MODULE 6

MEASURING MALNUTRITION: INDIVIDUAL ASSESSMENT

Part 1: Fact sheet

Part 2: Technical notes

Part 3: Trainer's guide

Part 4: Training resource list

Harmonised Training Package (HTP):
Resource Material for Training on
Nutrition in Emergencies. Version 2, 2011

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Module 6: Measuring malnutrition: Individual assessment

Version 2 (Current):

Lead author:	Diane Holland (Independent)
Editorial oversight:	Tamsin Walters (NutritionWorks)
Reviewers:	Helen Young (Tufts University) Alison Tumilowicz (FANTA 2)
Contributors:	Monika Bloessner and Adelheid Onyango (WHO)

Version 1:

Lead author:	Fiona Watson (NutritionWorks)
Contributors:	Jacqueline Frize (Independent)
Reviewers:	Irwin Shorr (Independent) Onyango Adelheid Werimo (WHO)

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32, Leopold Street, Oxford, OX4 1PX, UK. Tel: +44(0)1865 324996/324997, email: office@ennonline.net

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For further information on the HTP Version 2, please write to Carmel Dolan, NutritionWorks (www.nutritionworks.org.uk) at cmadolan@aol.com

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The Harmonised Training Package (HTP): Resource Material for Training on Nutrition in Emergencies

What is the HTP?

The Harmonised Training Package: Resource Material for Training on Nutrition in Emergencies (the HTP) is a comprehensive documentation of the latest technical aspects of Nutrition in Emergencies (NiE). The word **Harmonised** reflects the pulling together of the latest technical policy and guidance, the word **Training** refers to its main application and the word **Package** refers to the bringing together of the subject matter into one place. It is organised as a set of modules by subject, each containing technical information, training exercises and a resource list for use in training course development.

The HTP is an initiative of the IASC Global Nutrition Cluster (GNC) and has been endorsed by the GNC and its member's agencies. In 2007, the IASC GNC commissioned the UK based partnership, NutritionWorks, to develop a training resource to facilitate capacity development in the NiE sector. HTP Version 1 was launched in 2008. HTP Version 2 update in 2010/11 was funded under an USAID OFDA grant to the UK based charity, the Emergency Nutrition Network (ENN). The update was undertaken in an ENN/NutritionWorks collaboration, with NutritionWorks responsible for overall coordination and editorial management, and editorial oversight and module production supported by the ENN.

What the HTP is not

The HTP is not a ready-to-use training course. It cannot be used as an 'off the shelf' package; rather, it should be used as a resource package during a process of course development by experienced trainers.

Who is the HTP for?

The HTP is a primarily a **resource for trainers** in the NiE sector and it can be used by individuals to increase their technical knowledge of the sector. It is designed to provide trainers from any implementing agency or academic institution with information from which to design and implement a training course according to the specific needs of the target audience, the length of time available for training and according to the training objectives. It is written in clear English and will be available in other languages in the future.

How is the HTP organised?

The HTP is organized into four sections containing a total of 21 modules which can be used as stand-alone modules or as combined modules depending on the training needs.

Section 1: Introduction and concepts

1. Introduction to nutrition in emergencies
2. The humanitarian system: Roles, responsibilities and coordination
3. Understanding malnutrition
4. Micronutrient malnutrition
5. Causes of malnutrition

Section 2: Nutrition needs assessment and analysis

6. Measuring malnutrition: Individual assessment
7. Measuring malnutrition: Population assessment
8. Health assessment and the link with nutrition
9. Food security assessment and the link with nutrition
10. Nutrition information and surveillance systems

Section 3: Interventions to prevent and treat malnutrition

11. General food distribution
12. Management of moderate acute malnutrition
13. Management of severe acute malnutrition
14. Micronutrient interventions
15. Health interventions
16. Livelihoods interventions
17. Infant and young child feeding
18. HIV/AIDS and nutrition
19. Working with communities in emergencies

Section 4: Monitoring, evaluation and accountability

20. Monitoring and evaluation
21. Standards and accountability in humanitarian response

Each module contains 4 parts which have a specific purpose as follows:

Part 1: The Fact Sheet – provides an overview of the module's topic and is designed for non-technical people to obtain a quick overview of the subject area.

