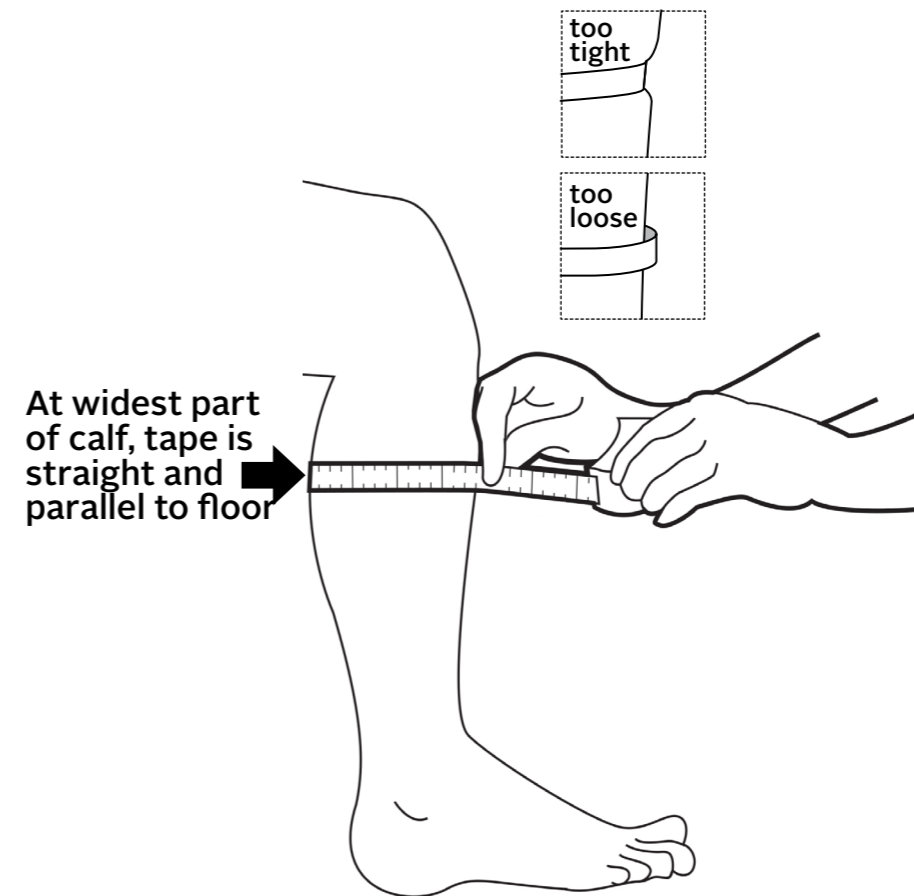


Procedure for Measuring Calf Circumference

1. Ask the person to either sit with the left leg hanging loosely or stand with his/her weight evenly distributed on both feet.
2. Wrap the tape around the calf at the widest part, making sure the tape is straight. Make sure the measuring tape is snug but not tight enough to compress the skin.
3. Take additional measurements above and below the point measured to ensure that the first measurement was the largest. Read aloud the largest measurement to the nearest 0.1 cm (1 mm).
4. The trained assistant should record the person's calf circumference to the nearest 0.1 cm (1 mm) clearly and accurately on the health card, questionnaire, or other relevant document. If a trained assistant is not available, record the calf circumference yourself.
5. Check the recorded calf circumference for accuracy and legibility.

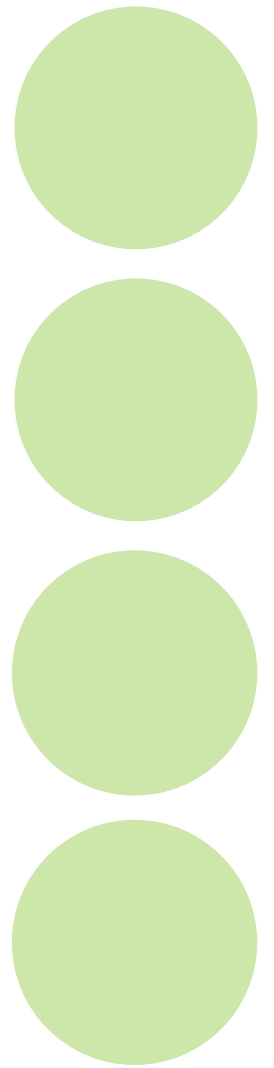
FOR ACCURATE MEASUREMENT, REMEMBER:

- The leg should dangle loosely and not be flexed.
- Measure the widest part of the calf, directly against the skin.
- Ensure the tape lies flat and is not too loose or tight.
- Read and record measurements carefully.



