Hands-on Anthropometry

A South African Handbook for Large-Scale Nutrition Studies

Training and Standardisation Manual

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HANDS-ON ANTHROPOMETRY

A SOUTH-AFRICAN HANDBOOK FOR LARGE-SCALE NUTRITION STUDIES

TRAINING AND STANDARDISATION MANUAL

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Each module in this manual is accompanied by PowerPoint presentations that can be used for training. The presentations can be downloaded from **https://www.up.ac.za/centre-for-maternal-fetal-newborn-and-child-healthcare**

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List of Abbreviations

cm	Centimetre
CC	Calf circumference
DHS	Demographic and Health Survey
g	Gram
kg	Kilogram
mm	Millimetre
MUAC	Mid-upper arm circumference
NDOH	National Department of Health
NDIS	National Dietary Intake Survey
NHANES	National Health and Nutrition Examination Survey
SANHANES	South African National Health and Nutrition Examination Survey
WC	Waist circumference

Introduction and Background

"Unless measurement is carried out to the highest standards, the effort of performing anthropometry is time wasted" (Cole, 2000)

Anthropometry, the science of measuring and evaluating human body size and proportions, is the backbone of most nutrition surveys and a core component of nutrition assessment.

The purpose of this manual is to

- outline equipment requirements,
- detail the training of fieldworkers and
- provide guidelines for quality assurance procedures

for *basic* anthropometric measurements of able-bodied persons in multi-site research studies. The emphasis is on the South African setting, especially for tertiary education and research institutions, when numerous fieldworkers must be trained to take anthropometric measurements for a research study.

It is widely believed that anthropometric measurements are easy to perform. However, international findings suggest widespread concerns about data quality, particularly the reliability (i.e. precision and repeatability) and accuracy of measurements. This is particularly true for national studies[1] such as the Demographic and Health Survey (DHS), which is also periodically performed in South Africa.

Anthropometric data of questionable quality may significantly

- threaten the accuracy and interpretation of the absolute findings (i.e. the anthropometric measurements as such and the indices and indicators calculated from these measurements), leading to incorrect conclusions about the overall nutrition status of the study sample,
- affect (i.e. dilute or attenuate) associations between anthropometric data and other variables of interest within a larger study, such as dietary intake or food/nutrition security, and
- affect the comparability of studies across settings or over time.

The training and standardisation of fieldworkers are thus of primary importance, and an essential step when planning a study that includes anthropometry. It is rightfully receiving considerable attention in the international research community. In order to ensure comparability, the specifications and procedures in this manual are compiled from authoritative international procedure manuals, including the FANTA practical anthropometry guide[2], the USAID guidelines for

[1] Perumal N, Namaste S, Qamar H, Aimone A, Bassani DG, Roth DE. *Anthropometric data quality assessment in multisurvey studies of child growth.* Am J Clin Nutr 2020;112(Suppl):806S–815S. DOI: https://doi.org/10.1093/ajcn/nqaa162

[2] Cashin K, Oot L. 2018. *Guide to Anthropometry: A Practical Tool for Program Planners, Managers, and Implementers.* Washington, DC: Food and Nutrition Technical Assistance III Project (FANTA)/FHI 360. Available online at: https://www.fantaproject.org/tools/anthropometry-guide

anthropometric data collection in Demographic and Health Surveys (DHSs)[3] and the World Health Organization guide for anthropometric indicators in children under five[4] (WHO, 2019). In addition, it is informed to some extent by previous South African national surveys (e.g. the National Food Consumption Surveys of 1999[5] and 2006[6], and the SANHANES-I[7], which builds on the methodology of the US NHANES[8]). The authors gratefully acknowledge these sources.

It is our sincere wish that this manual will contribute to quality anthropometric measurements in studies that are intended to be a sound basis for planning, monitoring and evaluating nutrition programmes tailored to the needs of South Africans.

The authors

December 2021

[3] USAID DHS Program. 2019. *Best practices for quality anthropometric data collection at the DHS program*. Rockville, MD: The Demographic and Health Surveys Program. Available online at: https://dhsprogram.com/publications/publication-od77-other-documents.cfm

[4] WHO, UNICEF. *Recommendations for data collection, analysis and reporting on anthropometric indicators in children under 5 years old.* Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), 2019. Available online at: https://www.who.int/nutrition/publications/anthropometry-data-quality-report/en/

[5] Labadarios D, Steyn NP, Maunder E, MacIntryre U, Gericke G, Swart R, Huskisson J, Dannhauser A, Vorster HH, Nesmvuni AE, Nel JH. *The National Food Consumption Survey (NFCS): South Africa, 1999. Public Health Nutr*. 2005; 8(5): 533-43. Available online at: https://www.cambridge.org/core/journals/public-health-nutrition/article/national-food-consumption-survey-nfcs-south-africa-1999/A082639300EF8492E454054699491272

[6] Labadarios D, Swart R, Maunder EMW, Kruger HS, Gericke GJ, Kuzwayo PMN, Ntsie PR, Steyn NP, Schloss I, Dhansay MA, Jooste PL, Dannhauser A; Nel JH, Molefe D, Kotze TJvW. (2008*). National Food Consumption Survey-Fortification Baseline (NFCS-FB-I): South Africa, 2005.* South African Journal of Clinical Nutrition, 21(3), 245-300. Available online at: http://www.sajcn.co.za/index.php/SAJCN/article/view/286

[7] Shisana O, Labadarios D, Rehle T, Simbayi L, Zuma K, Dhansay A, et al. *South African National Health and Nutrition Examination Survey (SANHANES-1).* Cape Town: HSRC Press; 2013. Available online at: http://www.hsrc.ac.za/en/research-outputs/view/6493

[8] Centres for Disease Control and Prevention (CDC). 2020. *National Health and Nutrition Examination Survey (NHANES) Anthropometry procedures manual*. Atlanta, GA: Centres for Disease control and Prevention. Available online at: https://wwwn.cdc.gov/nchs/data/nhanes/2019-2020/manuals/2020-Anthropometry-Procedures-Manual-508.pdf

Structure of the Manual

Table 0-1 below links each of the twelve modules of the training programme to its intended target group. Each module in the training program is accompanied by a PowerPoint presentation to facilitate training[9]. The ✓ shows which groups should have achieved the specified learning outcomes after the training.

TABLE 0-1: OVERVIEW OF THE TRAINING MODULES

Module	Lead anthropometrist/ site coordinator	Anthropometrists and assistants	All field workers
Module 1: Introduction to anthropometry	✓	✓	✓
Module 2.1: Brief overview of anthropometric equipment	✓	✓	✓
Module 2.2: Equipment calibration, verification, care and maintenance	✓	✓	
Module 3: Anthropometry-specific infection prevention and control	✓	✓	
Module 4: Pre-measurement procedures	✓	✓	
Module 5: General guidelines for measuring and recording	✓	✓	
Module 6: Measuring weight	✓	✓	
Module 7: Measuring length/height	✓	✓	
Module 8: Measuring MUAC	✓	✓	
Module 9: Measuring calf circumference	✓	✓	
Module 10: Measuring waist circumference	✓	✓	
Module 11: Conducting the training	✓		
Module 12: Standardisation and reliability assessment	✓		

[9] Available online at https://www.up.ac.za/centre-for-maternal-fetal-newborn-and-child-healthcare

TRAINING MODULES

- Module 1: Introduction to anthropometry
- Module 2: Anthropometric equipment
- Module 3: Anthropometry-specific infection prevention and control
- Module 4: Pre-measurement procedures
- Module 5: General guidelines for measuring and recording
- Module 6: Measuring weight
- Module 7: Measuring length/height
- Module 8: Measuring MUAC
- Module 9: Measuring calf circumference
- Module 10: Measuring waist circumference
- Module 11: Conducting the training
- Module 12: Standardisation and reliability assessment

MODULE 1: Introduction

Module 1.1: What is anthropometry?

Anthropometry is a science involving the *measurement* and *interpretation* of the size and proportions of the human body – this includes weight, height or length, and various circumferences.

This manual focuses on the basic anthropometric *measurements* that are typically part of nutrition surveys that include infants, children and adults.

Module 1.2: Why do we do anthropometry?

For individuals of all ages, anthropometric measurements are an important part of assessing nutrition status, helping us to identify undernutrition and overnutrition. In infants and young children, anthropometric measurements also give a good indication of their overall health.

In a large-scale, multi-site nutrition survey, anthropometric assessment also allows us to:

- describe the overall nutrition/anthropometric status of South Africans (for example, how many people are underweight or overweight, and some details of those affected),
- explore how anthropometric measurements relate to the other things we are measuring (for example, whether people's weight is related to the types and amounts of food they eat),
- compare the results to those of previous surveys in South Africa and in other countries, and to
- determine how the body size and proportions of South Africans are changing over time (for example, we can see whether more people are underweight or overweight now than before).

Module 1.3: Why are good quality anthropometric measurements important?

Anthropometric measurements may seem easy to do, but they are difficult to do *well*.

When doing research, anthropometric measurements must be done with great care to ensure that they are accurate. Inaccurate measurements will affect the outcome of a study by:

- giving inaccurate information about the anthropometric status of South Africans,
- making it difficult to tell how anthropometric status relates to food intake, and
- making it difficult to compare our results to the result of other studies.

Various steps can be taken to ensure that anthropometric measurements are as accurate as possible. Specifically, we can look at equipment-related matters and measurement-related matters:

- Equipment-related matters:
    - Good quality equipment should be used, preferably purchased new.
    - Ideally, all measurement teams should use the same brand and model of equipment.
    - Equipment should be tested for accuracy daily (a process known as verification).
    - Equipment must be set up and used correctly.
    - Equipment must be properly cared for on a day-to-day basis.
- Measurement-related matters:
    - Measurements must be taken in the same way every time, according to standardised protocols such as those in this manual.
    - Measurements must be taken twice.
    - Anthropometrists (that is, the people taking the measurements) must be properly trained in measurement protocols.
    - After training, anthropometrists must be assessed to ensure that they are able to take the measurements reliably.

Module 1.4: Who does what? Team roles and responsibilities

An anthropometry team typically consists of:

- The **anthropometry planning team**: responsible for planning anthropometric data collection, compiling manuals and guidelines, and training the lead anthropometrists.
- One **lead anthropometrist (coordinator)** per study site: responsible for training all the anthropometry field workers at their sites, conducting standardisation exercises, and monitoring day-to-day data collection.
- Two **anthropometry field workers** per team, of which one is trained as an **anthropometrist** and one as an **assistant** – they work together to take the anthropometric measurements.

Figure 1-1 summarises the composition of the anthropometry team. Every member is critical for the quality of the anthropometric measurements.

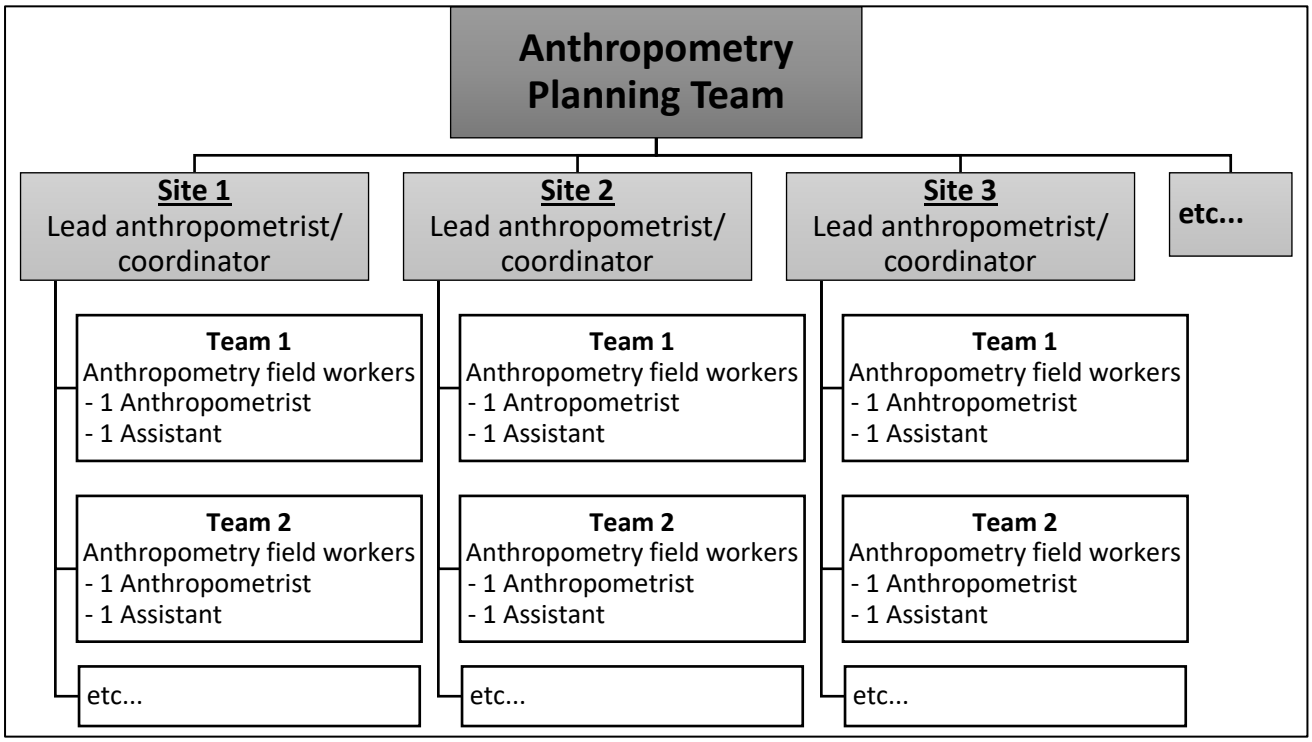


FIGURE 1-1: COMPOSITION OF THE ANTHROPOMETRY TEAM

Module 1.5: Which measurements for which participants?

The following measurements represent basic anthropometry that may be done in a large-scale nutrition survey:

- The date of the assessment and the date of birth, which are used to calculate age (this is necessary for us to be able to interpret the anthropometric measurements).
- Weight – in all participants.
- Length/height:
    - Length (lying down) – in children 0-24 months.
    - Height (standing up) – in everyone older than 24 months.
- Mid-upper arm circumference (MUAC) – in everyone aged three months and older.
- Calf circumference (CC) – in adults 18 years and older, including the elderly.
- Waist circumference (WC) – in secondary school learners (from age 13 years) and adults 18 years and older, including the elderly.

Table 1-1 summarises the above.

TABLE 1-1: MATCHING MEASUREMENTS TO PARTICIPANTS

Measurement	In whom?					
	0-3 months	3 months – 2 years	2-13 years	13-18 years	18+ years	Elderly
Date of birth Date of assessment	✓	✓	✓	✓	✓	✓
Weight	✓	✓	✓	✓	✓	✓
Length/height						
> Length (lying down)	✓	✓				
> Height (standing up)			✓	✓	✓	✓
Mid-upper arm circumference (MUAC)		✓	✓	✓	✓	✓
Calf circumference (CC)					✓	✓
Waist circumference (WC)				✓	✓	✓

The rest of this manual contains detailed instructions for:

- verifying and taking care of the anthropometric equipment,
- taking all the measurements, including preparing for measurements, taking measurements and recording measurements,
- appropriate hygiene and infection control measures for anthropometric assessment, and
- setting up and conducting a standardisation exercise to ensure the quality of anthropometric data (lead anthropometrists only).

MODULE 2: Anthropometric Equipment

Module 2.1: Brief overview of equipment

The equipment listed in Table 2-1 is typically used.

TABLE 2-1: SUMMARY OF ANTHROPOMETRIC EQUIPMENT

Measurement	Equipment
Weight	Electronic platform scales (the tare function is used to weigh infants and young children who cannot stand)
Length/height	- Infantometer (length board): for measuring recumbent (lying down) length of infants - stadiometer: for measuring standing height of older children and adults
Mid-upper arm circumference (MUAC)	- Colour-coded MUAC tape: for children up to 5 years - Spring-wound measuring tape: older children and adults
Calf circumference (CC)	Spring-wound measuring tape
Waist circumference (WC)	Spring-wound measuring tape

Some extra pieces of equipment and consumables will also be needed, as listed inBox 2-1.

BOX 2-1: EXTRA ITEMS NEEDED IN THE ANTHROPOMETRY KIT

In addition to the anthropometric equipment, you will also need:

- Spare batteries for scales
- Screwdrivers to open battery compartments, if necessary (depending on model)
- Machine oil, to lubricate the moving parts on length and height meters
- A ruler, for measuring the height of incompressible hairstyles
- A regular dressmaker's measuring tape
- Wax-based cosmetic pencils for marking measurement sites on skin (black/brown and white) with a sharpener
- Alcohol swabs, "wet wipes" or tissues for cleaning off pencil marks
- Sanitiser for hands and equipment
- Disposable latex/nitrile examination gloves
- Disposable face masks
- Paper towels
- Extra forms and pens
- Disposable nappies for babies

It's recommended that you keep all these extras in a bag or backpack for easy transport

Detailed descriptions of each piece of equipment can be found on the following pages.

Electronic scales

Platform scales are used to weigh all participants:

- Infants and young children are weighed together with a parent/caregiver, using the tared weighing method.
- Children over the age of 24 months and adults are weighed standing up.

The Seca 874, shown in Figure 1-1, is often used in large-scale nutrition surveys.

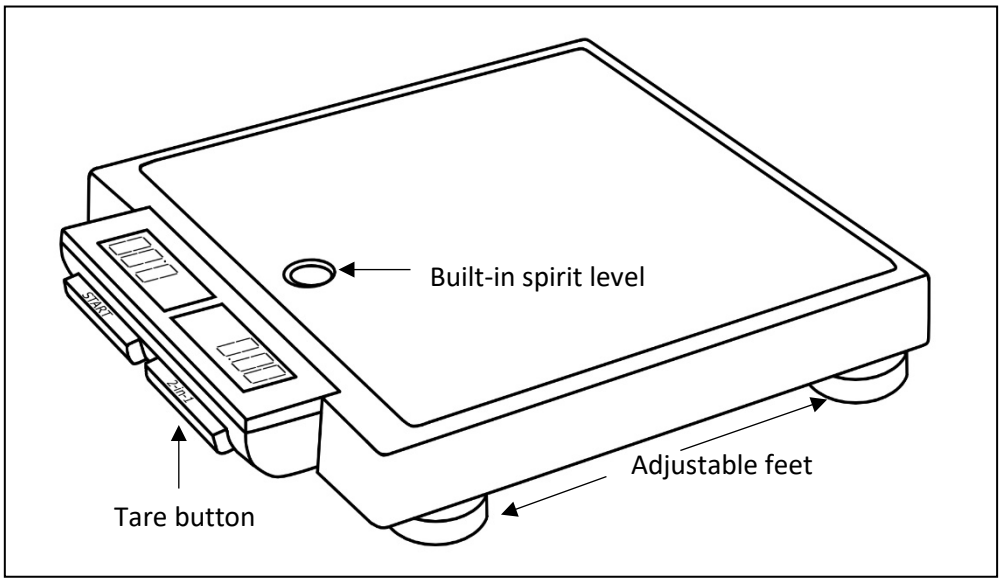


FIGURE 2-1: ELECTRONIC PLATFORM SCALES (SECA 874)

Length/height meters

An infantometer (or length board) is used to measure length (lying down) in infants and children up to the age of 24 months. Figure 2-2 shows the Seca 417 infantometer.

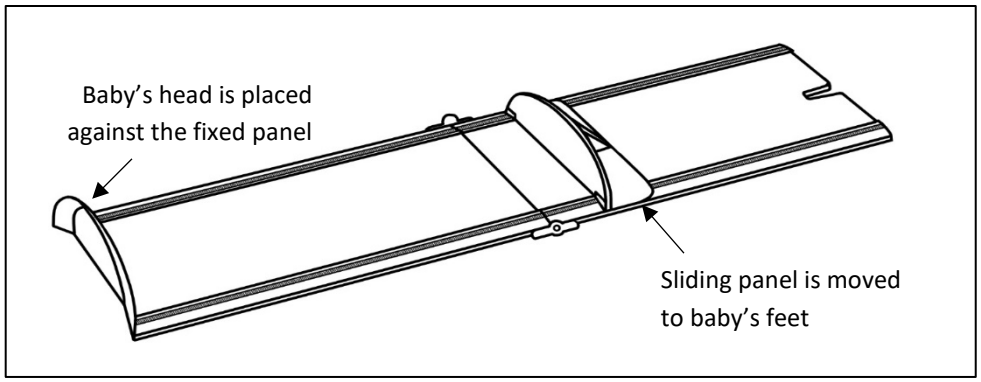
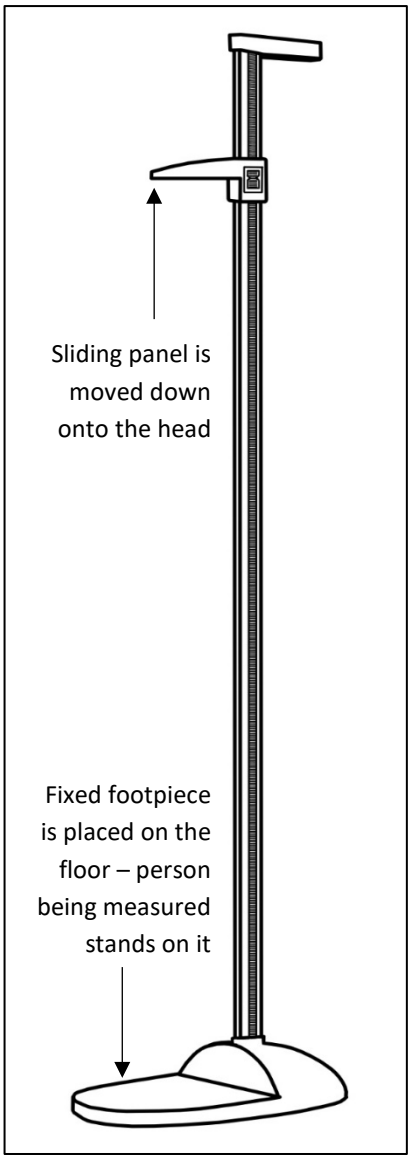


FIGURE 2-2: LENGTH METER (SECA 417 INFANTOMETER)



A stadiometer is used to measure standing height in children over the age of 24 months and adults. Figure 2-3 shows the Seca 213 stadiometer.

FIGURE 2-3 : HEIGHT METER (SECA 213 STADIOMETER)

The length and height meter can also be combined into one piece of equipment, e.g. the ShorrBoard™, shown in Figure 2-4.

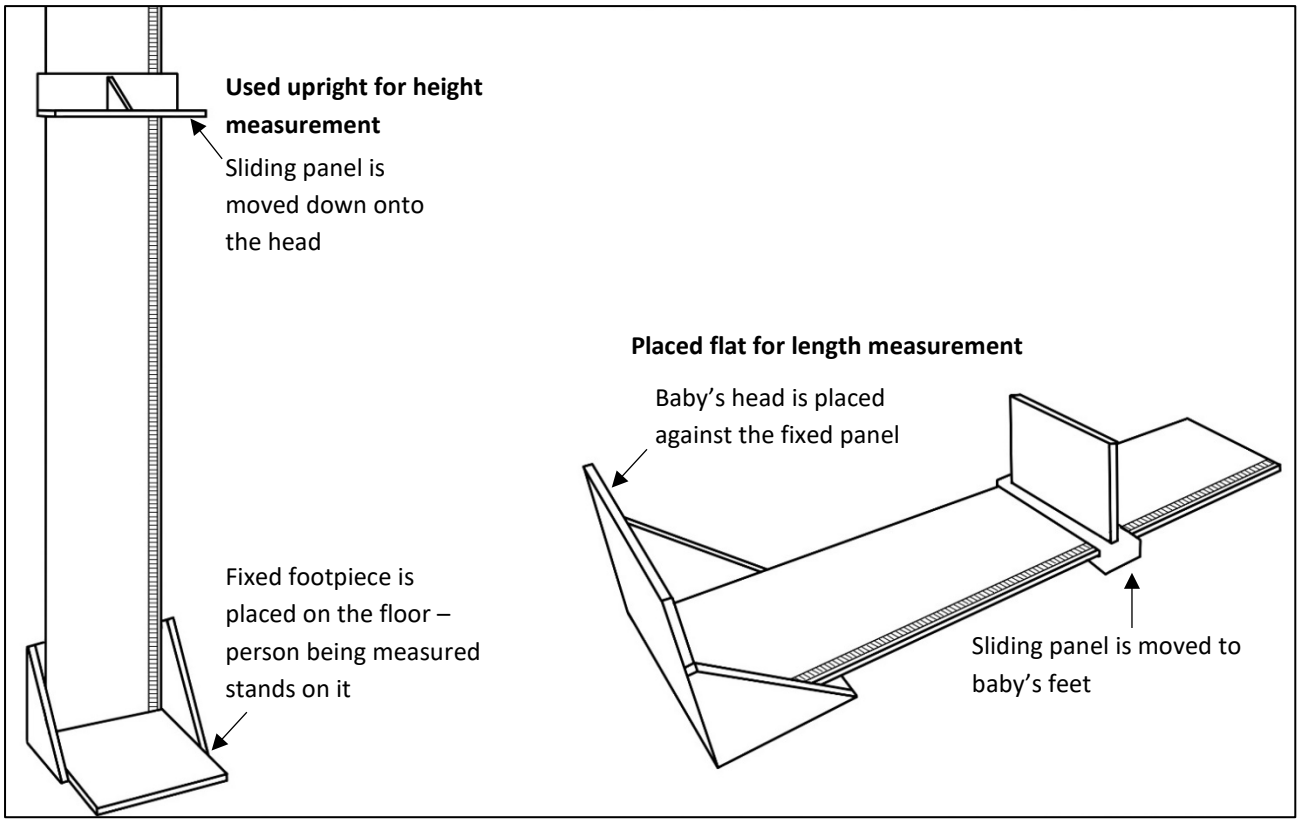


FIGURE 2-4: COMBINED LENGTH-AND HEIGHT METER (SHORRBOARD™)

Measuring tapes

Different kinds of measuring tapes can be used to take anthropometric measurements. Specialised non-stretchable tapes that are manufactured expressly for anthropometric measurements should always be used.

Mid-upper arm circumference (MUAC) tapes for children – shown in Figure 2-5 – are colour-coded to make it easy to identify children with acute undernutrition.

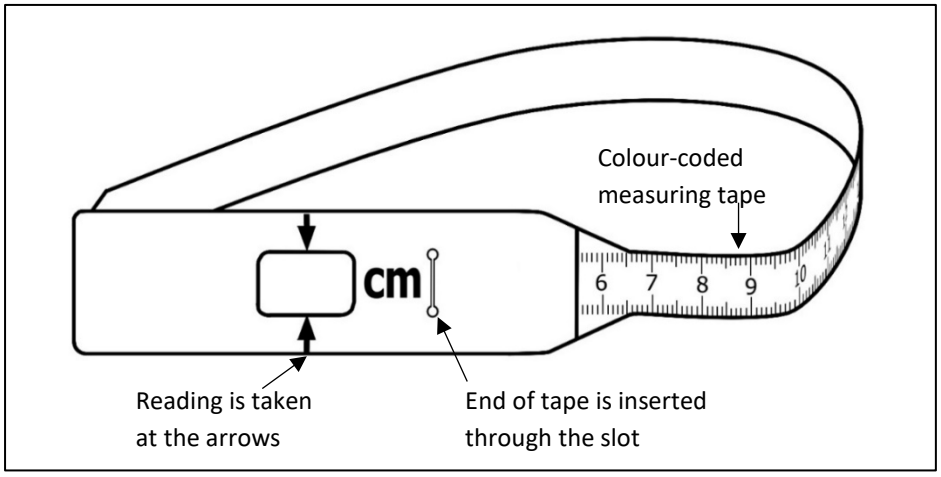


FIGURE 2-5: MUAC INSERTION TAPE FOR CHILDREN UNDER 5

Spring-wound measuring tapes are used to measure calf circumference (CC), waist circumference (WC) and MUAC in adults. Figure 2-6 shows an example of such a measuring tape, the Seca 201.

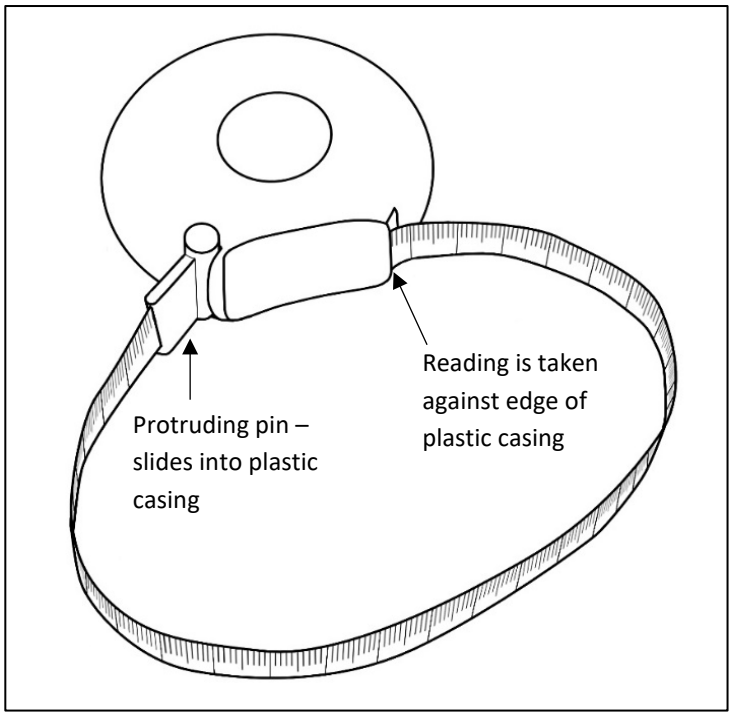


FIGURE 2-6: SPRING-WOUND MEASURING TAPE (SECA 201)

Module 2.2: Equipment care and maintenance

It is impossible to take accurate measurements with faulty equipment! The day-to-day care of anthropometric equipment is essential to keep it in good working order.

The following guidelines apply to all anthropometric equipment:

- At the start of each day, check equipment for wear and damage.
- If any equipment is faulty, contact the lead anthropometrist for your site to get a replacement. Every study should have a plan of action in such an event. Do not use damaged equipment to take measurements, since those measurements will not be accurate.
- Clean all equipment with sanitising solution after each use.
- While not in use, equipment must be stored in the provided storage containers; this helps to protect it against damage.
- Avoid letting the equipment get wet or dirty.

In addition to the above, all equipment must be checked for accuracy, or verified, daily. Verification involves measuring an object of known size, and checking whether the equipment gives the correct measurement. Daily verification is essential to ensure that the equipment is working correctly; it must *never* be skipped. The results of the verification must be recorded on the Daily Verification Log Forms (Annexure A) or a suitable electronic data collection application.

If the equipment fails the verification – that is, if it does not measure the true value within the specified limits – one of two actions can be taken:

1. Ideally, the faulty equipment should be replaced. It is advisable that each site/province has some extra equipment available in case of equipment failure. The new equipment should also be verified before use, and the faulty equipment should be returned to the manufacturer to be serviced and calibrated.
2. If it is not possible to replace the equipment, the measured values can be adjusted for the measurement error during data processing.
    a. To accurately adjust measured weights, it is necessary to have at least two (preferably three) verifications done with different weights. If you have two different weights, weigh each one separately and both together to give three different verification weights.
    b. For length/height meters, only one verification measurement is needed.
    c. Record all verification weights and the measured values clearly.
    d. Make a note on all the data collection forms of the day that the values need to be adjusted for an equipment error.

Different studies may use different procedures; the procedures for your specific study should be clearly explained during training.

Equipment-specific care instructions, as well as the procedures for verification of scales and length/height meters, will be covered next.

Electronic scales

General care

- Check that the batteries are still working at the start of each day.
    - If the scale gives a “low battery” warning, replace the batteries. Scales may not measure accurately when the batteries are low, even if the display still works.
    - Always ensure that you have spare batteries to take with you when going out to do the assessments.
- When sanitising the scales, be careful not to let the sanitising solution drip into the scales, as this can damage the electronic components.
- Never put anything on top of the scales; it can damage the spring.

Verification

Scales are verified by weighing an object of known weight.

- Ensure that the scale is standing on a flat, solid, level surface.
- Weight the provided standard weights.
    - The verification weights that will be used must be set before study commencement
    - The choice of verification weights will depend on the target population – for example, a study that includes infants and young children should include a verification weight at the low end, e.g. 5 kg.
    - Consult the manufacturer’s maintenance plan for appropriate verification weights.
- Record the verification weight used and the actual measured weight shown on your scales on the Daily Calibration Log Form (Annexure A1) or the electronic data collection application.
- Acceptable accuracy limits for the measured weight will depend on the study goals, target population and model of scales.
    - Accuracy limits should be set before the study commences and applied consistently.
    - If your measured weights do not fall within the defined accuracy limits, contact your study site co-ordinator.

Length/height meters

General care

- Unfold the infantometer and assemble the stadiometer. Check that all the joins are smooth and that the pieces fit together tightly.
- Check that the moveable foot-/headpieces can slide easily. If it is sticking, you can put a drop of light machine oil at the place where the sliding panel meets the track and slide the panel back and forth a few times to spread the oil.

Verification: infantometer

- Infantometers are verified lying flat on a table or floor.
- A rigid verification rod of known length <100cm is used to verify the infantometer.
- Measure the verification rod:
    - Place the rod with one end against the fixed pane where the baby's head would go.
    - Lay the rod flat against the backboard and parallel to the measuring tape.
    - Bring the sliding footpiece to rest against the other end of the rod.
    - Read the length value on the measuring tape.
- Record the actual length of the verification rod and your measured length on the Daily Calibration Log Form (Annexure A2) or the electronic data collection application.
- Acceptable accuracy limits for the measured length will depend on the study goals, target population and model of length meter
    - Accuracy limits should be set before the study commences and applied consistently.
    - If your measured lengths do not fall within the defined accuracy limits, contact your study site co-ordinator.

Verification: stadiometer

- Stadiometers are calibrated standing upright against a vertical wall.
- A rigid verification rod of known length >100cm is used to verify the stadiometer.
- Measure the calibration rod:
    - Place the rod upright with one end on the footpiece so that it is touching the base of the stadiometer's upright measuring bar. Make sure the calibration rod is parallel to the upright bar.
    - Slide the headpiece down to rest against the top of the calibration rod.
    - Read the length value on the upright measuring bar.
- Record the length of the calibration rod and your measured length on the Daily Calibration Log Form (Annexure A2) or the electronic data collection application.
- Acceptable accuracy limits for the measured length will depend on the study goals, target population and model of length meter
    - Accuracy limits should be set before the study commences and applied consistently.
    - If your measured lengths do not fall within the defined accuracy limits, contact your study site co-ordinator.

Note: combined length/height meters should be calibrated using both verification rods, to ensure that they are measuring accurately at lengths <100 cm and >100 cm.

Measuring tapes

General care

- Before use, check that the numbers and measurement markings on the measuring tape are clearly legible.
- Check that the tape is not torn or warped anywhere.
- Ensure that spring-loaded tapes are in good condition and that the springs pull the tape tightly.
- Ensure that you have a regular measuring tape in your kit as a backup in case the MUAC tape or spring-loaded tape gets damaged during the day.

Medical-quality anthropometry tapes do not need to be verified daily, as they are made of a non-stretchable material.

MODULE 3: Anthropometry-Specific Hygiene and Infection Prevention Measures

Anthropometric measurements involve close contact between the anthropometrist, assistant and the person being measured. This makes hygiene and infection control measures particularly important. General measures that should always be observed are discussed in this module, while measures related specifically to COVID-19 are included in Annexure E.

The following hygiene and infection prevention measures should be observed when taking anthropometric measurements:

- Sanitise your hands with alcohol-based hand sanitiser (≥60% alcohol) *before* you start, *between* assessing different participants and *after* you are done.
    - If your hands become dirty or soiled, wash them with soap and water and dry them with a paper towel.
- All anthropometric equipment should be sanitised with the provided alcohol-based surface sanitiser after use, or in-between assessing different participants (e.g. at a school).
- Whenever you need to touch a participant (i.e. when taking the anthropometric measurements), you should wear disposable latex/nitrile examination gloves.
    - You can use a single pair of gloves for the entire household; it is not necessary to change gloves between measuring people who live together, unless the gloves tear or become soiled.
    - Dispose of the used gloves after assessing each household.
    - When measuring large groups of children at schools or creches, a new pair of gloves should be used for each child.

Figure 3-1 on the next page shows the proper technique for washing/sanitising hands.

FIGURE 3-1: HAND RUBBING TECHNIQUE FOR SANITISING HANDS (WORLD HEALTH ORGANIZATION)

MODULE 4: Pre-Measurement Procedures

Module 4.1: Setting up the equipment

When choosing a place to take measurements, keep the following in mind:

- Choose an area that is private – remember, the person you are measuring will be wearing minimal clothing.
- Choose an area that is warm enough to be comfortable.
- Ensure that there is enough light to read measurements off the equipment easily, or to allow the proper operation of solar-powered scales (if used).
- A stool or chair (about 40cm high) will be needed for calf circumference measurements, and for the caregiver to sit on while they hold an infant/child for MUAC measurements.
- Measurements may be done outside, provided that:
    - there is a suitable surface (see below) available to place the equipment on, and
    - it is private enough that the person being measured is not uncomfortable.

Scales and length/height meters require a hard, flat level surface, such as the floor or a sturdy table.

- The surface must be hard. Concrete, wooden tabletops or smooth tiles are good surfaces on which to place equipment. Grass, carpeted floors and dirt floors are not suitable.
- Stadiometers should be placed against a vertical wall.
- If using a table:
    - Make sure the table is large enough that the scales and/or length board can fit on it comfortably. If a piece of the equipment is hanging off the edge of the table, it can affect the accuracy of the measurement, or the equipment could fall, causing injury to the anthropometrist or participant.
    - Ensure that the table is sturdy. It should not wobble at all, and the tabletop should not bend when a heavy object is placed on it.
    - Ensure that the table is level.

Module 4.2: Pre-measurement interview

Before you take any measurements, you need to explain to the person being measured what you want to do, and get consent. The participants will give written consent for participating in the survey as a whole, but you should also ask their permission before taking any measurements.

- If you are measuring an infant or young child, explain the procedures to the parent/caregiver. If the child is old enough to understand you, also explain everything to the child.
    - Show them the equipment.
    - Explain what you will do.
    - Remember to use simple language that they can understand!
- You need to get permission before taking any measurement.
    - For infants/young children, the parent/caregiver has to consent.
    - For older children, both the parent/caregiver and the child must consent/assent.
    - If a person refuses to be measured, you have to respect their decision.
    - Also, explain to participants that they are allowed to consent to only some of the measurements (e.g. a person may agree to have their height measured but not their waist circumference).
- Afterwards, remember to thank participants for their cooperation. Remember, they are doing us a favour!

Here are a few examples of how you can introduce yourself and explain the procedures (you will, of course, change the names and forms of address to suit the situation)

Scenario 1: Measuring an infant or young child (0-24 months)

Hello Ma'am. My name is Sam and I would like to take some measurements of your baby. Can I explain to you what I want to do, and then you can tell me whether it is okay with you?

This is the scale I will use to weigh baby. I will ask you to take off all baby's clothes. Then you will get on the scale first, I'll press the button to zero it, and my colleague, Jane, will hand baby to you, and we can see how much he weighs.

I will use this board to measure how long baby is. He will lie on his back with his head over here [point to the headboard] – Jane here will help to hold his head in position – and then I will move this piece to press against his feet [show how the foot piece moves].

I will use this measuring tape to measure around baby's upper arm. To make sure I measure in the right spot, I will have to use this pencil to make a little mark on baby's skin. It's a normal makeup pencil so it won't harm baby's skin, and it will clean off easily afterwards.

I need to take all the measurements two times to make sure that I got them right.