Procedure for Measuring Calf Circumference for Adults who are Bedridden

1. Ask the person being measured to lie on his/her back with the left knee bent at a 90° angle. An assistant can help, if needed.
2. Wrap the calf circumference tape around the widest part of the calf; slide the tape up and down to be sure you have the largest part of the calf.
3. Pull the tape so it is snug but not so tight that the skin is compressed. Make sure the tape is at a right angle to the length of the calf.
4. The trained assistant should record the person's calf circumference to the nearest 0.1 cm (1 mm) clearly and accurately on the health card, questionnaire, or other relevant document. If a trained assistant is not available, record the calf circumference yourself.
5. Check the recorded calf circumference for accuracy and legibility.



Assessing Bilateral Pitting Edema

(Adapted from GNC 2011 [Module 6: Measuring Malnutrition: Individual Assessment]; WHO 2008a; World Vision International 2011.)

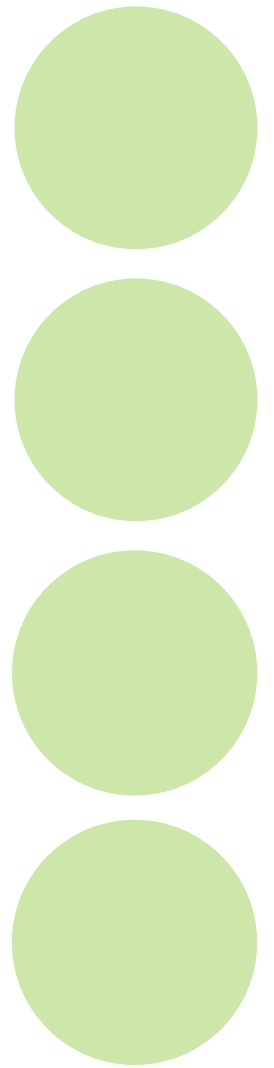
This section provides guidance on assessing for bilateral pitting edema for all demographic groups included in this guide.

Preparing to Assess for Bilateral Pitting Edema

1. Explain to the person or parent/caregiver that you are about to check for bilateral pitting edema. If checking a child, inform the parent/caregiver that her/his help may be needed.
2. Ask the person being measured or the parent/caregiver (if a child is to be measured) to remove any footwear or socks and have the person being measured sit on a chair or stool (or in the case of a small child in the arms of the parent/caregiver). Sitting down will ensure that the person maintains balance when her/his feet are being held.

TIP

If assessing a child who can sit alone, ask the parent/caregiver to kneel by the child to help keep the child still and secure.



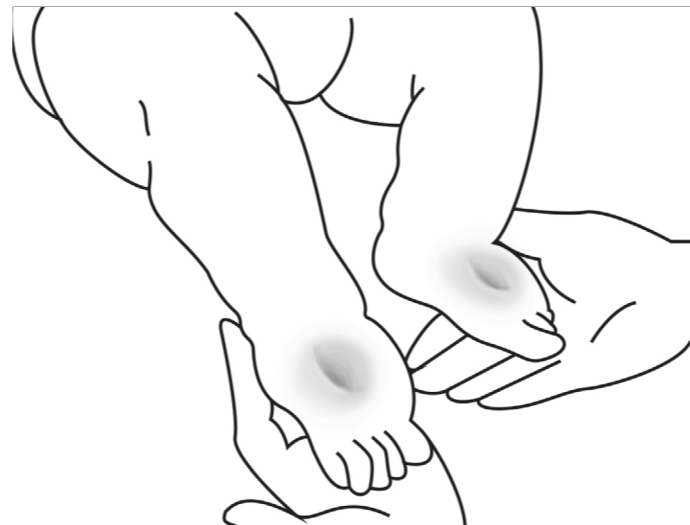
Procedure for Assessing for Bilateral Pitting Edema

1. Grasp the person's feet so that they rest in your hands, with one thumb on top of each foot.
2. Press your thumbs gently on both feet at the same time for at least 3 seconds. Count slowly, "one thousand one, one thousand two, and one thousand three" to reach 3 seconds. The person has bilateral pitting edema if pits (dents) remain in both feet when you lift your thumbs.
3. Record the results: absent, edema + (feet/ankles), edema ++ (feet/ankles, lower legs, lower arms, hands), edema +++ (generalized: feet/ankles, legs, arms, face).

Note: If a person has bilateral pitting edema, refer him/her to the health center for diagnosis and treatment, as this is a sign of severe acute malnutrition and may also indicate other medical problems. Pregnant and lactating women and girls may also have edema that is not related to nutrition.