If you are uncomfortable at any time, or if you want me to stop what I'm doing, please tell me and I will stop immediately. You do not have to do anything that you do not want to.

Scenario 2: Measuring an adolescent/adult

Hello Sir. My name is Sam and I would like to take some measurements of you. Can I explain to you what I want to do, and then you can tell me whether it is okay with you?

This is the scale that I will use to weigh you. I will ask you to take off your shoes and heavy clothes, so that you are wearing as little as possible when I weigh you.

I will use this height meter to measure how tall you are. You will stand on the platform here, and then I will move this piece to press against your head [show how the headpiece moves]. You will need to take of your shoes and hat when I measure your height.

I will use this measuring tape to measure around your upper arm. You will need to move the sleeve of your shirt out of the way for me, all the way up to your shoulder, or take the shirt off on that side. To make sure I measure in the right spot, I will have to use this pencil to make a little mark on your skin. It's a normal makeup pencil so it won't harm you skin, and it will clean off easily afterwards.

I will use this measuring tape to measure around your waist. I will need you to lift your shirt for me, and perhaps roll down your pants a little bit if they sit high on your waist. To make sure I measure in the right spot, I will have to use this pencil to make a little mark on your skin. It's a normal makeup pencil so it won't harm you skin, and it will clean off easily afterwards.

I will use this measuring tape to measure around your lower leg while you are sitting on this stool. You will need to move your trousers out of the way for me, all the way up to your knee.

I need to take all the measurements two times to make sure that I got them right.

If you are uncomfortable at any time, or if you want me to stop what I'm doing, please tell me and I will stop immediately. You do not have to do anything that you do not want to.

MODULE 5: General Guidelines for Measuring and Recording

Two people work together to take the anthropometric measurements:

- The anthropometrist makes sure that the participant is positioned correctly for the measurement and reads off the measurements.
- The anthropometrist assistant helps to hold the participant and the equipment in the correct position, lends a hand where needed, and writes down the measurements as the anthropometrist calls them out.

You need to work together as a team, the way you have been trained, to ensure that you get the best possible measurements.

Module 5.1: Which measurements must be taken in which participants?

Study protocols differ. The following measurements are very basic and are part of the NDIS-2022:

- The date of the assessment and the date of birth, which are used to calculate age (this is needed for us to be able to interpret the anthropometric measurements).
- Weight – in all participants.
- Length/height:
    - Length (lying down) – in children 0-24 months.
    - Height (standing up) – in everyone older than 24 months.
- Mid-upper arm circumference (MUAC) – in everyone aged three months and older.
- Calf circumference (CC) – in adults 18 years and older, including the elderly.
- Waist circumference (WC) – in secondary school learners (from age 13 years) and adults 18 years and older, including the elderly.

Table 5-1 summarises which measurements are done in whom.

TABLE 5-1: WHICH MEASUREMENTS IN WHICH PARTICIPANTS

Measurement	In whom?					
	0-3 months	3 months – 2 years	2-13 years	13-18 years	18+ years	Elderly
Date of birth and date of assessment	✓	✓	✓	✓	✓	✓
Weight	✓	✓	✓	✓	✓	✓
Length/height						
> Length (lying down)	✓	✓				
> Height (standing up)			✓	✓	✓	✓
Mid-upper arm circumference (MUAC)		✓	✓	✓	✓	✓
Calf circumference (CC)					✓	✓
Waist circumference (WC)				✓	✓	✓

Module 5.2: Data capturing

All measurements are recorded on the Anthropometry Data Capture Form (Annexure B) or using a suitable electronic data collection application.

On this form or on the electronic application, you will record:

- The date of assessment.
- The participant's date of birth.
    - If the person is not sure of the exact date of birth, try to at least get the year and month, or the person's age. The Road to Health booklet can also be consulted.
- The participant's sex (male/female).
- For every anthropometric measurement, record:
    - The measured value: you take each measurement twice, and record both values in the spaces labelled "1" and "2".
    - If you could not take the measurement, please record the reason why (e.g. "refused", "participant unable to stand" etc.) in the section provided.
    - If there is anything you think we should know, please write it down in the *"Comments"* section. This would include anything that may have influenced the accuracy of the measurements, for example "baby would not lie still".

If you are using the paper-based form, please make sure that you write clearly, so that the numbers are easy to read. Likewise, if you scratch anything out or make any corrections, please initial next to it so that we know it was an intentional change and not someone messing with the forms.

MODULE 6: Measuring Weight

Module 6.1: Measuring weight: 0-2 years old

Infants and young children up to the age of 2 years are weighed together with a parent/caregiver, using the tared weighing method. The same method can be used for a child older than 2 who does not stand still long enough for you to get an accurate reading if weighed by themselves. If you use this method for a child older than two, write *"tared weight"* in the comment section on the Anthropometry Data Capture Form or the electronic data collection application.

The instructions below refer specifically to the Seca 874 platform scale, but any platform scale with a tare function can be used.

1. Set up the scale.
    - Place the scale on a hard, flat, level floor surface.
    - Make sure the scale is level using the scale's built-in spirit level. Use the adjustable feet to level the scale if necessary.
2. Ask the parent/caregiver to help the child take off their clothes, so that the child is only wearing underwear.
    - Babies should be weighed naked and without a nappy. It may be a good idea to include some disposable nappies of known weight in your kit.
    - In some cases, the parent/caregiver may not be willing to let the child undress fully. If this is the case, you should make a note in the "comments" section of the Anthropometry Data Capture Form, e.g. *"child weighed wearing shorts and t-shirt, or: child weighed with nappy weighing xxx gram."*
3. Turn on the scale by pressing the "START" button, and make sure it is reading zero (0.00).
4. Ask the parent/caregiver to step onto the scale.
    - Ensure the parent/caregiver is standing with both feet fully on the platform of the scale, one foot to each side of the centre, and with their weight distributed equally on both feet.
    - You can record the parent/caregiver's weight now, so that you don't have to weigh them again later.
5. While the parent/caregiver is still standing on the scale, press the "2-in-1" button. Hold it in until the display shows "NET". Stop pressing the 2-in-1 button. The scale should read "0.00" again.
    - If you are using a different model of scale, the button may be labelled "zero" or "tare". Press the zero/tare button until the display reads "0.00".
6. When the scale reads zero, hand the child to the parent/caregiver. They should not step off the scale; you must hand the child to them.
7. Remind the parent/caregiver to remain standing with their weight equally distributed between both feet.
8. Wait for the number on the scale to stabilise (stop changing).

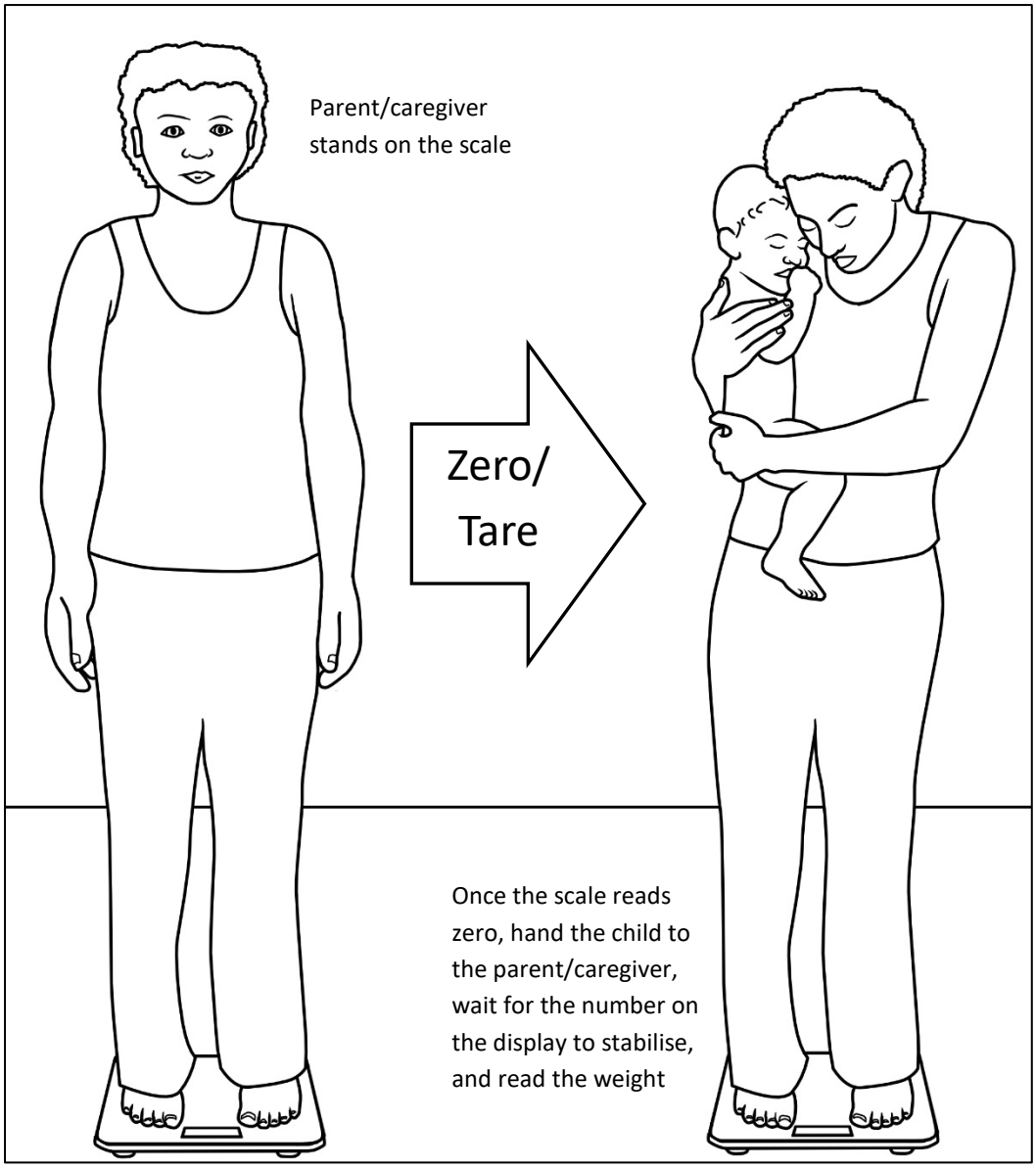


FIGURE 6-1: TARED WEIGHING OF INFANTS AND YOUNG CHILDREN

9. Record the weight on the Anthropometry Data Capture Form or the electronic app in the space next to "1". The anthropometrist calls out the value, and the assistant writes it down.
10. Repeat the measurement.
    - Ask the parent/caregiver to step off the scale.
    - Turn the scale off and on again so that it reads zero.
    - Repeat the entire weighing process.
    - Record the weight on the Anthropometry Data Capture Form or the electronic app in the space next to "2".
11. Thank the parent/caregiver and the child. Allow them to put the child's clothes back on, but ask them to leave the left arm free for the MUAC measurement. Do not let them put their shoes on until you have measured their length.
12. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

Module 6.2: Measuring weight: 2-5 years old

Children older than two years (24 months) are weighed standing up, using a platform scale.

1. Set up the scale.
    - Place the scale on a hard, flat, level floor surface.
    - Check that the scale is level using the scale's built-in spirit level. Use the adjustable feet to level the scale if necessary.
2. Ask the parent/caregiver to help the child take off their clothes, so that the child is only wearing underwear.
    - It is important to remove the child's shoes.
    - In some cases, the parent/caregiver may not be willing to let the child undress fully. If this is the case, you should make a note in the "comments" section of the Anthropometry Data Capture Form, e.g. *"child weighed wearing shorts and t-shirt."*
3. Turn on the scale by pressing the "START" button, and make sure it is reading zero (0.00).
4. Ask the child to step onto the scale.
    - Position the child so that both feet are fully on the platform of the scale, one foot to each side of the centre, with the weight equally distributed on both feet (Figure 6-2).

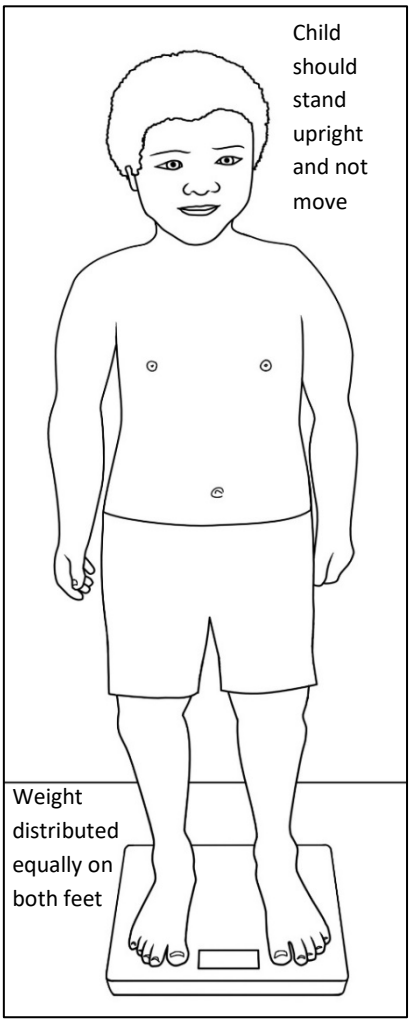


FIGURE 6-2: WEIGHING A CHILD AGED 2-5 YEARS

5. Wait for the number on the scale to stabilise (stop changing).
6. Record the weight on the Anthropometry Data Capture Form or the electronic app in the space next to “1”. The anthropometrist calls out the value, and the assistant writes it down.
7. Repeat the measurement.
    - Ask the child to step off the scale.
    - Turn the scale off and on again so that it reads zero.
    - Weigh the child again.
    - Record the weight on the Anthropometry Data Capture Form or the electronic app in the space next to “2”.
8. Thank the parent/caregiver and the child. Allow them to put their clothes back on, but ask them to leave the left arm free for the MUAC measurement. Do not let them put their shoes on until you have measured their height.
9. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

Module 6.3: Measuring weight: older children (5+ years), adolescents and adults

Everyone older than 5 years – children, adolescents, adults and the elderly – is weighed standing upright, using a platform scale.

1. Set up the scale.
    - Place the scale on a hard, flat, level floor surface.
    - Make sure the scale is level using the scale's built-in spirit level. Use the adjustable feet to level the scale if necessary.
2. Ask the person to take off shoes and outer clothing. Ideally, they should be wearing only light clothing, e.g. shorts and a vest.
3. Turn on the scale by pressing the "START" button, and make sure it is reading zero (0.0).
4. Ask the person to step onto the scale.
    - Ensure they are standing with both feet fully on the platform of the scale, one foot to each side of the centre, and their weight distributed equally on both feet (Figure 6-3).

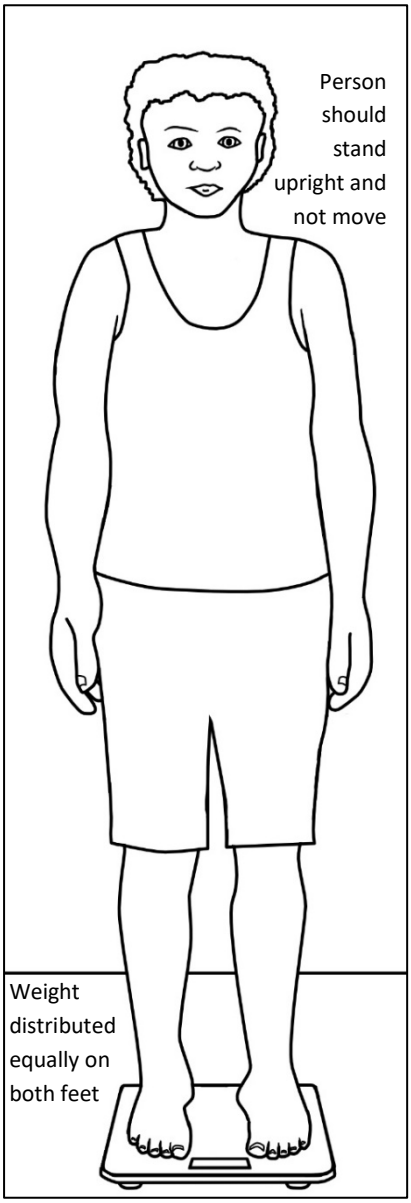


FIGURE 6-3: WEIGHING AN ADOLESCENT OR ADULT

5. Wait for the number on the scale to stabilise (stop changing).
6. Record the weight on the Anthropometry Data Capture Form or the electronic app in the space next to “1”. The anthropometrist calls out the value, and the assistant writes it down.
7. Repeat the measurement.
    - Ask the person to step off the scale.
    - Turn the scale off and on again so that it reads zero.
    - Ask the person to step back onto the scale, and read the weight again.
    - Record the weight on the Anthropometry Data Capture Form or the electronic app in the space next to “2”.
8. Thank the person, and ask them to remain in their light clothing until the other measurements have been completed.
9. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

MODULE 7: Measuring Length/Height

Module 7.1: Measuring length: 0-2 years old

All children up to the age of 2 years (24 months) are measured lying down. Children aged 2-3 years who will not stand still to have their height measured standing up can also be measured lying down, but this should be clearly indicated on the data collection form. It may not seem important, but it makes a difference in how the measurement is interpreted.

1. Place the length board down on a hard, flat, level surface, such as the floor or a sturdy table.
2. If the baby is not already undressed, ask the parent/caregiver to remove any bulky clothes.
    - The baby can wear a light shirt and a dry disposable nappy.
    - Shoes and socks must be removed.
    - Headwear, such as hats and hair ornaments, must be removed.
3. Position the baby on the length board (Figure 7-1):
    - Position baby with their head against the fixed panel of the length board, lying on their back, with their body straight along the length board.

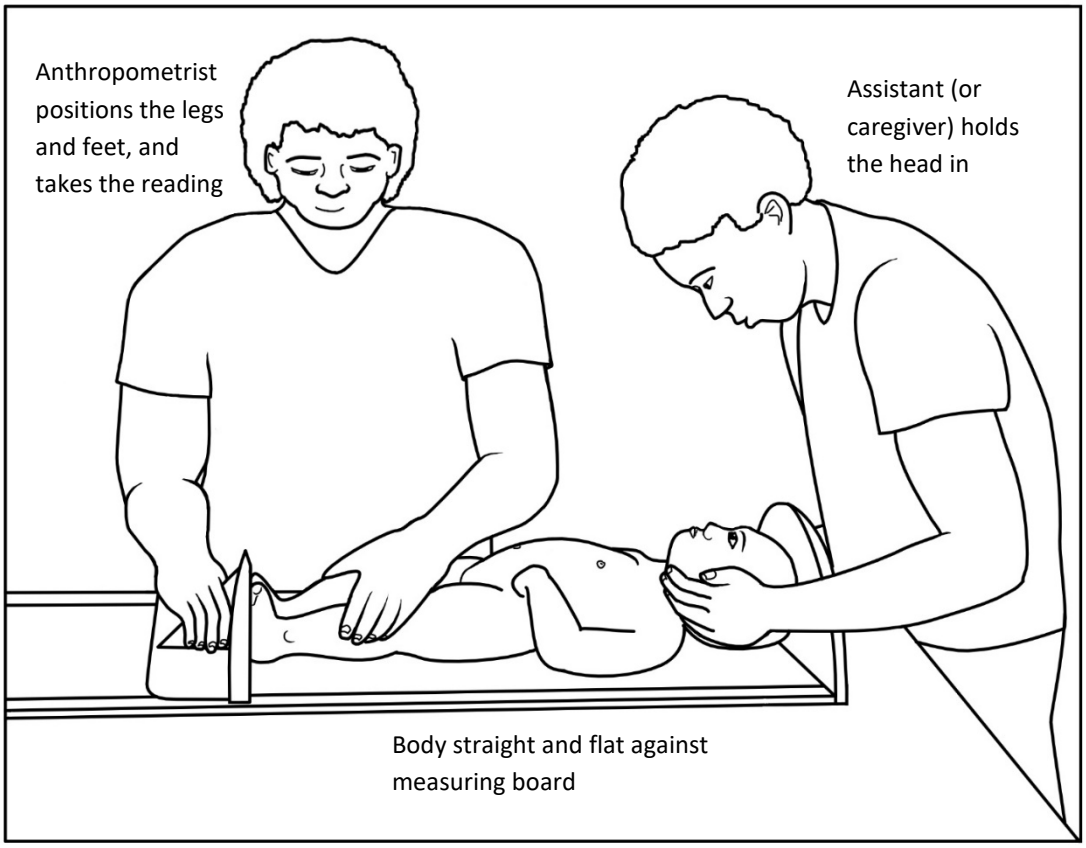


FIGURE 7-1: POSITIONING A BABY TO MEASURE LENGTH

4. Place baby's head in the correct position (Figure 7-2):
    - Baby should be looking straight up: the Frankfort plane (an imaginary line drawn from the lowest edge of the bony eye socket to the top of the ear opening) should be at a right angle to the measuring board, and parallel to the fixed headpiece.
    - The crown of the baby's skull must be pressed against the headpiece. If the baby's hairstyle makes this impossible, follow the instructions in Box 7-1 at the end of this section.
    - The assistant (or the caregiver if that makes the baby calmer) holds the baby's head: stand at the head of the length board, with one hand on each of the baby's ears, and look down on the baby directly from above to make sure the head is positioned correctly.

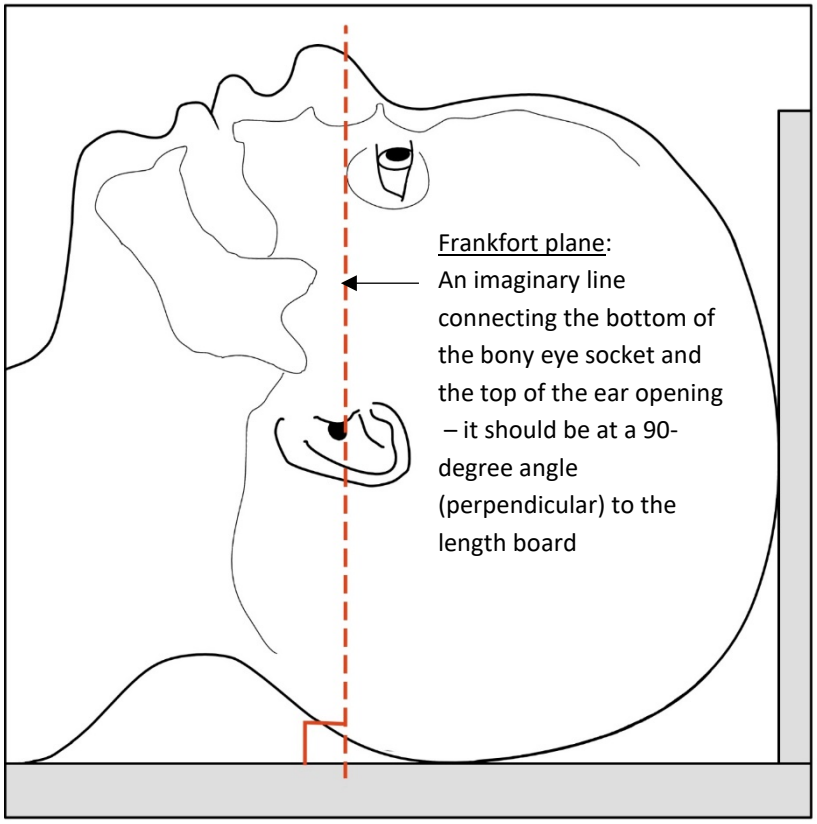


FIGURE 7-2: CORRECT POSITION OF THE HEAD WHEN MEASURING LENGTH

5. Make sure the baby's neck, body and legs are all straight. If the baby is squirming, you can ask the parent/caregiver to place a hand on their tummy to calm them down. The caregiver then stands on the opposite side of the length board .
6. The anthropometrist positions the baby's legs (Figure 7-3):
    - Straighten both legs, and use one hand to hold the legs together.
    - Press down gently to flatten the legs against the length board (but be careful not to hurt the baby – very young babies' legs may not be able to straighten completely).

7. Use the hand not holding the baby's legs down to slide the moveable foot piece up to meet the baby's feet (Figure 7-3).
    - Slide the foot piece until the soles of the baby's feet are completely flat against the board from heel to toe.
    - Baby's toes should be pointing up. Tickling the baby under the foot may help.

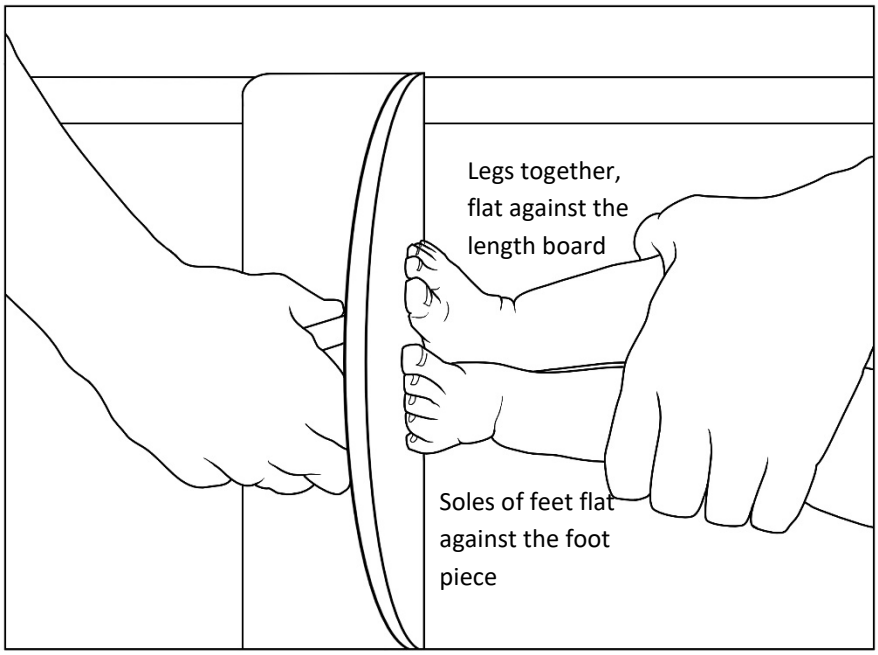


FIGURE 7-3: POSITIONING THE LEGS AND FEET FOR LENGTH MEASUREMENT

8. Read the measurement on the measuring tape of the length board.
    - Read the measurement along the same edge of the foot piece as the child's feet are pressed against.
    - Make sure your eye is directly above the edge of the foot piece when you read the measurement, otherwise it is easy to read it wrong. Figure 7-4 illustrates this.

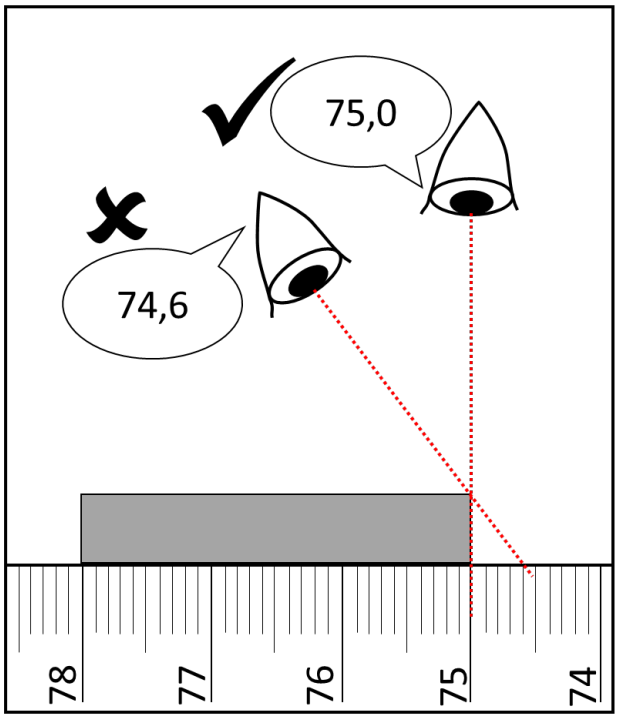


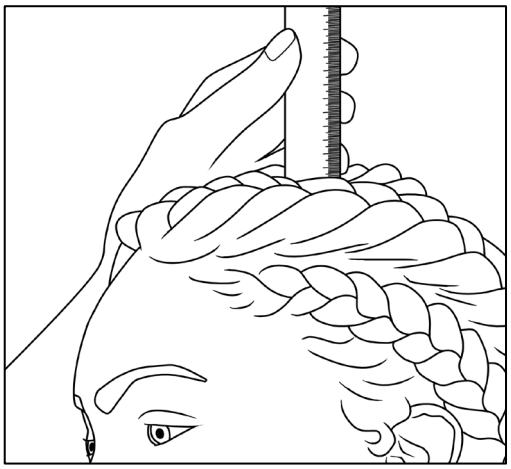
FIGURE 7-4: CORRECT EYE POSITION FOR READING LENGTH MEASUREMENTS

9. Record the length on the Anthropometry Data Capture Form or the electronic app in the space next to “1”. The anthropometrist calls out the value, and the assistant writes it down.
    - Remember to check the box labelled “lying down”.
    - Record length in centimetres, to one decimal place; for example 77.2 cm.
10. Remove the baby from the length board and repeat the measurement.
    - Record the second length measurement on the Anthropometry Data Capture Form or the electronic app in the space next to “2”.
    - Record length in centimetres, to one decimal value.
11. Thank the parent/caregiver and allow them to dress the baby in light clothing that still leaves the left arm free for the MUAC measurement.
12. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

BOX 7-1: WHAT TO DO IN CASE OF INCOMPRESSIBLE HAIRSTYLES

If a baby has a hairstyle that cannot be removed or compressed (e.g. thick braids), it will influence the length measurement and make the baby seem taller than they really are.

- When you measure the baby’s length, press the top of the hair against the measuring board.
- Afterwards, ask the parent/caregiver to hold the baby upright, and use a ruler to measure the thickness of the hairstyle at the point where the baby’s head touched the headpiece of the length board.
- Record this measurement clearly on the Anthropometry Data Capture Form or the electronic app in the comments section, e.g. *“incompressible hairstyle: 6mm”*. The extra length will be subtracted when the data are processed.



Module 7.2: Measuring height: 2-5 years old

Children older than 2 years (24 months) are measured standing up.

(Note: Children aged 2-3 years who will not stand still to have their height measured standing up can be measured lying down, but this should be clearly indicated on the Anthropometry Data Capture Form or the electronic app. It may not seem important, but it makes a difference in how the measurement is interpreted.)

1. Set the height meter down on a hard, flat, level floor surface.
2. Ask the parent/caregiver to help the child remove any bulky clothing, such as thick jackets.
    - Shoes and socks must be removed.
    - Headwear, such as hats and hair ornaments, must be removed.
3. Ask the child to step on to the foot piece of the length meter, with their back to the measuring board.
4. Starting from the feet and moving upwards, position the child correctly (Figure 7-5):
    - Both feet must be on the platform, with the heels touching the measuring board.
    - Ask the child to put their feet and knees together.
        - Some children may only be able to have their knees touching but not their feet, or may only be able to bring their feet together but not their knees. This is acceptable, as long as one of the two (feet or knees) is touching.
    - Ask the child to stand up tall so that their heels, buttocks, shoulders and head all touch the measuring board.

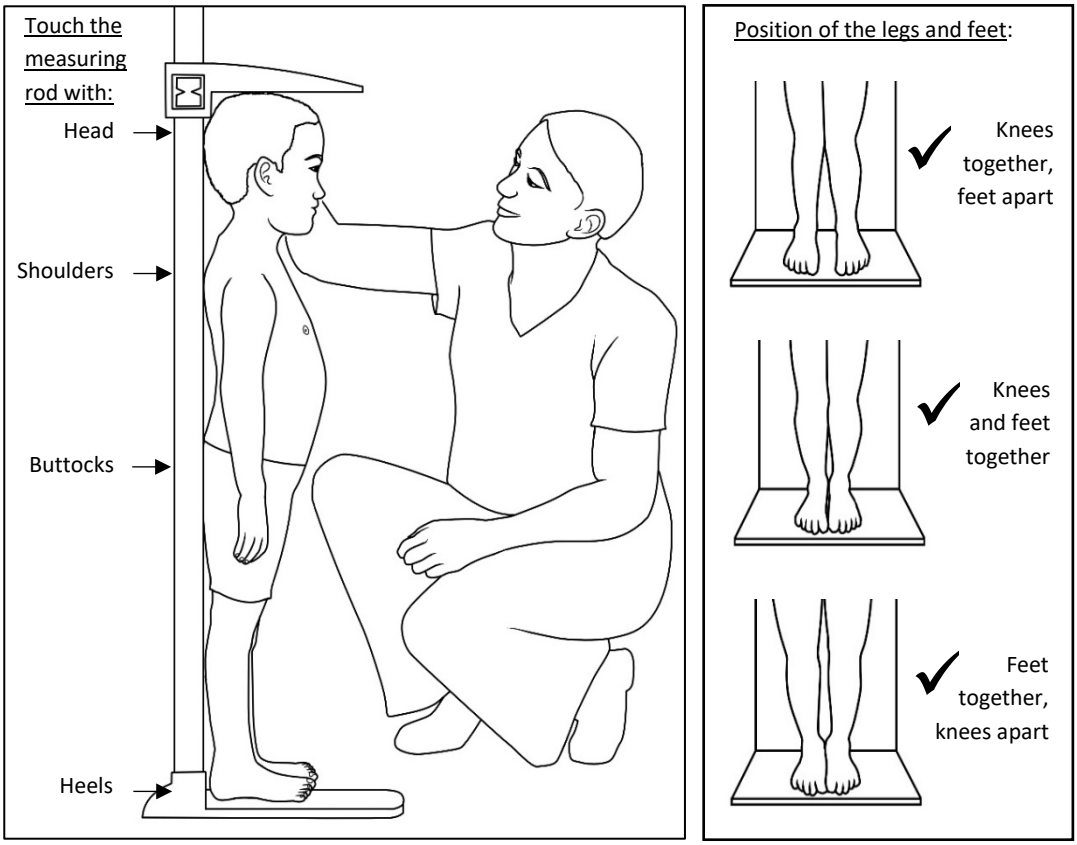


FIGURE 7-5: CORRECT POSITION OF THE BODY, LEGS AND FEET FOR HEIGHT MEASUREMENT

5. Position the child's head (Figure 7-6):
    - You should crouch down so that your eyes are at the level of the child's head.
    - Ask the child to look straight ahead.
    - Tilt the head so that the Frankfort plane (an imaginary line drawn from the lowest edge of the bony eye socket to the top of the ear opening) is parallel to the floor, and at a right angle to the measuring board.
    - Slide the headpiece down onto the crown of the child's head. Press down hard enough to compress the hair, so that the headpiece is resting against the skull. If the child's hairstyle makes this impossible, follow the instructions in Box 7-2 at the end of this section .

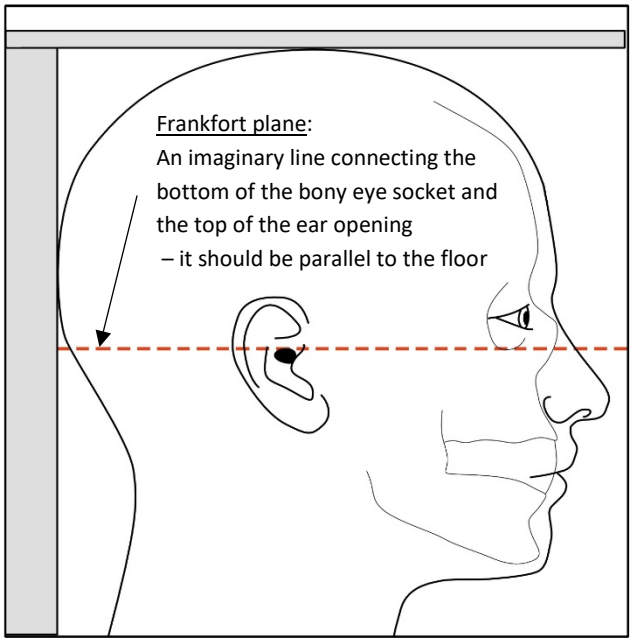


FIGURE 7-6: CORRECT POSITION OF THE HEAD WHEN MEASURING HEIGHT

6. Do a final check to see that the child is still standing straight before you take the reading.

7. Read the measurement on the measuring tape of the height meter.
    - Read the measurement at the indicator arrow.
    - Make sure your eye is directly in front of the indicator arrow when you read the measurement. Otherwise, it is easy to read it wrong, as shown in Figure 7-7.

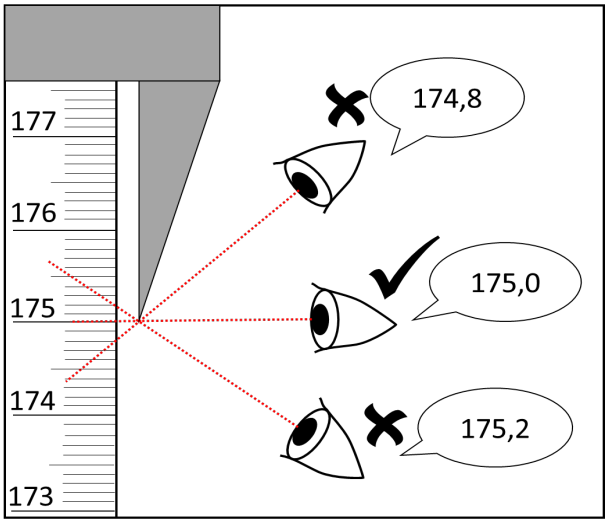


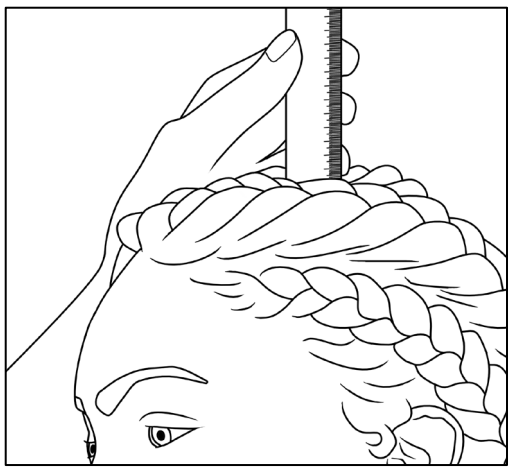
FIGURE 7-7: CORRECT EYE POSITION FOR READING HEIGHT

8. Record the length on the Anthropometry Data Capture Form or the electronic app in the space next to “1”. The anthropometrist calls out the value, and the assistant writes it down.
    - Remember to check the box labelled “standing up”.
    - Record height in centimetres, to one decimal place; for example 107.2 cm.
9. Ask the child to step off the height meter.
10. Repeat the measurement.
    - Record the second length measurement on the Anthropometry Data Capture Form or the electronic app in the space next to “2”.
11. Thank the parent/caregiver and the child, allow them to dress in light clothing that still leaves the left arm free for the MUAC measurement.
12. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

BOX 7-2: WHAT TO DO IN CASE OF INCOMPRESSIBLE HAIRSTYLES

If a child has a hairstyle that cannot be removed or compressed (e.g. braids), it will influence the length measurement and make the child seem taller than they really are.

- When you measure the child’s height, press the headpiece against the top of the hair.
- Afterwards, use a ruler to measure the thickness of the hairstyle at the point where the headpiece touched the child’s head.
- Record this measurement clearly on the Anthropometry Data Capture Form or the electronic app in the comments section, e.g. *“incompressible hairstyle: 6mm”*. The extra length will be subtracted when the data is processed.



Module 7.3: Measuring height: older children (5+ years), adolescent and adults

For everyone older than 5 years – children, adolescents, adults and the elderly – height is measured standing up.