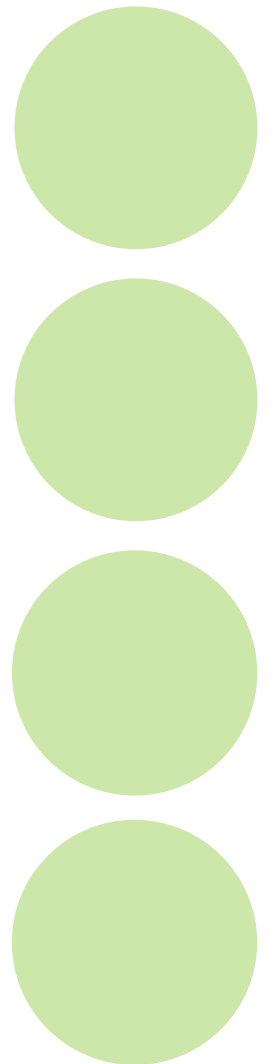
Hold thumbs for three seconds



Pitting in both feet remains

FOR ACCURATE MEASUREMENT, REMEMBER:

- Use thumbs to assess for bilateral pitting edema.
- Press thumbs into feet for at least 3 seconds.
- Record results carefully.



Anthropometric Equipment

What Does this Section Cover?

This section provides information on the equipment needed to conduct the anthropometric measurements in this guide, standards to help users select appropriate equipment for each measurement, and information on where equipment can be purchased. This section does not provide instructions on how to use specific equipment models; users should review the equipment’s instruction manual and be trained in the proper use and care of the equipment to ensure accurate measurement. **Table 6.2** summarizes the common types of anthropometric equipment included in this guide. It is organized according to age group and measurement.

PURCHASING ANTHROPOMETRIC EQUIPMENT

Several vendors sell anthropometric equipment. This guide does not endorse any one vendor. For convenience, two websites that sell a wide range of equipment are listed below.

[UNICEF Supply Catalogue](#)

[Weigh and Measure, LLC](#)

Table 6.2 Anthropometric Equipment Covered in this Guide

	Weighing Scales					Tools to Measure Length or Height		Circumference Tapes for Additional Measurements		
	Electronic		Mechanical							
	Infant electronic scale	Standing electronic scale	Hanging scale	Infant beam scale	Standing beam scale	Length/height board	Knee caliper	MUAC tape	Head circumference tape	Waist/calf circumference tape
Children under 5 years of age	X*	X**	X	X*	X**	X		X (6–59 months of age)	X	
Children and adolescents 5+ years of age		X			X	X		X		
Pregnant/postpartum women and girls		X			X	X		X		
Adults (18+ years of age)		X			X	X	X	X		X

* The term “infant” usually refers to children under 1 year of age. However, infant scales can be used for any child who weighs less than its maximum capacity, regardless of age.

** Infants and children who cannot stand must be held by an adult.



Equipment for Measuring Weight

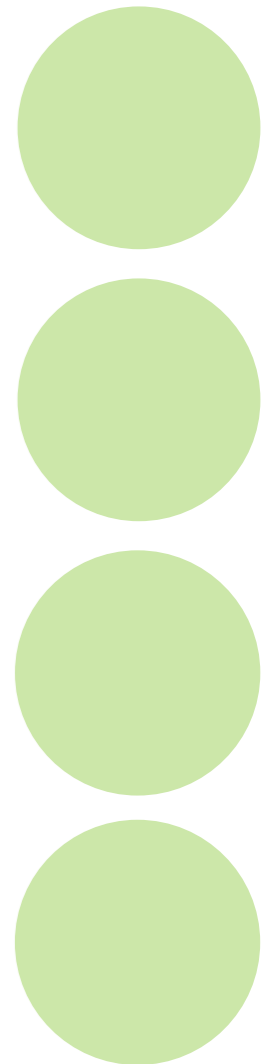
Selecting an appropriate scale is an important part of collecting accurate measurements. Both electronic scales, which require electrical power (including batteries) or solar power, and mechanical scales can be used.

Considerations for choosing a scale:

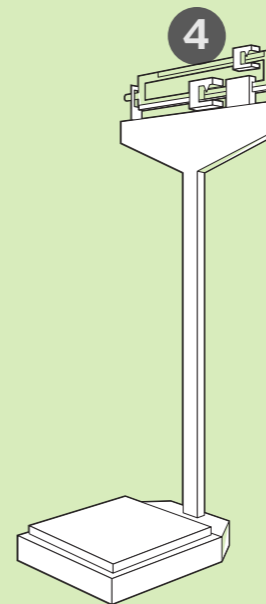
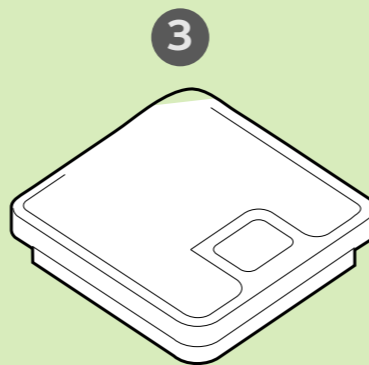
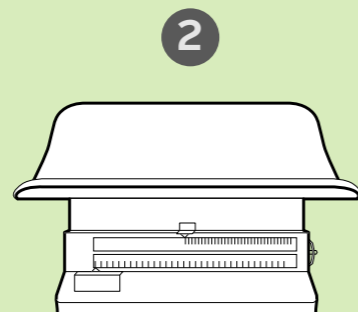
- What age group do you need to weigh? Adults? Children? Both?
- Does the scale need to be portable?
- How durable is the scale? Can it withstand multiple daily uses and/or traveling to multiple sites?
- Is electricity available at the weighing site?

TIP

Some scales are intended for infants or young children only while others can weigh people of all ages.

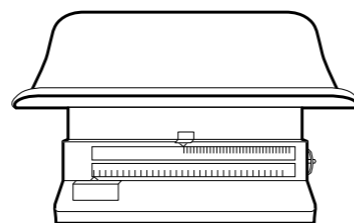
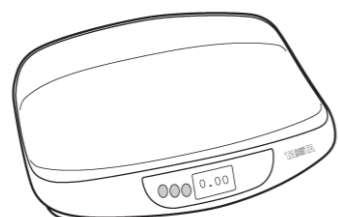


EQUIPMENT USED TO MEASURE WEIGHT



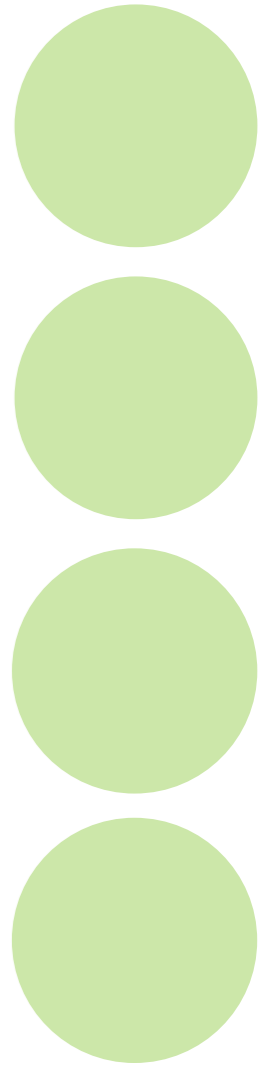
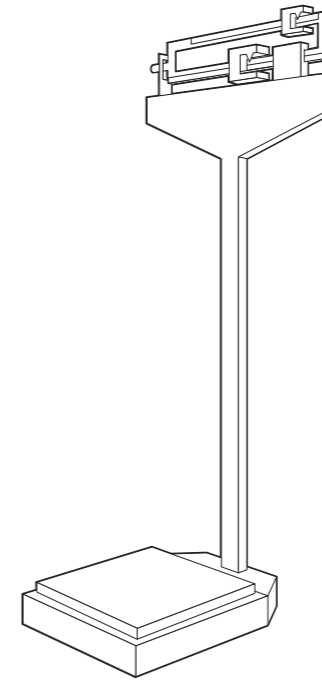
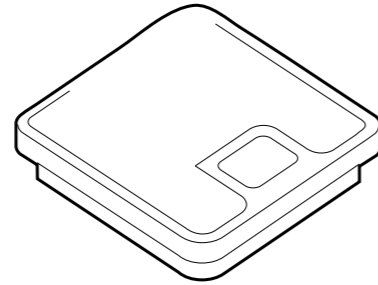
1. Infant electronic scale 2. Infant beam scale 3. Electronic scale 4. Beam scale 5. Hanging scale with pants