1. Place the height meter down on a hard, flat, level floor surface.
2. Ask the participant to remove any bulky clothing, such as thick jackets.
    - Shoes and socks must be removed.
    - Headwear, such as hats and hair ornaments, must be removed.
3. Ask the person to step onto the footpiece of the height meter, with their back to the measuring rod.
4. Ask the person to put their feet and knees together. If a participant cannot do both at the same time, this is acceptable, as long as either the feet or the knees are touching (Figure 7-8).
5. Ask the person to stand up tall.
    - In the case of children, their heels, buttocks, shoulders and head should all touch the measuring board.
    - In adults, make sure that the buttocks are touching the measuring board. Then, position the feet and shoulders so that an imaginary line running from the back of the shoulder to the back of the heel is at a right angle to the floor, parallel to the measuring board. For many adults, this will mean that the heels do not touch the back of the measuring board (Figure 7-8).

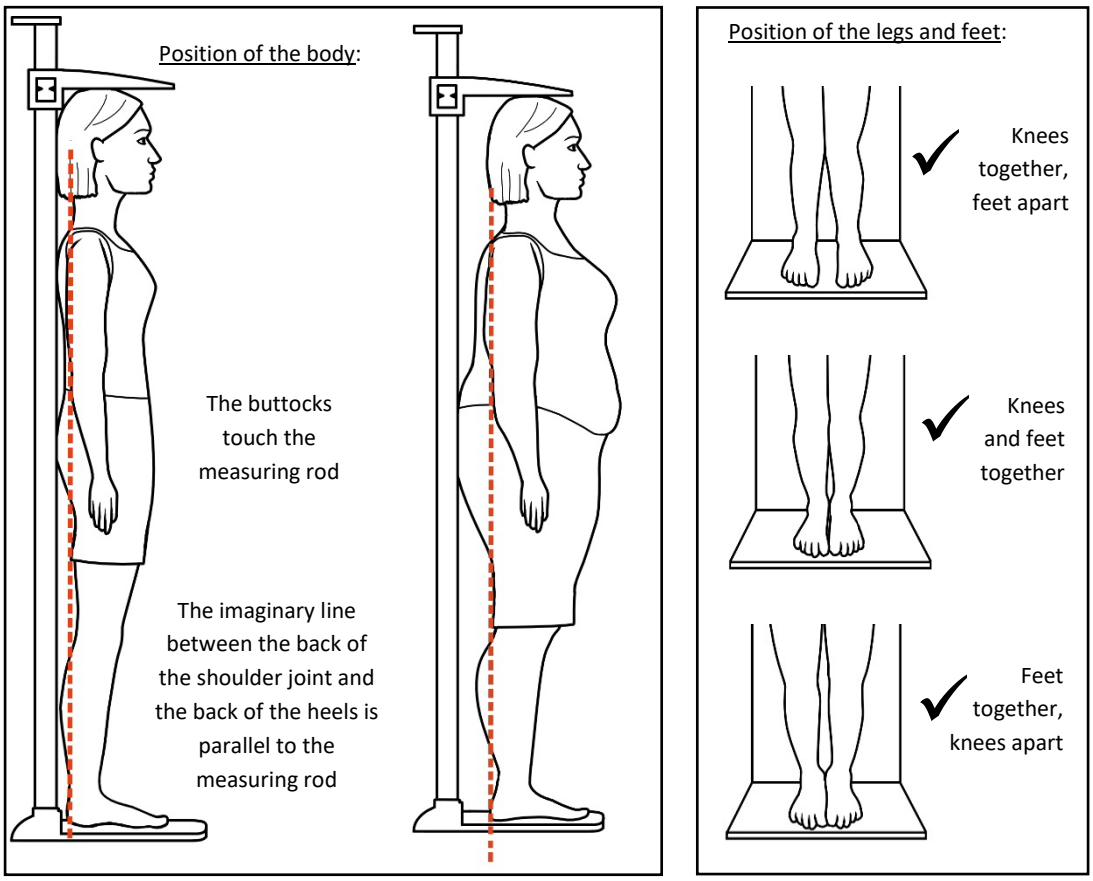


FIGURE 7-8: CORRECT POSITION OF THE BODY, LEGS AND FEET FOR HEIGHT MEASUREMENT

6. Position the person's head (Figure 7-9):
    - Ask the person to look straight ahead.
    - Tilt the head so that the Frankfort plane (an imaginary line drawn from the lowest edge of the bony eye socket to the top of the ear opening) is parallel to the floor, and at a right angle to the measuring board.
    - Slide the headpiece down onto the crown of the person's head. Press down hard enough to compress the hair, so that the headpiece is resting against the skull. If the person's hairstyle makes this impossible, follow the instructions in Box 7-3 at the end of this section.

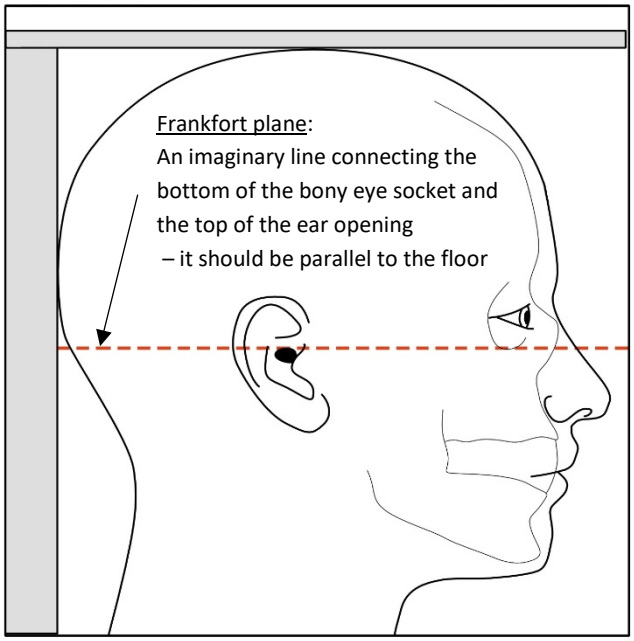


FIGURE 7-9: CORRECT POSITION OF THE HEAD WHEN MEASURING HEIGHT

7. Do a final check to see that the person is still standing straight before you take the reading.

8. Read the measurement on the measuring tape of the height meter.
    - Read the measurement at the indicator arrow.
    - Make sure your eye is directly in front of the indicator arrow when you take the reading. Otherwise, it is easy to read it wrong, as shown in Figure 7-10.

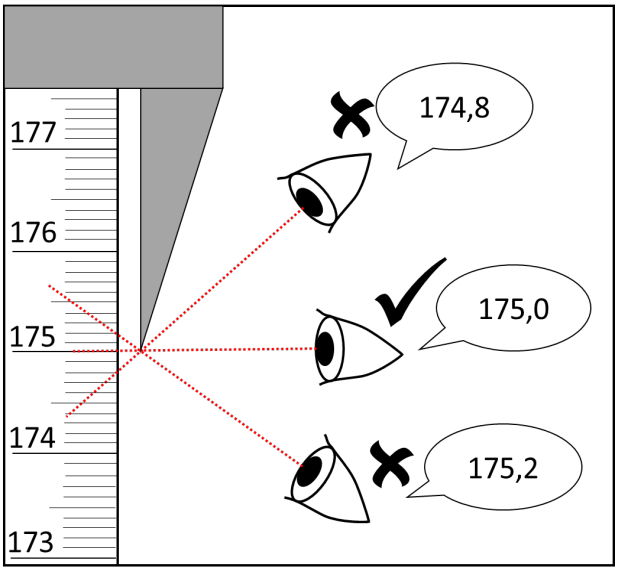


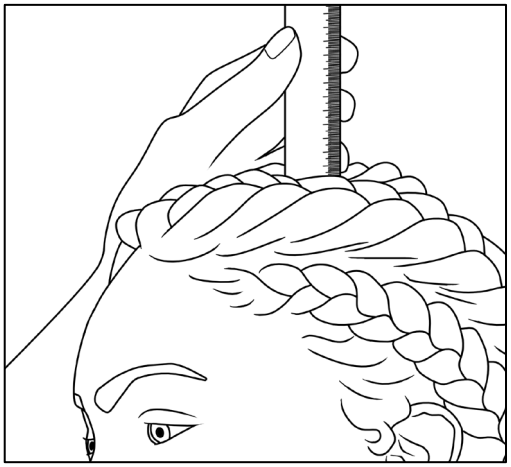
FIGURE 7-10: CORRECT EYE POSITION FOR READING HEIGHT

9. Record the length on the Anthropometry Data Capture Form or the electronic app in the space next to “1”. The anthropometrist calls out the value, and the assistant writes it down.
    - Remember to check the box labelled “standing up”.
    - Record height in centimetres, to one decimal place; for example 157.2 cm.
10. Ask the person to step off the height meter.
11. Repeat the measurement.
    - Record the second length measurement on the Anthropometry Data Capture Form or the electronic app in the space next to “2”.
12. Thank the person and allow them to dress in light clothing that still leaves the left arm free for the MUAC measurement.
13. Check that the measurements are recorded clearly and legibly. Both, the anthropometrist and the assistant, should check the form.

BOX 7-3: WHAT TO DO IN CASE OF INCOMPRESSIBLE HAIRSTYLES

If a person has a hairstyle that cannot be removed or compressed (e.g. braids), it will influence the length measurement and make the person seem taller than they really are.

- When you measure the child’s height, press the headpiece against the top of the hair.
- Afterwards, use a ruler to measure the thickness of the hairstyle at the point where the headpiece touched the child’s head.
- Record this measurement clearly on the Anthropometry Data Capture Form or the electronic app in the comments section, e.g. *“incompressible hairstyle: 6mm”*. The extra length will be subtracted when the data is processed.



MODULE 8: Measuring Mid-Upper Arm Circumference (MUAC)

Module 8.1: Measuring MUAC: 0-2 years old

The MUAC is only measured from the age of 3 months onwards.

The MUAC is measured on the LEFT arm using a colour-coded MUAC tape (Figure 8-1).

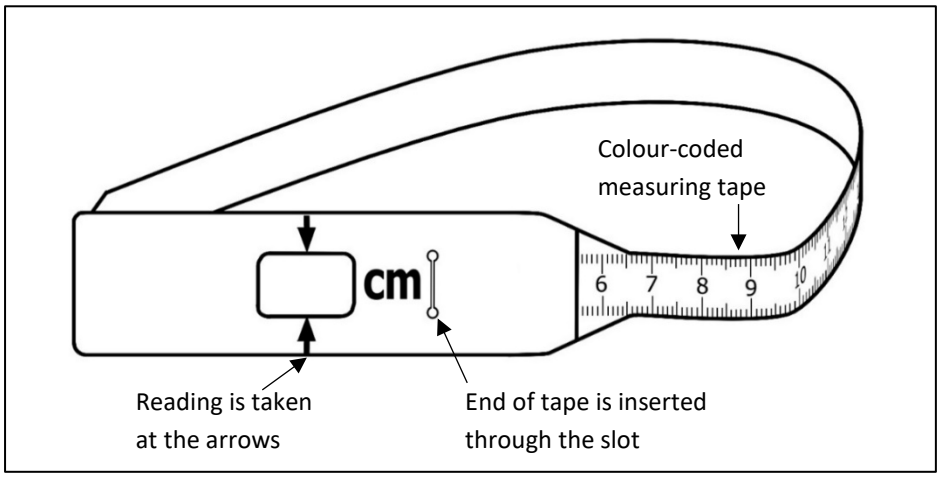


FIGURE 8-1: MUAC INSERTION TAPE FOR CHILDREN UNDER 5

1. Ask the parent/caregiver to uncover the baby's arm all the way up to the shoulder. The easiest way to do this is to remove the arm from the sleeve of the shirt.
2. Let the baby sit upright on the parent/caregiver's lap. Position the chair and the participants so that you can easily access the baby's left arm.

3. Find the midpoint of the upper arm using a regular dressmaker's tape measure, as described below and shown in Figure 8-2:

   To find the midpoint:

   - The assistant holds the baby's arm in a bent position, with the upper arm at a right angle to the floor, the lower arm parallel to the floor (in other words, the elbow is bent at 90 degrees), and the palm of the baby's hand is facing up.
   - Find the upper reference point: feel for the acromion process of the scapula; that is, the furthest sideways bony point of the shoulder blade on the shoulder joint. Mark it with a cosmetic pencil.
   - Find the lower reference point: feel for the olecranon of the ulna; that is, the lowest bony edge of the elbow that forms part of the bone of the forearm. Mark the point with a cosmetic pencil.
   - Place your tape measure with the zero end on the shoulder point, and measure the distance between the two points on the side of the body. Divide the distance by two: this is the midpoint.
     - The electronic data collection application should have a built-in function to calculate the midpoint.
     - An alternative (but less accurate) method is described in Box 8-1 (next page).

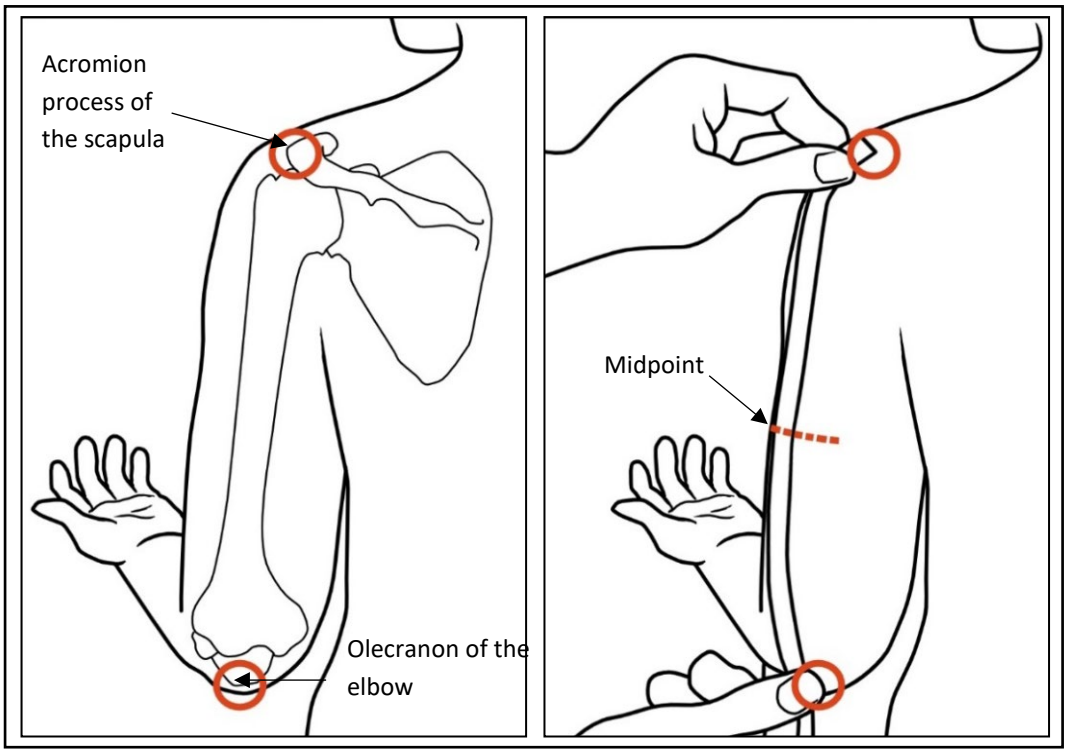


FIGURE 8-2: FINDING THE CORRECT SITE FOR MEASURING MUAC

   - Mark the midpoint with the cosmetic pencil.

BOX 8-1: AN ALTERNATIVE METHOD FOR FINDING THE MIDPOINT

The "fold in half" method may be useful for anthropometrists who struggle with mental arithmetic – but it can only be done with dressmaker's measuring tapes.

- Secure the tape with the small finger of your left hand at the acromion process and flatten it with your thumb along the side of the participant's arm.
- Use your right hand to "mark" the exact position of the olecranon on the tape measure, and then fold the tape in half, bringing the acromion and the olecranon markings together.
- Press the two sides of the measuring tape against each other and mark the midpoint at the fold.

Whilst this method eliminates the arithmetic, it requires considerable finger skills and practice. It is not advised for studies where quality equipment and standardised techniques are of core importance.

4. Let the baby relax their arm.
5. Take the measurement:
    - The baby's arm should now be hanging loosely down while the measurement is taken. If necessary, the assistant can gently hold the arm straight.
    - Place the MUAC tape around the baby's arm at the midpoint that you marked. The tape should be at a right angle to the long bone of the arm.
    - Thread the end of the tape through the slit in the MUAC tape (Figure 8-3).

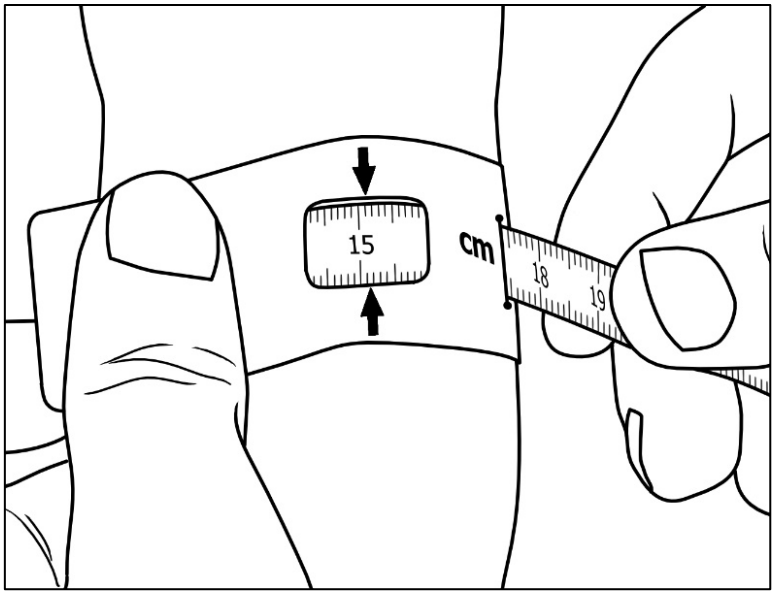


FIGURE 8-3: POSITIONING THE MUAC TAPE

- Pull the tape snug. Be careful not to pull it too tight, so that it compresses the arm, or to leave it too loose.

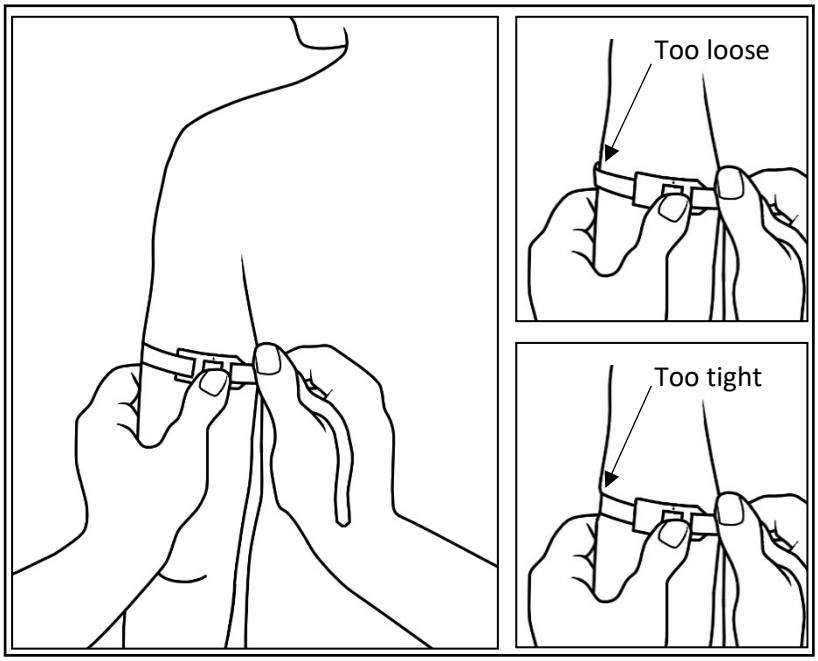


FIGURE 8-4: TAKING THE MUAC MEASUREMENT

6. Read the measurement at the arrow indicator (Figure 8-3).
7. Record the MUAC on the Anthropometry Data Capture Form or the electronic app in the space next to "1".
    - The anthropometrist calls out the value, and the assistant writes it down.
    - Record MUAC in centimetres, to one decimal place; for example 14.2 cm.
8. Remove the MUAC tape and repeat the measurement.
    - Record the second MUAC measurement on the Anthropometry Data Capture Form or the electronic app in the space next to "2".
9. Thank the parent/caregiver and allow them to dress the baby.
10. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

IMPORTANT!!

If a child between 6 months and 5 years old has a MUAC that falls in the yellow or red sections of the tape, refer the child to their local clinic, as they may be underweight or ill.

Module 8.2: Measuring MUAC: 2-5 years old

The MUAC is measured for all children aged 2-5 years.

MUAC is measured on the LEFT arm using a colour-coded MUAC tape (Figure 8-5).

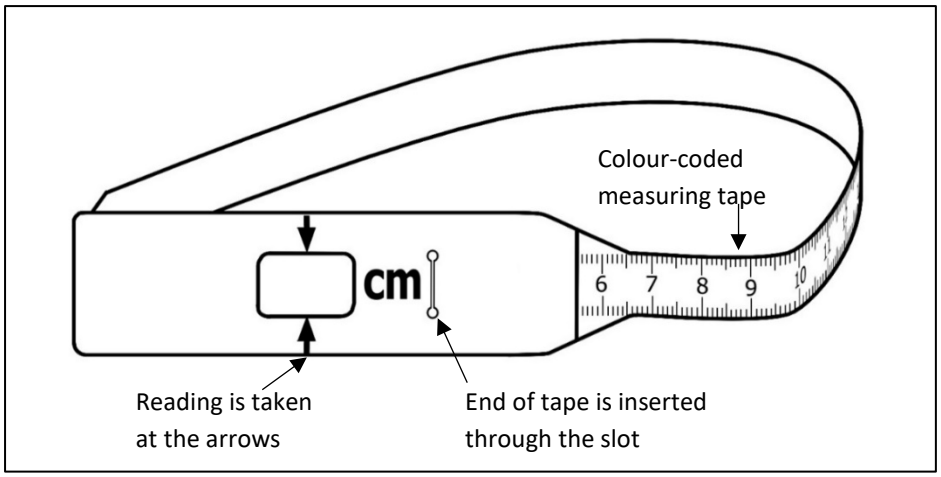


FIGURE 8-5: MUAC INSERTION TAPE FOR CHILDREN UNDER 5

1. Ask the parent/caregiver to help the child uncover their arm all the way up to the shoulder. The easiest way to do this is to remove the arm from the sleeve of the shirt.
2. Let the child stand comfortably. If the child is restless, they can sit upright on the parent/caregiver's lap. Position the chair or stool from the outset such that you can easily access the left arm of the child.

3. Find the midpoint of the upper arm using a regular dressmaker's tape measure, as described below and shown in (Figure 8-6):
    - Ask the child to hold their arm in a bent position, with the upper arm at a right angle to the floor, the lower arm parallel to the floor (in other words, the elbow is bent at 90 degrees), and the palm of the child's hand is facing up. The assistant should hold the arm in position.
    - Find the upper reference point: feel for the acromion process of the scapula; that is, the furthest bony point of the shoulder blade on the shoulder joint. Mark it with a cosmetic pencil.
    - Find the lower reference point: feel for the olecranon of the ulna; that is, the lowest bony edge of the elbow that forms part of the bone of the forearm. Mark the point with a cosmetic pencil.
    - Place your tape measure with the zero end on the shoulder point, and measure the distance between the two points on the side of the body. Divide the distance by two: this is the midpoint.
        - The electronic data collection application should have a built-in function to calculate the midpoint.
        - An alternative (but less accurate) method is described in Box 8-2.

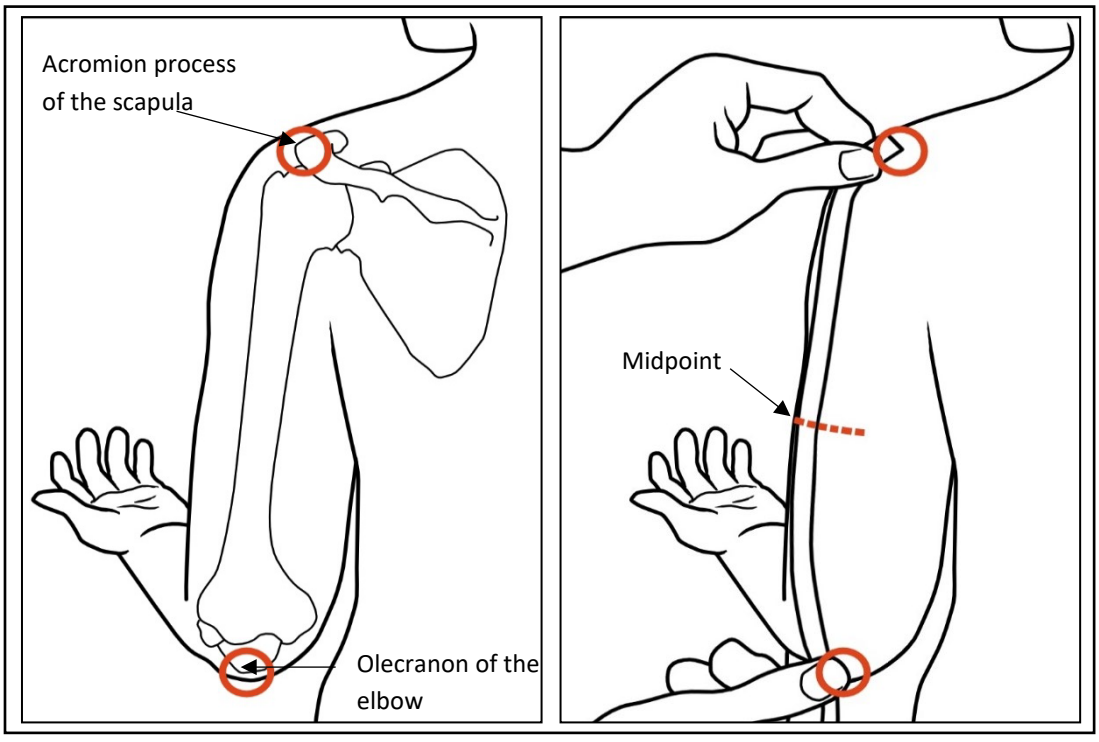


FIGURE 8-6: FINDING THE CORRECT SITE FOR MEASURING MUAC

- Mark the midpoint with the cosmetic pencil.

BOX 8-2: AN ALTERNATIVE METHOD FOR FINDING THE MIDPOINT

The "fold in half" method may be useful for anthropometrists who struggle with mental arithmetic – but it can only be done with dressmaker's measuring tapes.

- Secure the tape with the small finger of your left hand at the acromion process and flatten it with your thumb along the side of the participant's arm.
- Use your right hand to "mark" the exact position of the olecranon on the tape measure, and then fold the tape in half, bringing the acromion and the olecranon markings together.
- Press the two sides of the measuring tape against each other and mark the midpoint at the fold.

Whilst this method eliminates the arithmetic, it requires considerable finger skills and practice. It is not advised for studies where quality equipment and standardised techniques are of core importance.

4. Let the child relax their arm.
5. Take the measurement:
    - The child's arm should be hanging straight down while the measurement is taken. If necessary, the assistant can gently hold the arm straight.
    - Place the MUAC tape around the child's arm at the midpoint that you marked. The tape should be at a right angle to the long bone of the arm.
    - Thread the end of the tape through the slit in the MUAC tape (Figure 8-7).

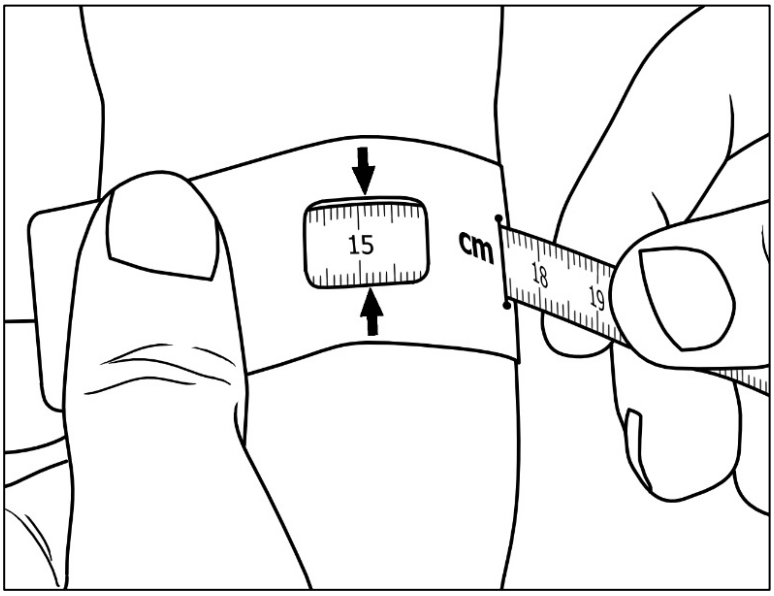


FIGURE 8-7: POSITIONING THE MUAC TAPE

- Pull the tape snug. Be careful not to pull it too tight, so that it compresses the arm, or to leave it too loose (Figure 8-8).

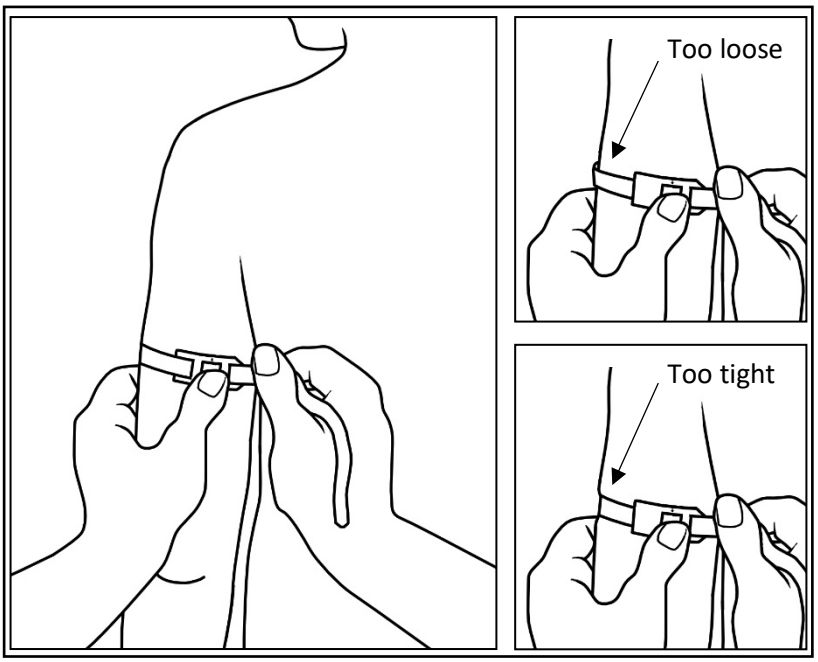


FIGURE 8-8: TAKING THE MUAC MEASUREMENT

6. Read the measurement at the arrow indicator (Figure 8-7).
7. Record the MUAC on the Anthropometry Data Capture Form or the electronic app in the space next to "1".
    - The anthropometrist calls out the value, and the assistant writes it down.
    - Record MUAC in centimetres, to one decimal place; for example 16.2 cm.
8. Remove the MUAC tape and repeat the measurement.
    - Record the second MUAC measurement on the Anthropometry Data Capture Form or the electronic app in the space next to "2".
9. Thank the parent/caregiver and the child, and allow them to get dressed.
10. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

IMPORTANT!!

If a child between 6 months and 5 years old has a MUAC that falls in the yellow or red sections of the tape, refer the child to their local clinic, as they may be underweight or ill.

Module 8.3: Measuring MUAC: older children (5+ years), adolescents and adults

The MUAC is measured for all children over the age of 5 years, adolescents, adults and the elderly.

The MUAC is measured on the LEFT arm using a spring-wound measuring tape (Figure 8-9).

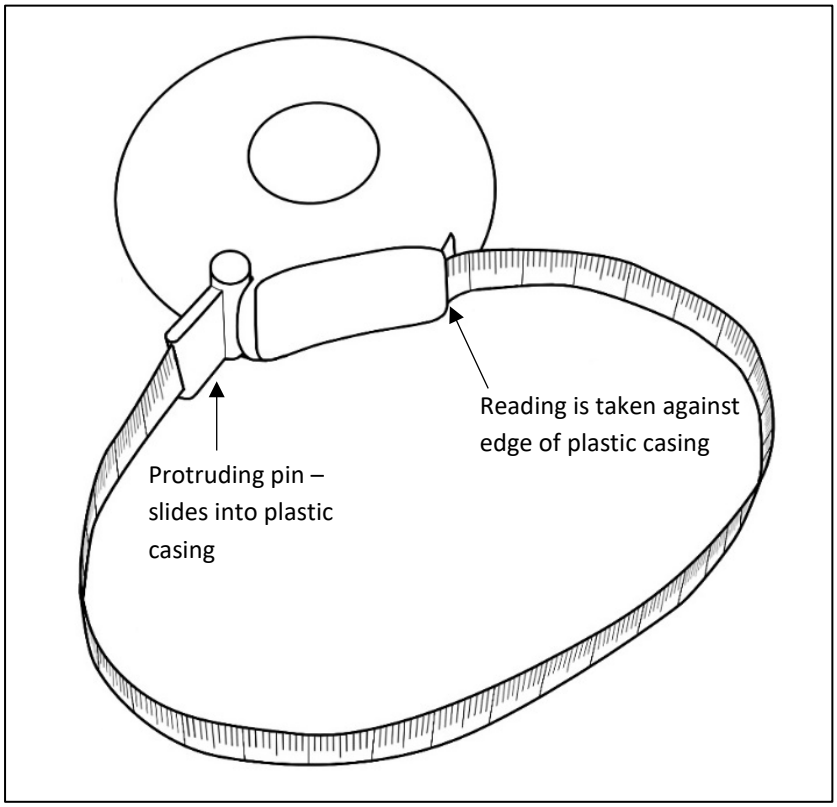


FIGURE 8-9: SPRING-WOUND MEASURING TAPE (SECA 201)

1. Ask the person to uncover their arm all the way up to the shoulder. The easiest way to do this is to remove the arm from the sleeve of the shirt.
2. Ask the person to stand comfortably, in a position that allows you to easily access their left arm.

3. Find the midpoint of the arm using a regular dressmakers' measuring tape, as described below and shown in Figure 8-10:
    - Ask the person to hold their arm in a bent position, with the upper arm at a right angle to the floor, the lower arm parallel to the floor (in other words, the elbow is bent at 90 degrees), and the palm of the person's hand is facing up. The assistant should hold the arm in position.
    - Find the upper reference point: feel for the acromion process of the scapula; that is, the furthest bony point of the shoulder blade on the shoulder joint. Mark it with a cosmetic pencil.
    - Find the lower reference point: feel for the olecranon of the ulna; that is, the lowest bony edge of the elbow that forms part of the bone of the forearm. Mark the point with a cosmetic pencil.
    - Place your tape measure with the zero end on the shoulder point, and measure the distance between the two points on the side of the body. Divide the distance by two: this is the midpoint.
        - The electronic data collection application should have a built-in function to calculate the midpoint.
        - An alternative (but less accurate) method is described in Box 8-3.

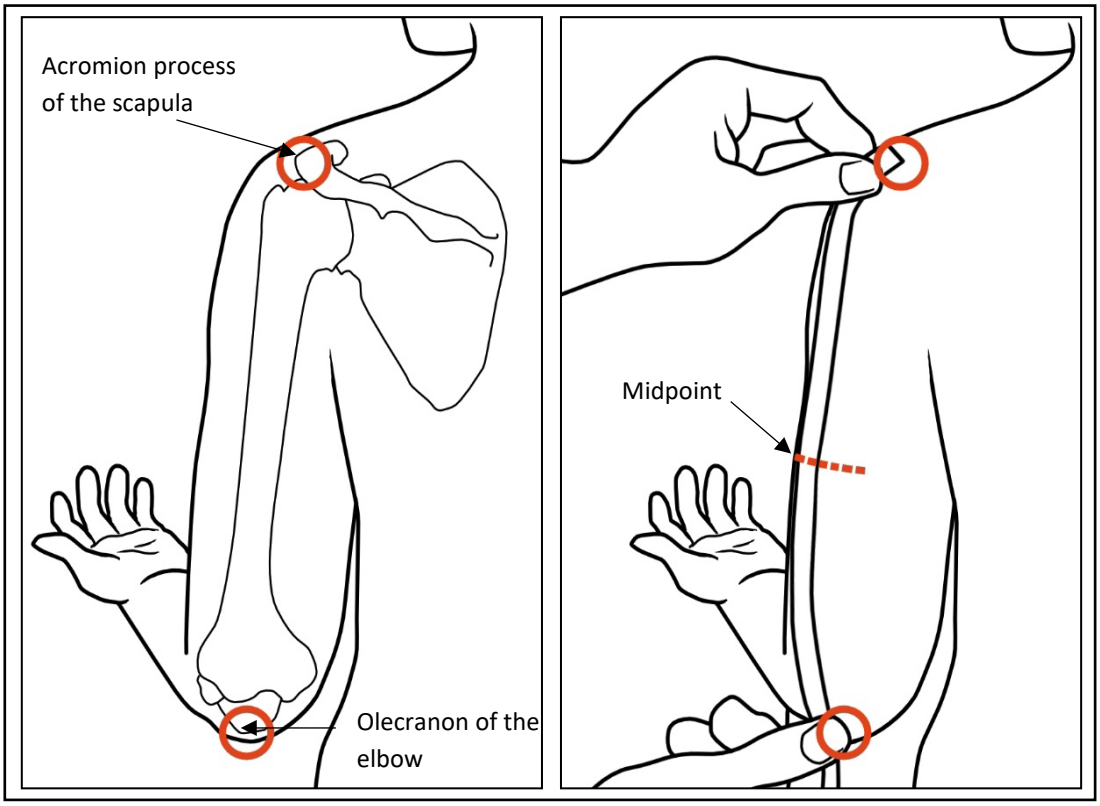


FIGURE 8-10: FINDING THE CORRECT SITE FOR MEASURING MUAC

- Mark the midpoint with the cosmetic pencil.

BOX 8-3: AN ALTERNATIVE METHOD FOR FINDING THE MIDPOINT

The "fold in half" method may be useful for anthropometrists who struggle with mental arithmetic – but it can only be done with dressmaker's measuring tapes.

- Secure the tape with the small finger of your left hand at the acromion process and flatten it with your thumb along the side of the participant's arm.
- Use your right hand to "mark" the exact position of the olecranon on the tape measure, and then fold the tape in half, bringing the acromion and the olecranon markings together.
- Press the two sides of the measuring tape against each other and mark the midpoint at the fold.

Whilst this method eliminates the arithmetic, it requires considerable finger skills and practice. It is not advised for studies where quality equipment and standardised techniques are of core importance.

4. Ask the person to relax their arm.
5. Take the measurement (Figure 8-11):
    - The person's arm should be hanging straight down while the measurement is taken. Ask them to relax the arm and let it hang.
    - Place the spring-wound measuring tape around the person's arm at the midpoint that you marked. The tape should be at a right angle to the long bone of the arm.
    - Slide the protruding pin into the plastic casing.
    - Press the button on the measuring tape so that it pulls snug. Check that the tape is not too tight, so that it compresses the arm, or too loose.