Comparison of Scales for Infants and Children



	INFANT ELECTRONIC SCALE	INFANT BEAM SCALE	HANGING SCALE
Age group(s)	Infants only	Infants only	Infants/children under age 5 years
Portable	Yes, depends on model	No	Yes
Features	<ul style="list-style-type: none"> Durable, easy to read, and easy to maintain and clean Some models can also measure an infant's length 	<ul style="list-style-type: none"> Durable, easy to read, and easy to maintain and clean Some models can also measure an infant's length 	<ul style="list-style-type: none"> Can be hung from a post, beam, or tree; a sling or weighing pants are used to weigh the child Lightweight (often less than 1 kg), easy to carry Requires little maintenance Available in developing countries
Other considerations		Heavy and hard to carry	<ul style="list-style-type: none"> Harder to clean/keep hygienic than other scales Less reliable than other infant scales, especially when weighing an agitated child May be harder to use for heavier/older children Requires a sling for infants under 3 months of age to support their necks/heads
Range	Typically can weigh children up to 10 kg, but some models can weigh infants up to 20 kg or more	Typically can weigh children up to 10 kg, but some models can weigh infants up to 16 kg or more	Can weigh children up to 25 kg
Precision	Precise to at least 10 g (some infant scales offer precision up to 5 g for infants weighing less than 7.5 kg)	Precise to 10 g (.01 kg)	Precise to 100 g (0.1 kg)
Power	Solar or electrical power (including batteries) depending on model	No power needed	No power needed
Cost	Approximately US\$75–300	Approximately US\$86–350	<ul style="list-style-type: none"> US\$6–15 for scale Sling and/or pants sold separately: Pants are approximately US\$12 per set of five; sling is approximately US\$2.50

Comparison of Scales for All Age Groups



	STANDING ELECTRONIC SCALE	STANDING BEAM SCALE
Age group(s)	All age groups (infants/children who cannot stand must be held by an adult)	All age groups (infants/children who cannot stand must be held by an adult)
Portable	Yes	No
Features	<ul style="list-style-type: none"> • Durable, easy to read, and easy to maintain and clean • Some models include a taring option, which calculates the weight of a child being held in an adult's arms; this reduces risk of human error in calculating a child's weight by hand 	<ul style="list-style-type: none"> • Durable, easy to read, and easy to maintain and clean • Some models can also measure height
Other considerations	These are professional scales; household or "bathroom" scales are not recommended because they do not have the precision required for high quality anthropometric measurement	<ul style="list-style-type: none"> • Heavy and hard to move • Weighing an infant in an adult's arms using a beam scale will require calculating the child's weight by hand
Range	Varies; typically can weigh individuals 0–150 kg	Varies; typically can weigh individuals 5–180 kg
Precision	Precise to 100 g (0.1 kg)	Precise to 100 g (0.1 kg)
Power	Solar or electrical power (including batteries), depending on model	No power needed
Cost	Approximately US\$45–130	Approximately US\$145–165

Equipment for Measuring Height

Length/Height Boards

Length/height boards are used to measure the length/height of individuals. Smaller boards are used only for infants and children; however, most children can also be measured using an adult height board. Some models can be used for length and height, measuring children lying down or standing.

Considerations for choosing a length/height board:

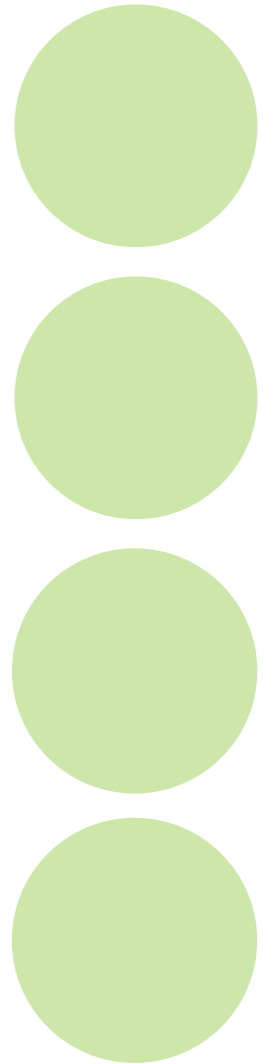
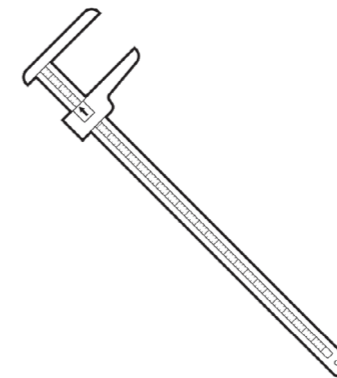
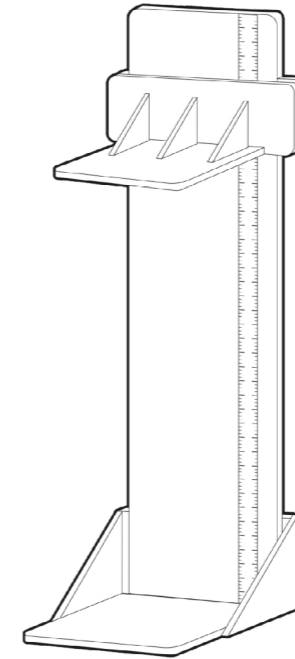
- What age group are you measuring? Children under 2 years of age? Children 2 years of age and over? Adults?
- Does the board need to be portable?
- How frequently will it be used? Does it need to withstand multiple daily uses?