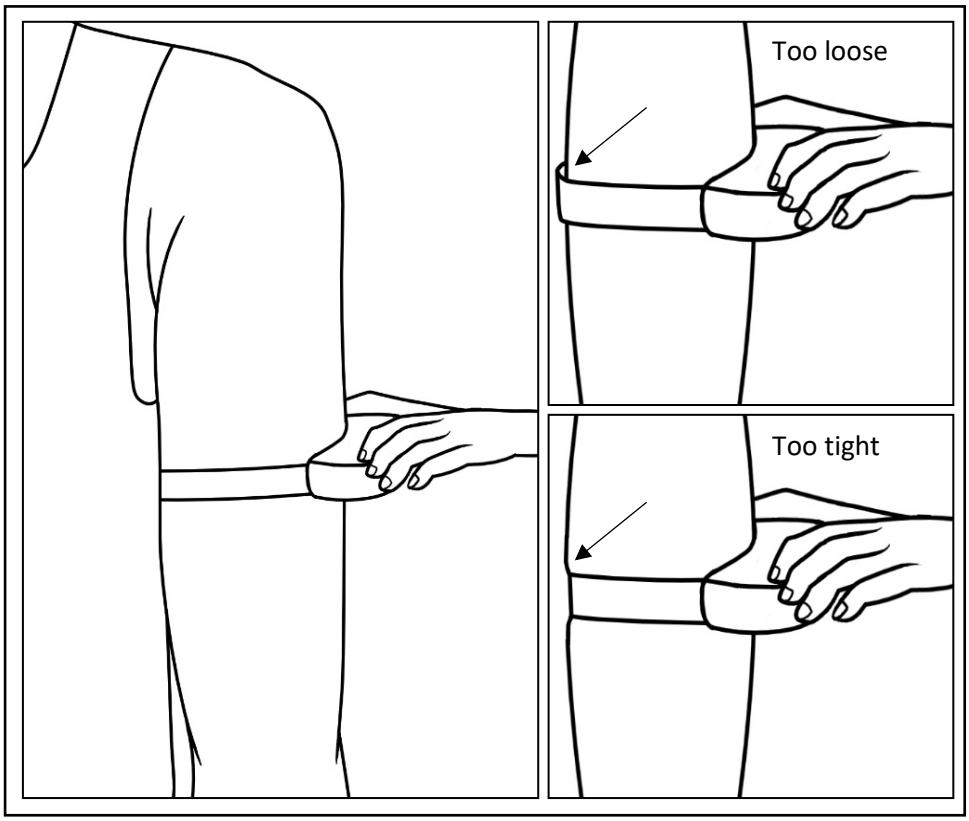


FIGURE 8-11: TAKING THE MUAC MEASUREMENT

6. Read the measurement on the measuring tape where it crosses the end (or zero-point) of the measuring tape.
7. Record the MUAC on the Anthropometry Data Capture Form or the electronic app in the space next to “1”.
    - The anthropometrist calls out the value, and the assistant writes it down.
    - Record MUAC in centimetres, to one decimal place; for example 27.2 cm.
8. Remove the measuring tape and repeat the measurement.
    - Record the second MUAC measurement on the Anthropometry Data Capture Form or the electronic app in the space next to “2”.
9. Thank the person, and allow them to get dressed.
10. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

MODULE 9: Measuring Calf Circumference

Module 9.1: Measuring calf circumference: adults (18+ years)

Calf circumference (CC) is only measured in adults aged 18 years and older.

The CC is measured on the LEFT leg.

1. Ask the person to remove their shoes and to uncover their left leg to the knee.
2. Let the person sit on a stool or chair that allows them to bend the knee at a 90-degree angle, so that the thigh is parallel to the ground and the lower leg is at a right angle to the ground.
    - If necessary, the person can place their foot on a brick, thick book or footstool.
3. Ask the person to relax the leg.
4. Position the measuring tape at the widest part of the calf (Figure 9-1).
    - You will need to move the measuring tape up and down a bit to determine where the widest part of the calf is.
    - Make sure the tape lies at a right angle to the shin bone.
    - Slide the protruding pin into the plastic casing.
    - Press the button on the measuring tape so that it pulls snug. Check that the tape is not too tight, so that it compresses the calf muscle, or too loose.

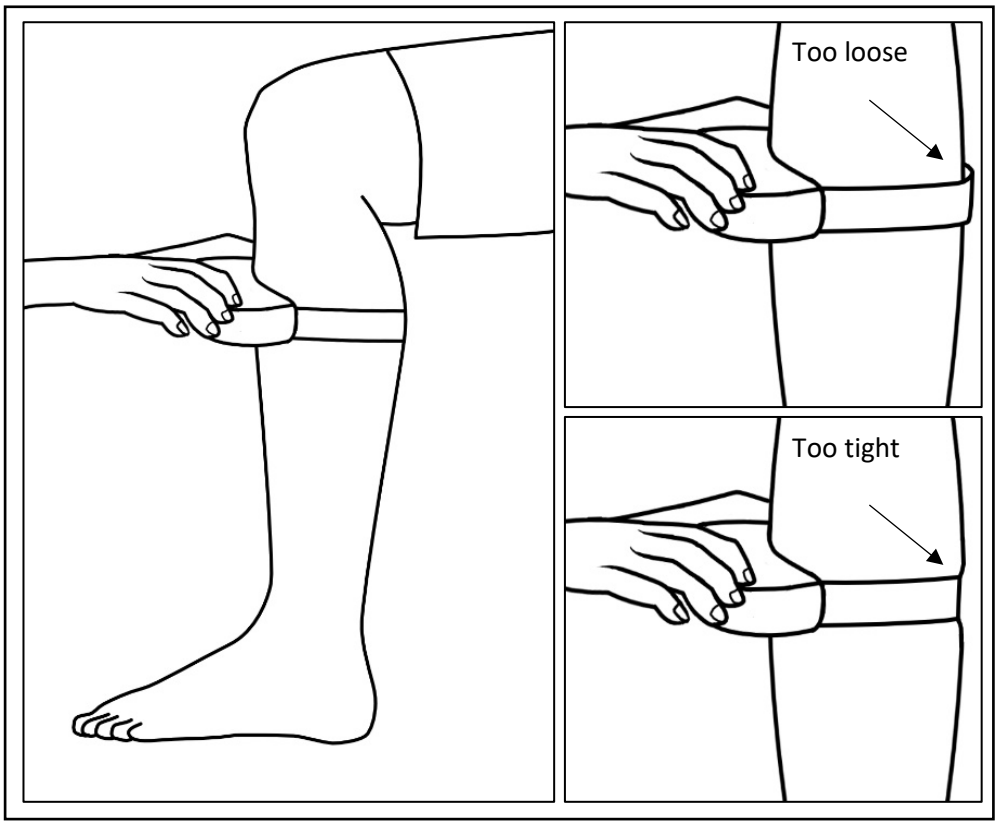


FIGURE 9-1: MEASURING CALF CIRCUMFERENCE

5. Read the measurement at the edge of the plastic casing.
6. Record the calf circumference on the Anthropometry Data Capture Form or the electronic app in the space next to “1”.
    - The anthropometrist calls out the value, and the assistant writes it down.
    - Record calf circumference in centimetres, to one decimal place; for example 37.2 cm.
7. Remove the measuring tape and repeat the measurement.
    - Record the second calf circumference measurement on the Anthropometry Data Capture Form or the electronic app in the space next to “2”.
8. Thank the person, and allow them to readjust their clothing.
9. Check that the measurements are recorded clearly and legibly. Both the anthropometrist and the assistant should check the form.

MODULE 10: Measuring Waist Circumference

Module 10.1: Measuring waist circumference: adolescents and adults

Waist circumference is measured in secondary school children (13 years and older), adults and the elderly.

1. Before starting, ask a woman if she is currently pregnant or if she was recently pregnant. Waist circumference is NOT measured in women who are pregnant or who have given birth or had a miscarriage in the past six months.
    - On the Anthropometry Data Capture Form or the electronic app, mark the relevant boxes (Y=yes, N=no) labelled “pregnant” and “<6 months postpartum” (this means less than 6 months after having delivered).
    - If you mark “Y” for either, do not do this measurement.
2. Ask the person to uncover their waist. This may require raising their shirt and possibly lowering their trousers slightly. If the person is wearing a dress, suggest that they change into a separate shirt and trousers/skirt to allow you to access their waist.
3. The anthropometrist and the assistant position themselves to opposite sides of the participant. Standing directly in front of or behind the participant may make him or her feel uncomfortable.
    - For a right-handed anthropometrist, it is easiest to work on the right side of the participant.

4. The anthropometrist locates the midpoint of the waist at one side (Figure 10-1):

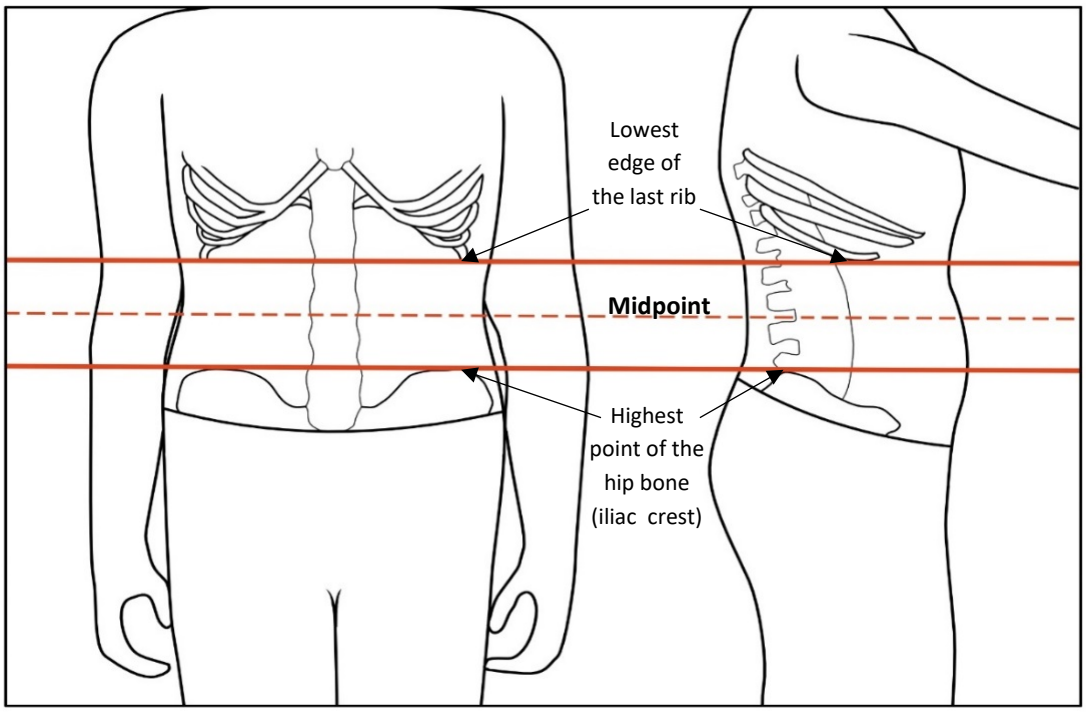


FIGURE 10-1: FINDING THE CORRECT SITE FOR MEASURING WAIST CIRCUMFERENCE

- Find the lowest edge of the lowest rib, and mark it with the cosmetic pencil.
- Find the highest point of the hip bone (iliac crest).
- Place your measuring tape with the zero end on the upper point, and measure the distance between the points. Divide the distance by two: this is the midpoint where the measurement should be taken.
    - The electronic data collection application should have a built-in function to calculate the midpoint.
    - An alternative (but less accurate) method is described in Box 10-1.

BOX 10-1: AN ALTERNATIVE METHOD FOR FINDING THE MIDPOINT

The "fold in half" method may be useful for anthropometrists who struggle with mental arithmetic – but it can only be done with dressmaker's measuring tapes.

- Secure the tape with the small finger of your left hand at the edge or the last rib process and flatten it with your thumb along the side of the participant's body.
- Use your right hand to "mark" the exact position of the highest point of the hip on the tape measure, and then fold the tape in half, bringing the top and bottom markings together.
- Press the two sides of the measuring tape against each other and mark the midpoint at the fold.

Whilst this method eliminates the arithmetic, it requires considerable finger skills and practice. It is not advised for studies where quality equipment and standardised techniques are of core importance.

- Mark the midpoint with the cosmetic pencil.

5. Place the measuring tape around the person's waist at the level of the mark you made.
    - The anthropometrist holds the casing of the measuring tape in the one hand (right hand for right-handed anthropometrist) and uses their left hand to pass the end of the tape measure to the assistant around the participant's back. The assistant then takes the tape measure around the participant and uses their left hand to pass the end of the tape measure to the anthropometrist around the participant's front.
    - Ensure that the measuring tape is horizontal and parallel to the floor all the way around the waist, not curving up or down in the front or back.
    - The measuring tape should fit snugly; neither compressing the tissue nor hanging loosely.
    - The assistant should help to hold the measuring tape in position.

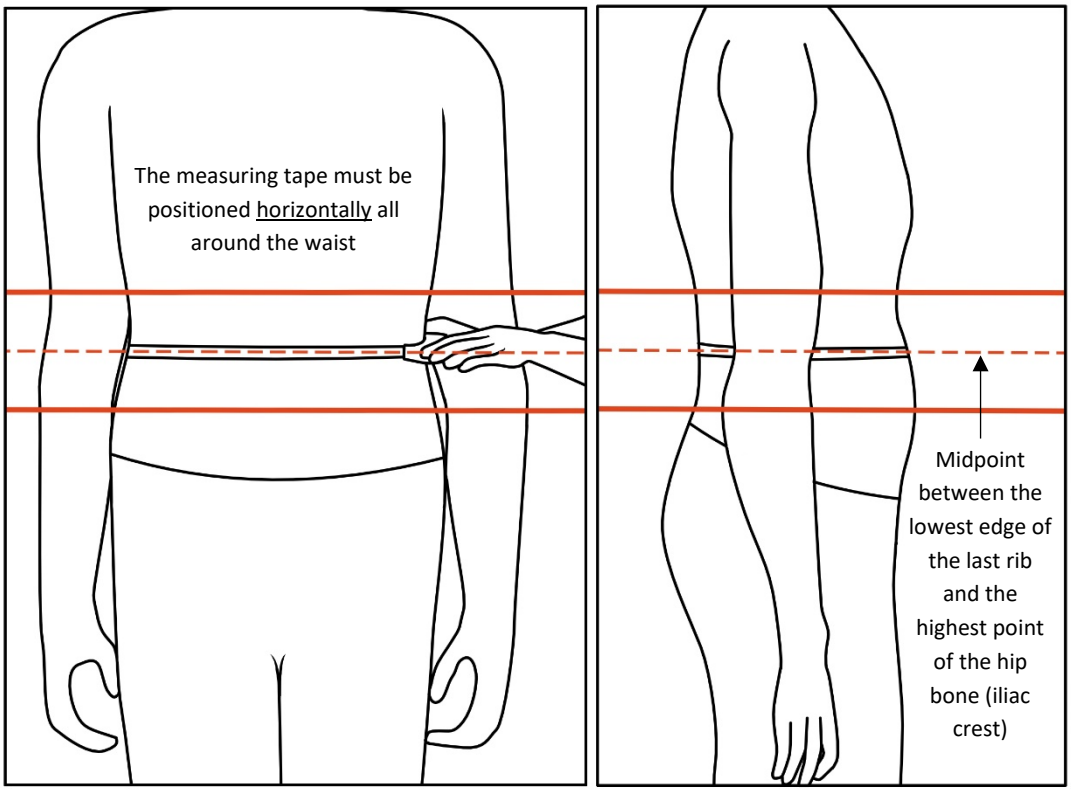


FIGURE 10-2: MEASURING WAIST CIRCUMFERENCE

6. Read the measurement at the edge of the plastic casing.
7. Record the waist circumference on the Anthropometry Data Capture Form or the electronic app in the space next to "1".
    - The anthropometrist calls out the value, and the assistant writes it down.
    - Record calf circumference in centimetres, to one decimal place; for example 103.2 cm.
8. Remove the measuring tape and repeat the measurement.
    - Record the second waist circumference measurement on the Anthropometry Data Capture Form or the electronic app in the space next to "2".
9. Thank the person, and allow them to readjust their clothing.
10. Check that the measurements are recorded clearly and legibly. The anthropometrist and the assistant should both check the form.

MODULE 11: Guidelines for Trainers

Module 11.1: Roles and responsibilities

The entire survey team is involved in some aspects of the anthropometry training. The exact responsibilities of various team members (with regard to training) are study-specific, but the table below describes a typical role delineation.

Anthropometry planning team	• Compile the training materials and forms. • Organise and conduct the training of all the lead anthropometrists (site coordinators) – this "training of the trainers" should include a standardisation exercise. • Collate results of standardisation exercises from all the trainings, analyse the results, report on them. • Provide support to site lead anthropometrists in conducting their own trainings.
Lead anthropometrists (co-ordinators) for each study site	• Attend the "training of trainers". • Organise and conduct the training of all the anthropometry fieldworkers (anthropometrists and assistants) at their sites • Conduct the standardisation exercise after the training is completed.
Anthropometry field workers – anthropometrists and assistants	• Attend training and participate in the standardisation exercise. • Important: No fieldworker will be allowed to collect any anthropometric data if they have not done this.
All team members involved in planning, field work and data analysis	• View the online/recorded "introduction to anthropometric assessment" presentation.

Module 11.2: Preparation of the venue and materials

The first step in organising a training is to identify a suitable venue. Local Departments of Health and universities may have suitable venues available. Keep the following in mind when choosing a venue:

- You will need chairs and tables for participants to sit at, plus extra chairs for the volunteers.
- The training uses PowerPoint presentations; make sure the venue has electricity and a data projector. It is a good idea to always have an extension cord and multiplug with you when conducting trainings.
- There should be adequate space to allow participants to practice their skills on volunteers and/or each other.
- Additionally, make sure there is a suitable space to conduct the standardisation exercise (described in detail in Module 12)
- Make provision for refreshments for participants and volunteers. Provide lunch, or advise participants ahead of time if they need to bring their own.

The following supplies and equipment will also be needed:

- One printed copy of the training manual for each participant.
- Stationery (even if participants bring their own, it is wise to have extra). Clipboards come in handy.
- Anthropometric equipment for demonstration and practice, as well as for the standardisation exercise (see Module 12).
    - Use the same equipment that you will be using for the survey, so that anthropometrists can become familiar with the equipment.
    - Remember "consumables" such as cosmetic pencils, spare batteries and lubricating oil – all of which form part of the standard fieldworkers' anthropometry kit (Box 11-1).

BOX 11-1: EXTRA ITEMS NEEDED IN THE ANTHROPOMETRY KIT

In addition to the anthropometric equipment, you will also need:

- Spare batteries for scales
- Screwdrivers to open battery compartments, if necessary (depending on model)
- Machine oil, to lubricate the moving parts on length and height meters
- A ruler, for measuring the height of incompressible hairstyles
- A regular dressmaker's measuring tape
- Wax-based cosmetic pencils for marking measurement sites on skin (black/brown and white) with a sharpener
- Alcohol swabs, "wet wipes" or tissues for cleaning off pencil marks
- Sanitiser for hands and equipment
- Disposable latex/nitrile examination gloves
- Disposable face masks
- Paper towels
- Extra forms and pens
- Disposable nappies for babies

It's recommended that you keep all these extras in a bag or backpack for easy transport

- If tablets will be used for data collection in the survey, they should be available during the training. Remember to bring the chargers!
- Supplies for infection prevention and control, including disposable gloves, masks, sanitising solution and paper towels for infection prevention and control.

Module 11.3: Recruiting volunteers

Volunteers are needed for the training itself (for the trainer to demonstrate measurement techniques on, and the participants to practice) as well as for the standardisation exercise. The volunteers needed for the standardisation exercise are discussed in Module 12.

For studies that include all age groups and the basic anthropometry described in this manual, it is recommended you have the following persons available for trainees to practice anthropometric techniques:

- A baby younger than one year.
- A small child (age 2-5 years).
- An older child/adolescent.
- A thin or normal weight adult.
- An overweight/obese adult (since many of the measurements are more difficult to take on obese adults, particularly persons with a lot fat around the abdomen).

Try to recruit as many volunteers as you can – the more volunteers you have, the fewer times each person will have to be measured. Trainees can also practice taking the measurements on each other; this eliminates the need to recruit adult volunteers. An easy way to recruit volunteers is to ask friends and family members of trainees to volunteer.

You should offer your volunteers refreshments.

MODULE 12: Standardisation and Reliability Assessment

Module 12.1: How is data quality measured?

We can think of data quality in two ways: accuracy and precision (also called reliability).

Accuracy

When we think about accuracy, we are asking the question: how close is the value we get when we measure something to the *real* value?

We test accuracy when we calibrate our equipment: we take an object of known weight or size, we use our equipment to weigh or measure it, and we see whether we get the true answer.

It is difficult to test accuracy when we are measuring live human subjects, because it is so challenging to get the "true" value. Because of this, accuracy testing is sometimes limited to calibration with inanimate objects (e.g. in the NDIS-2022 study).