Calipers for Knee Height

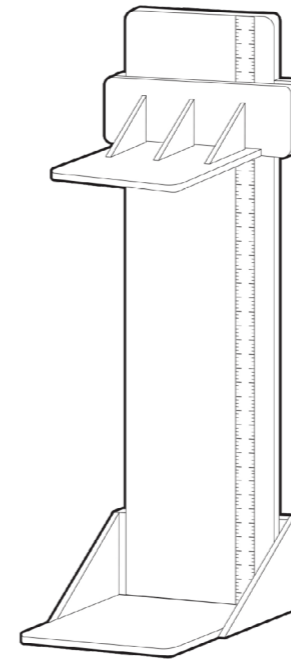
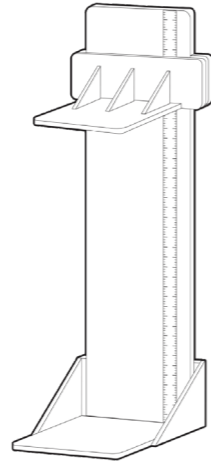
Calipers are used for measuring knee height, a proxy for height, for adults whose height cannot be measured directly.

Considerations for choosing knee height calipers:

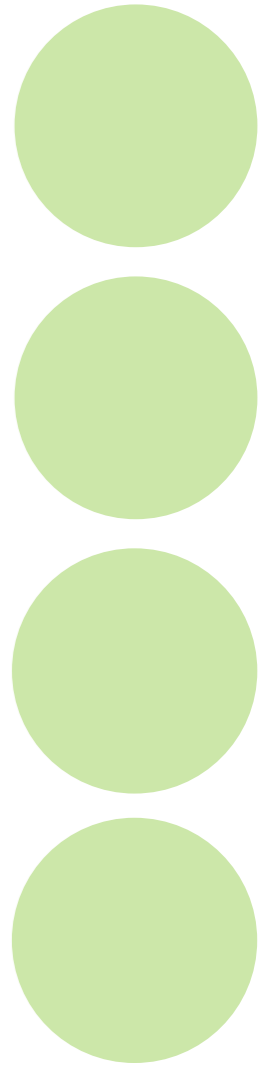
- Calipers should be able to measure up to at least 80 cm with a precision of 0.1 cm (1 mm)
- Cost: Approximately US\$350.



Comparison of Length/Height Boards



	INFANT/CHILD LENGTH/HEIGHT BOARD	INFANT/CHILD/ADULT LENGTH/HEIGHT BOARD
Age group(s)	Infants and children	Infants, children, adults
Portable	<ul style="list-style-type: none"> • Yes (is disassembled for portability) • Carrying case optional 	<ul style="list-style-type: none"> • Yes (is disassembled for portability) • Carrying case optional
Features	Converts from recumbent length (children under 2 years of age) to standing height (children 2 years of age and over)	Converts from recumbent length (children under 2 years of age) to standing height (children 2 years of age and over and adults)
Materials	Made of wood or plastic (metal can get hot and burn a person's skin)	Made of wood or plastic (metal can get hot and burn a person's skin)
Other considerations	<ul style="list-style-type: none"> • Easy to set up • Resistant to effects of excessive humidity and high temperature • Waterproof and shock-resistant • Make sure material has a smooth finish for safe use and easy cleaning 	<ul style="list-style-type: none"> • Bigger and heavier than the infant/child board • Easy to set up • Resistant to effects of excessive humidity and high temperature • Waterproof and shock-resistant • Make sure material has a smooth finish for safe use and easy cleaning
Range	Up to 130 cm	Up to 210 cm
Precision	Precise to 0.1 cm	Precise to 0.1 cm
Cost	Approximately US\$115–350	Approximately US\$129–450; can be made locally for as little as US\$20

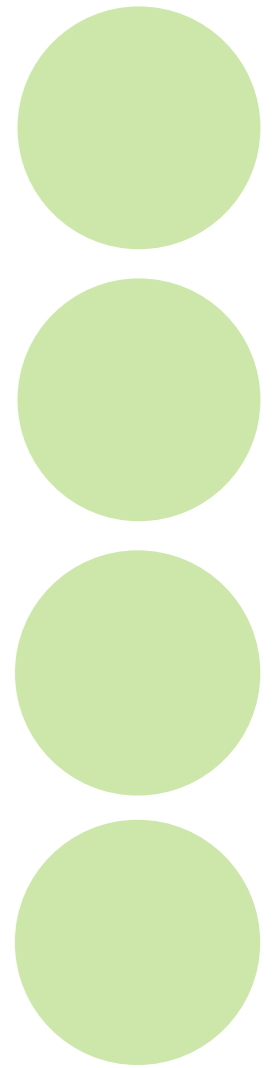


Circumference Tapes

Circumference tapes are used to measure MUAC, head circumference, and waist circumference.