Precision/reliability

Precision, or reliability, is concerned with a different matter: if we measure the same object/person repeatedly, do those measurements all give the same answer? Because the object/person being measured does not change in-between the two measurements, we would expect the measurements to be the same – any differences are caused by variability (inconsistency) in the measurement technique or the equipment. The bigger the difference between repeated measurements are, the poorer the quality of our data is, and the less faith we can have in our results.

Proper maintenance and correct use of equipment is important to prevent variation due to equipment. If the equipment measures reliably, the only other source of variation is the technique of the persons doing the measurements. We can test the reliability of measurers in two different ways:

<u>Intra-rater (test-retest) reliability</u>

The same anthropometrist measures the same person twice, and we compare the measures values. This will show us whether the anthropometrist is using consistent measurement techniques. If an anthropometrist gets a different value each time they measure the same person, we can be certain that their measurements will not be accurate.

<u>Inter-rater reliability</u>

Two different anthropometrists measure the same person, and we compare their results. This is very important for a large-scale multi-centre study, where the measurements are done by many different anthropometrists. If each anthropometrist gets a different answer while measuring the same person, it means we cannot pool or compare their results (it also means that, at best, only one of them is getting the "true" measurement).

Assessing reliability: the standardisation exercise

After each group of anthropometry field workers has completed their training, we must do a standardisation exercise to check whether they are able to take the necessary measurements reliably. This involves recruiting a group of volunteers, and allowing each anthropometrist-assistant pair to measure each volunteer twice. We can then compare the anthropometrist-assistant pairs to themselves (intra-rater or test-retest reliability) and each other (inter-rater reliability).

The rest of this module explains how to conduct the standardisation exercise.

Module 12.2: Conducting the standardisation exercise

The standardisation exercise should be conducted after the training is completed and the trainees have had the opportunity to practice on real people.

To conduct the standardisation exercise, you will need:

- A large enough space to set up ten measurement stations.
- Ten stations, each with
    - a table,
    - a chair for the volunteer to sit on,
    - all the necessary anthropometric equipment, and
    - sanitising and hygiene supplies (disposable gloves, sanitising solutions, paper towels, wastepaper basket)
- Privacy screens to erect between measurement stations.
- A clipboard, data collection forms (Annexure D) and pens (or tablets with the data capturing application installed) for each anthropometrist-assistant pair.
- Ten volunteers.

The equipment used for the standardisation exercise should be the same equipment that will be used during the survey.

Recruiting volunteers

It is the responsibility of the lead anthropometrist who organises the training to recruit volunteers for the standardisation exercise. At least ten volunteers will be needed to allow us to do meaningful statistical calculations. These should not be the same volunteers used for practice during the training, since they will become exhausted.

We want the volunteer group to represent all the different age groups and body shapes we are likely to encounter in the survey. While practical considerations will determine exactly which volunteers you are able to recruit, we want to include higher numbers of more “difficult to measure” subjects such as babies, small children and obese individuals. For example, for a survey covering all age groups, you could recruit the following:

- Two adults over 18:
    - One male and one female.
    - One thin or normal weight and one overweight/obese.
- Three children aged 0-24 months:
    - One 0-6 months.
    - One 6-12 months.
    - One 12-24 months;
- Two children aged 2-5 years:
    - One younger (2-3 years) and one older (4-5 years).
    - Ideally one thin/normal weight and one overweight.
- One child aged 6-12 years.
- Two adolescents aged 13-18 years, ideally one thin/normal weight and one overweight.

Each volunteer is given an identifying number. The lead anthropometrist should record the details of each volunteer (age, sex, body type) on the form in Annexure C. This will allow us to see whether certain types of participants are more difficult to measure reliably.

Taking care of your volunteers

Always remember that the volunteers are doing us a favour by helping out with the standardisation exercise. It can easily become a long, tiring day for them, so we need to take care to make them as comfortable as possible.

- Limit the number of trainees per group. Remember, each anthropometrist-assistant pair will measure each volunteer twice. Children, in particular, can easily get exhausted with repeated measurements.
- Provide refreshments for the volunteers (although you do not want them to eat or drink during the measurement exercise, as it can cause changes in weight – if someone drinks a 200 mL cup of tea, they will weigh 200g more, and it will look as if the measurements are not reliable.)
- Provide chairs for the volunteers to sit on.
- Make sure the room is not too cold – remember, babies will need to be undressed and all participants will be wearing minimal clothing. You can provide blankets for comfort between measurements.
- Put up privacy screens between stations, to minimise discomfort for the volunteers.

Setting up the exercise

When your ten stations have been set up, each volunteer is assigned to a station where they will sit – the trainees move from station to station and take the measurements.

Each station must be clearly labelled with the volunteer's identifying number.

Each anthropometrist-assistant pair starts at one of the stations, and moves numerically to the next station. If you have fewer trainee pairs than stations, spread them out evenly between the stations.

Some volunteers will take more time than others, e.g. because more measurements need to be taken. To avoid pile-ups of trainees, everyone should move on to the next station at the same time, when told to do so by the trainer.

The trainees need to move through the whole circuit twice. If you wish, a short break can be taken between the two rounds. It is important that the trainees should do the circuit twice, and not just measure each volunteer twice when they're at the station for the first round – we want to prevent the second measurement from being unduly influenced by the memory of the first one. For the same reason, trainees should get clean data collection forms (Annexure D) when starting the second round (if paper forms are used rather than tablets).

Figure 12-1 shows an example of how the standardisation exercise could be set up using two rooms.

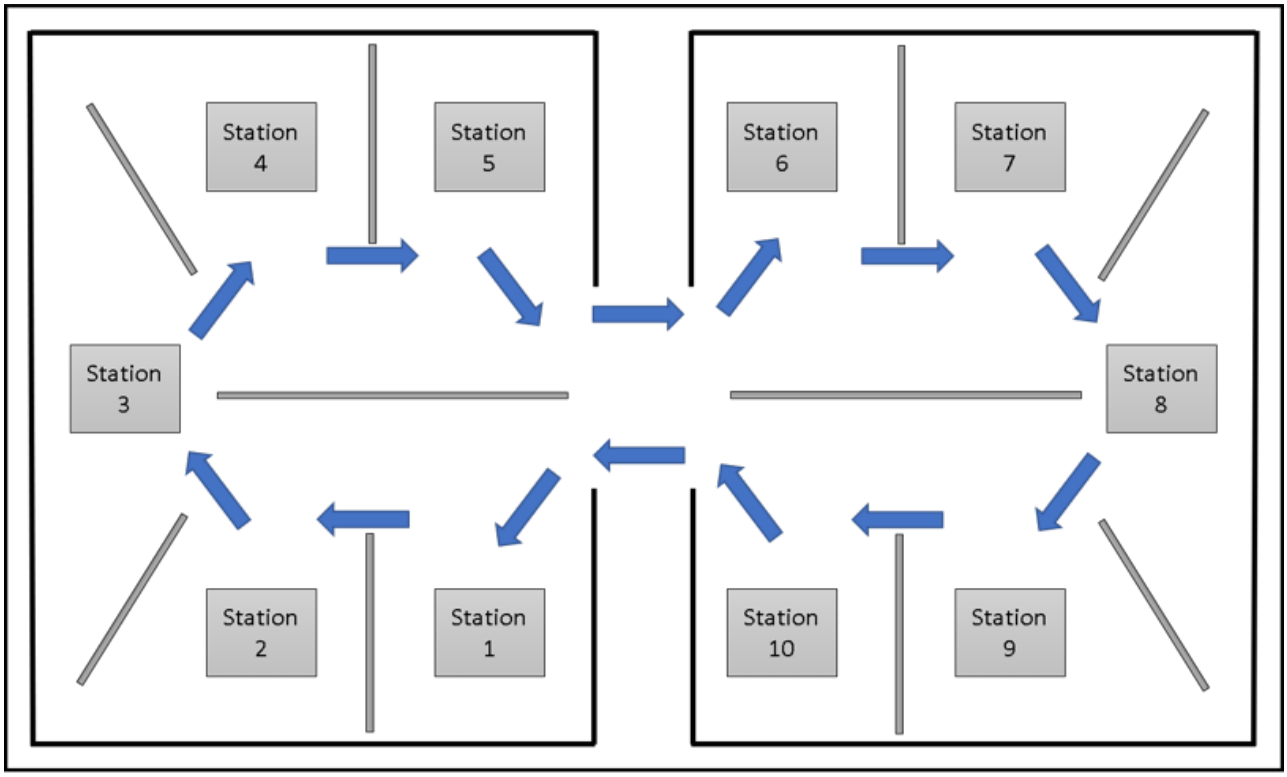


FIGURE 12-1: AN EXAMPLE STATION SETUP FOR THE ANTHROPOMETRY STANDARDISATION EXERCISE

Statistical analysis of the standardisation results

The statistical analysis will be done by the anthropometry planning team. You are only expected to submit the completed data collection forms to the anthropometry planning team. If you use tablets during the training and standardisation exercise, all the data are automatically captured, and you do not have to do anything further.

Module 12.3: Infection prevention and control during the standardisation exercise

You must implement all the usual infection prevention and control measures during the standardisation exercise:

- On arriving at a new station, trainees must:
    - Sanitise their hands
    - Put on a clean pair of disposable gloves.
- Before leaving a station, trainees must:
    - Sanitise all the equipment
    - Remove and discard their gloves
    - Sanitise their hands

Remember, even if the sanitisation measures seem excessive, it is good practice for the procedures that have to be followed in the field.

Additional information on preventing the spread of COVID-19 can be found in Annexure C

Annexure E provides additional detail on the prevention of COVID-19 during anthropometric assessments – those guidelines also apply during training and standardisation.

ANNEXURES

- Annexure A: Daily equipment verification logs
- Annexure B: Anthropometry data capture form
- Annexure C: Description of volunteers used for anthropometry standardisation exercise
- Annexure D: Data capture forms for anthropometry standardisation exercise
- Annexure E: Measures for preventing the spread of COVID-19 during anthropometric assessment

ANNEXURE A: Daily Equipment Verification Logs

A1: DAILY VERIFICATION LOG: SCALES

Equipment ID:					
Month and year:					
Date	**Verification weight**	**Measured weight**	**Verifier name and surname**	**Verifier signature**	**Comments**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

A2: DAILY VERIFICATION LOG: LENGTH/HEIGHT METER

Equipment ID:				
Equipment type: [ ] Length meter [ ] Stadiometer [ ] Combined				
Month and year:				
Length of calibration rod: **cm**				
Date	**Measured length**	**Verifier name and surname**	**Verifier signature**	**Comments**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
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26				
27				
28				
29				
30				
31				

ANNEXURE B: Anthropometry Data Capture Form

Fieldworker number		**Date of assessment**	Y Y Y Y M M D D
Household/School/ECD number		**Participant number**	

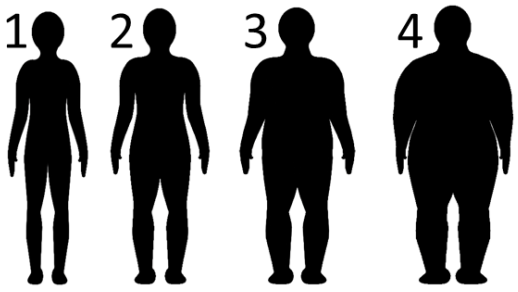
Participant Date of Birth	Y	Y	Y	Y	M	M	D	D	**Sex (circle)**									**M**	**F**
1. **Weight** (all participants)	**kg**	**1**				,			**2**				,						
Comments:																			
Unable to obtain measurement – reason:																			
2. **Height (or length)** (all participants)	**cm**	**1**				,			**2**				,						
Measured: ☐ Standing up ☐ Lying down																			
Comments:																			
Unable to obtain measurement – reason:																			
3. **Mid-upper arm circumference** (all participants)	**cm**	**1**			,		**2**				,								
Comments:																			
Unable to obtain measurement – reason:																			
4. **Calf circumference** (adults and elderly)	**cm**	**1**			,		**2**				,								
Comments:																			
Unable to obtain measurement – reason:																			
5. **Waist circumference** (secondary school children, adults, elderly)	**cm**	**1**				,		**2**				,							
Y N Pregnant									Y N <6 months postpartum										
Comments:																			
Unable to obtain measurement – reason:																			

ANNEXURE C: Description of Volunteers used for Anthropometry Standardisation Exercise

Date:	Site:
Lead anthropometrist:	

Volunteer ID	Sex (circle)	Age	Body type (circle)	Comments
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	
	M / F		1 / 2 / 3 / 4	

Body type:



ANNEXURE D: Data Capture Forms for Anthropometry Standardisation Exercise

Date:	**Site:**
Anthropometrist name:	
Assistant name:	
Measurement round (mark with X): [ ] 1 [ ] 2	

Volunteer ID	**Weight**	**Length/ height**	**MUAC**	**Calf circumference (adults only)**	**Waist circumference (secondary school, adults, elderly only)**
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm
	, kg	, cm	, cm	, cm	, cm

ANNEXURE E: Measures for preventing the spread of COVID-19 during anthropometric assessment

Anthropometric measurements involve close contact between the anthropometrist, assistant and the person being measured. This makes hygiene and infection control measures particularly important. This means there is a higher risk of spreading COVID-19. It is very important to follow strict protocols for infection prevention.

Note: Where available, study-specific protocols and forms can be used in place of the guidelines presented here – for example, if participants are screened for COVID-19 risk before interviewing them, it is not necessary to screen them again before taking anthropometric measurements.

GENERAL SURVEY GUIDELINES

The general survey protocols for the prevention of COVID-19 must be followed at all times. The important points are repeated here, since they apply just as much to anthropometry fieldworkers as to other data collectors.

- All anthropometry fieldworkers should be screened for COVID-19 risk factors (temperature, close contacts, symptoms) daily. The screening results should be recorded on the Daily COVID-19 Screening Record form (Annexure E1).
    - If any fieldworker has symptoms suggestive of COVID-19, the entire team needs to quarantine until the affected person has been tested and confirmed negative for COVID-19.
- Before entering a household:
    - Sanitise your hands with the provided alcohol-based hand sanitiser (≥60% alcohol).
    - Ensure you are wearing a mask covering your mouth and nose.
- Before you start with data collection, one fieldworker must screen all the household members for COVID-19 risk. This includes measuring their temperature with a no-contact infrared thermometer and asking some questions about COVID-19 symptoms and exposure. Record the screening results on the Daily COVID-19 Screening Record form (Annexure E2 for households, Annexure E3 for schools and creches).
- Exclude the entire household from data collection if any household member has:
    - A temperature ≥38°C.
    - A positive diagnosis of COVID-19 in the last 14 days.
    - Close contact (that is, being within 2 metres of a person who tested positive for COVID-19 for at least 15 minutes) in the past 14 days (bearing in mind that a person with COVID-19 can be contagious for 48 hours before symptoms develop; this thus includes contact up to two days before the person tested positive or developed symptoms).
- While collecting the data:
    - Maintain a distance of at least one meter, except when it cannot be avoided (e.g. while taking measurements, it will be necessary to touch the person. While explaining the procedures, a distance of one meter should be maintained).

    - As far as possible, do the data collection outdoors. If you need to work indoors due to the weather or because of privacy reasons (e.g. while taking anthropometric measurements), work in the largest, most well-ventilated room available.
    - Wear a face mask over your mouth and nose at all times, and ensure that all the household members do the same. Provide them with masks if they do not have their own.
    - Wear disposable gloves whenever you need to touch a participant.
- After completing data collection, dispose of used gloves and sanitise your hands again.

GUIDELINES SPECIFIC TO ANTHROPOMETRIC MEASUREMENTS

- All anthropometric equipment should be sanitised with the provided alcohol-based surface sanitiser after use, before it is returned to its box/carrier for transport.
- Whenever you need to touch a participant (i.e. when taking the anthropometric measurements), you should wear gloves.
    - You can use a single pair of gloves for the entire household; it is not necessary to change gloves between measuring people who live together, unless the gloves tear or become soiled.
    - Dispose of the used gloves after assessing each household.
    - When measuring large groups of children at schools or creches, a new pair of gloves should be used for each child.

The forms to be completed follow on the next several pages.

COVID-19 PREVENTION DURING THE STANDARDISATION EXERCISE

Care must be taken to prevent the spread of COVID-19 during the standardisation exercise. Remember to strictly implement all the following safety procedures:

- Screen all volunteers and trainees for COVID-19 risk (temperature, symptoms and contacts) before being allowed into the training venue. Record this on the COVID-19 Screening Form E1 (trainees) and E4 (volunteers).
- All volunteers (>2 years old) and trainees should wear face masks, covering the mouth and nose, at all times. Provide disposable face masks for volunteers.
- Use large, well-ventilated rooms.
- Limit the number of people per room. Ideally, you do not want more than 5 measurement stations and anthropometrist-assessor teams in a room at once. In order to include the necessary 10 measurement stations, the standardisation exercise can either be divided into two timeslots accommodating 5 volunteer subjects each, or performed in two separate rooms with 5 measurement stations in each.
- On arriving at a new station, trainees must:
    - Sanitise their hands
    - Put on a clean pair of disposable gloves.
- Before leaving a station, trainees must:
    - Sanitise all the equipment
    - Remove and discard their gloves
    - Sanitise their hands

Remember, even if the sanitisation measures seem excessive, it is good practice for the procedures that have to be followed in the field.

E1: DAILY COVID-91 SCREENING RECORD: TEAM MEMBERS

To be completed daily at the beginning of the day

Study site:						
Date:						
		Symptoms				**COVID-19 contact* in last 14 days?**
Name/ID	**Temperature**	**Dry cough (new)**	**Short of breath**	**Sore throat**	**Loss of taste/smell**	
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N
		Y / N	Y / N	Y / N	Y / N	Y / N

* A COVID-19 contact is defined as being **within 2 metres** of an infected person for at least **15 minutes** in the **last 14 days** (including up to 2 days before the infected person showed any symptoms or tested positive) (SMART, 2021)

E2: DAILY COVID-91 SCREENING RECORD: HOUSEHOLDS

To be completed for each household before entering the household.

Names of study team:										
Date:										
			Does anyone in the household have the following symptoms?							**Completed by (name and sign)**
Household ID	**Address**	**Contact number**	**Had COVID-19 in the last 14 days**	**Temperature ≥38°C**	**Dry cough (new)**	**Short of breath**	**Sore throat**	**Loss of taste/ smell**	**COVID-19 contact in last 14 days**	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	

* A COVID-19 contact is defined as being within **2 metres** of an infected person for at least **15 minutes** in the **last 14 days** (including up to 2 days before the infected person showed any symptoms or tested positive) (SMART, 2021)

E3: DAILY COVID-91 SCREENING RECORD: SCHOOLS/CRECHES

To be completed for each child.

Names of study team:
Name of school/creche:
Date:

Child name	**Class**	**Does anyone in the household have the following symptoms?**							**Completed by (name and sign)**
		Had COVID-19 in the last 14 days	**Temperature ≥38°C**	**Dry cough (new)**	**Short of breath**	**Sore throat**	**Loss of taste/ smell**	**COVID-19 contact in last 14 days**	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
		Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	

* A COVID-19 contact is defined as being within **2 metres** of an infected person for at least **15 minutes** in the **last 14 days** (including up to 2 days before the infected person showed any symptoms or tested positive) (SMART, 2021)

E4: COVID-91 SCREENING RECORD: TRAINING AND STANDARDISATION EXERCISE VOLUNTEERS

To be completed for each volunteer, including parents/caregivers of children.

Names of study team:
Date:

Name	**Address**	**Contact number**	**Does anyone in the household have the following symptoms?**							**Completed by (name and sign)**
			Had COVID-19 in the last 14 days	**Temperature ≥38°C**	**Dry cough (new)**	**Short of breath**	**Sore throat**	**Loss of taste/ smell**	**COVID-19 contact in last 14 days**	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	

* A COVID-19 contact is defined as being within **2 metres** of an infected person for at least **15 minutes** in the **last 14 days** (including up to 2 days before the infected person showed any symptoms or tested positive) (SMART, 2021)

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