Considerations for choosing circumference tapes:

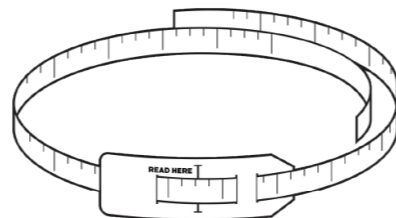
- What measurement do you need to take? Do you need a tape that can be used for different measurements (e.g., both calf and head circumference)?
- What age group are you measuring? Children under 5 years of age? Adults?
- How frequently will the tape be used? Does it need to withstand multiple daily uses?



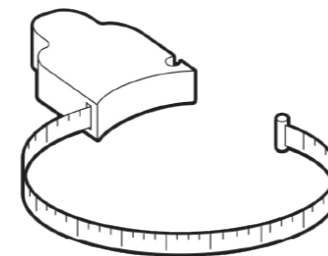
CIRCUMFERENCE TAPES



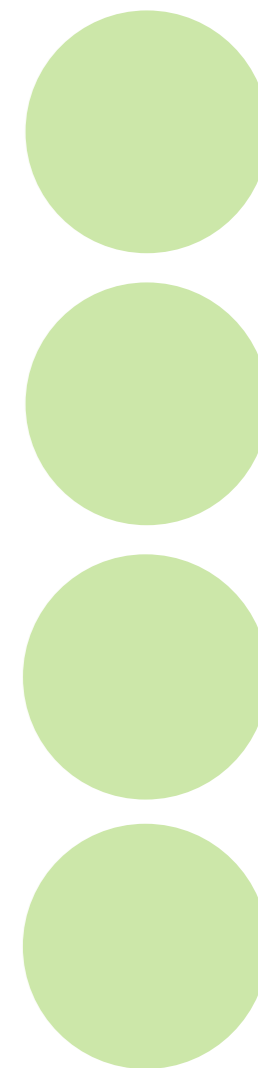
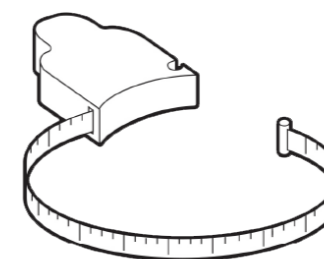
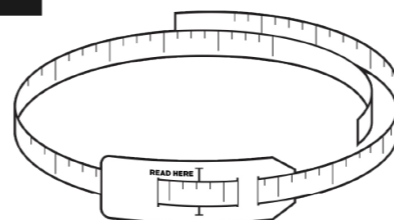
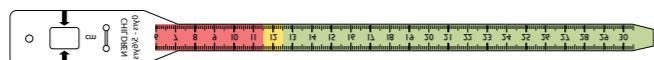
1. MUAC tape (colored)



2. Head circumference tape



3. Waist/calf circumference tape



	MUAC TAPE	HEAD CIRCUMFERENCE TAPE	WAIST/CALF CIRCUMFERENCE TAPE
Age group(s)	Individuals 6 months of age and older (there are tapes for specific age and demographic groups)	Children under 5 years of age	Typically only used for adults 18+ years of age
Portable	Yes	Yes	Yes
Features	<ul style="list-style-type: none"> Should be made from stretch-resistant plastic, plasticized paper, or synthetic paper that is at least 0.3 mm thick Should be flexible, unstretchable, untearable, weather-resistant, and easy to read in low light Should be both colored (red, yellow, and green) and numbered for ease of use Some tapes can also be used to measure head and calf circumference if it is clearly stated on the tape that it is intended for multiple purposes 	<ul style="list-style-type: none"> Should be made from stretch-resistant plastic, plasticized paper, or synthetic paper that is at least 0.3 mm thick Should be flexible, unstretchable, untearable, weather-resistant, and easy to read in low light Some tapes can be used to measure child and adult head circumference and limb circumference, and adult MUAC 	<ul style="list-style-type: none"> Should be made from stretch-resistant plastic, plasticized paper, or synthetic paper that is at least 0.3 mm thick Should be flexible, unstretchable, untearable, weather-resistant, and easy to read in low light Some tapes can be used to measure MUAC as well
Other considerations	Does not need any special maintenance (replace tapes when the numbers become hard to read)	Does not need any special maintenance (replace tapes when the numbers become hard to read)	Does not need any special maintenance (replace tapes when the numbers become hard to read)
Range	<ul style="list-style-type: none"> Should be able to measure up to at least 26 cm (260 mm) for children and 50 cm (500 mm) for adults Tapes marked with cutoffs for specific target audiences—including children under 5 years of age, adolescents, pregnant women, and non-pregnant adults—are available; some tapes are only for children under 5 years of age 	Should be able to measure up to at least 60 cm	Should be able to measure up to at least 150 cm for waist circumference and 65 cm for calf circumference
Precision	Precise to 0.1 cm (1 mm)	Precise to 0.1 cm (1 mm)	Precise to 0.1 cm (1 mm)
Power	No power needed	No power needed	No power needed
Cost	Approximately US\$3–10 for a pack of 50	Approximately US\$40 for a pack of 25 (prices may vary according to volume purchased)	Approximately US\$50

References

Cogill, B. 2003. *Anthropometric Indicators Measurement Guide*. Washington, DC: FHI 360/Food and Nutrition Technical Assistance Project (FANTA).

de Onis et al. 2004. "Measurement and Standardization Protocols for Anthropometry Used in the Construction of a New International Growth Reference." *Food and Nutrition Bulletin*. 25(1 Suppl): S27–36.

Division of Women, Infants, and Children (WIC). 2010. *Anthropometric Training Manual*. Pennsylvania Department of Health.

FANTA. 2008. *Training Guide for Community-Based Management of Acute Malnutrition (CMAM). Module 2: Defining and Measuring Acute Malnutrition*. Washington, DC: FHI 360/FANTA.

Food and Agriculture Organization of the United Nations (FAO). 2008. *Guidelines for Estimating the Month and Year of Birth of Young Children*. Rome: FAO.

Gibson, R.S. 2005. *Principles of Nutritional Assessment. Second Edition*. New York: Oxford University Press.

Global Nutrition Cluster (GNC). 2011. *The Harmonised Training Package (HTP): Resource Material for Training on Nutrition in Emergencies, Version 2*. GNC.

ICF International. 2012. *MEASURE DHS Biomarker Field Manual*. Calverton, MD: ICF International.

ICF International. 2017. *Demographic and Health Survey Interviewer's Manual*. Rockville, MD, U.S.A.: ICF International.

Lee, R.D. and Nieman, D.C. 1996. *Nutritional Assessment, 2nd Edition*. Boston: McGraw-Hill.

Nestle Nutrition Institute. 2009. *A Guide to Completing the Mini Nutritional Assessment—Short Form (MNA-SF)*. Available at: http://www.mna-elderly.com/forms/mna_guide_english_sf.pdf.

SMART Methodology. 2006. *Measuring Mortality, Nutritional Status, and Food Security in Crisis Situations: SMART Methodology Version 1*. Available at: <http://smartmethodology.org/survey-planning-tools/smart-methodology/smart-methodology-manual/>.

United Nations Department of Technical Co-Operation for Development (UNDTCD) and United Nations Statistical Office (UNSO). 1986. *How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children in Household Surveys*. New York: UNDTCD and UNSO.

U.S. Centers for Disease Control and Prevention (CDC). 2016. *National Health and Nutrition Examination Survey (NHANES): Anthropometry Procedures Manual*. Available at: https://www.cdc.gov/nchs/data/nhanes/nhanes_07_08/manual_an.pdf.

University of Oxford. 2012. INTERGROWTH-21st: International Fetal and Newborn Standards for the 21st Century. *Anthropometry Handbook*. Oxford, UK: The International Fetal and Newborn Growth Consortium.

Westat. 1988. National Health and Nutrition Examination Survey III. *Body Measurements (Anthropometry)*. Rockville, MD: Westat.

World Health Organization (WHO). 1995. *Physical Status: The Use and Interpretation of Anthropometry—A Report of a WHO Expert Committee*. Geneva: WHO.

WHO. 2008a. *Training Course on Child Growth Assessment*. Geneva: WHO.

WHO. 2008b. *WHO STEPwise Approach to Surveillance (STEPS). Part 3: Training and Practical Guides. Section 3: Guide to Physical Measurements (Step 2)*. Geneva: WHO.

WHO. 2008c. *Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation*. Geneva, 8–11 December, 2008.

WHO and UNICEF. 2009. *WHO Child Growth Standards and the Identification of Severe Acute Malnutrition in Infants and Children: A Joint Statement by the World Health Organization and the United Nations Children's Fund*. Geneva/New York: WHO and UNICEF.

World Vision International Nutrition Centre of Expertise. 2011a. *Measuring Child Growth for Surveys: Facilitator's Manual*. World Vision International.

World Vision International Nutrition Centre of Expertise. 2011b. *Measuring and Promoting Child Growth: Facilitator's Manual*. World Vision International.