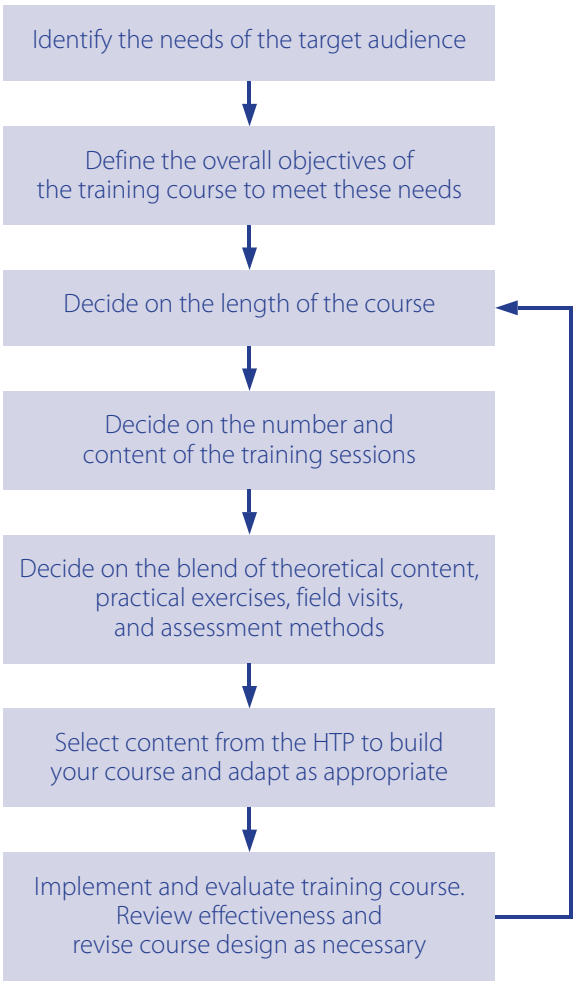
Part 2: The Technical Notes – for trainers and trainees, provides detailed technical guidance on current policies and practice.

Part 3: The Trainers' Guide – aims to help trainers develop a training course and provides tips and tools which can be adapted to the specific training context.

Part 4: Resources – lists of relevant available resources (including training materials) for the specific technical area.

How to use the HTP

The HTP should be used during a process of course development. The process of course development involves a number of steps and these are summarised in the diagram below.



MODULE 6

Measuring malnutrition: Individual assessment

PART 1: FACT SHEET

The fact sheet is the first of four parts contained in this module. It provides an overview of how acute malnutrition can be measured in individuals using *anthropometry* (body measurements) and *clinical signs* (e.g. *visible wasting* and *bilateral oedema*) in emergencies. The basic principles of anthropometric assessment are also applicable in non-emergency contexts and preventive programmes.[1] Detailed technical information is covered in Part 2. Assessment of micronutrient malnutrition is not included as it is covered in Module 4. Words in italics are defined in the glossary.

Anthropometry

Nutritional status cannot be observed directly so *proxy* (observable) indicators are used instead. There are four methods to assess an individual's nutritional status; anthropometry, biochemical assessment, clinical assessment and dietary intake. Anthropometry is the method most commonly used in emergencies, in combination with clinical assessment of *visible wasting* and *bilateral oedema*.

Anthropometry can be defined as the measurement of physical dimensions and gross composition of the body (height (or length in children under 24 months or under 87cm in height), weight, *MUAC* (mid-upper arm circumference), age, sex[2]. The information is used to generate *nutritional indices*. The degree of malnutrition is defined by *cut-off points*, in other words individuals falling below a specific cut-off point are classified with a specific degree of malnutrition.

Most nutritional indices are compared to expected anthropometric values for an individual of the same sex and age, e.g. a *growth standard or growth reference*. A standard is based on prescriptive criteria and involves value or normative judgments. In contrast, a reference reflects the expected values in a reference population. Some nutritional indices for acute malnutrition, (e.g. MUAC and Body Mass Index (BMI), are interpreted directly with cut-off points, without comparison to a growth standard or reference.

Measuring malnutrition in infants younger than 6 months

Infants less than 6 months old are usually not measured anthropometrically, with the exception of assessment of birthweight which is not a reflection of acute malnutrition. Assessment of nutritional status of infants less than 6 months of age for admission into selective feeding programmes has relied primarily on clinical signs (e.g. oedema, visible wasting, too weak to suckle, not gaining weight despite feeding) and risk factors (e.g. insufficient breastmilk, absence of mother). Research is ongoing to develop the evidence base needed to define protocols and cut-off points for anthropometric assessment of infants less than 6 months.

Measuring malnutrition in children 6-60 months

The nutritional indices commonly calculated for children 6-60 months are:

- *Weight-for-height* (WFH) – a measure of *wasting* or *acute malnutrition*
- *Height-for-age* (HFA) – a measure of *stunting* or chronic undernutrition
- *Weight-for-age* (WFA) – a measure of *underweight* or wasting and stunting combined
- MUAC – a measure of wasting or acute malnutrition

Each form of growth failure reflects a different condition. It is important to note that one individual can be classified with more than one form of growth failure at the same time. A child that is suffering from severe acute malnutrition may be both severely wasted and stunted. In emergencies, the main focus is on wasting, due to its link to morbidity and mortality.

[1] While obesity is acknowledged to be an issue of increasing importance globally, it is not addressed in this module because during an emergency, the focus is on acute malnutrition.

[2] Jelliffe, DB (1966). *The assessment of the nutritional status of the community*. WHO Monograph No. 53. Geneva. WHO.

The prevalence (rate) of acute malnutrition (defined by weight-for-height and bilateral oedema) in children 6-59 months is frequently assessed in emergencies and used to determine response and to identify target groups and geographical areas at risk. It reflects recent changes in dietary intake and infection and acts as a proxy for the nutritional status of the entire population. The concern, however, is not just for the children who are classified with moderate or severe acute malnutrition, but for the entire population whose nutritional status is sub-optimal.

Prior to 2006, the internationally accepted reference population for calculating nutrition indices among children 0-60 months was the 1978 National Center for Health Statistics (NCHS) international reference. In 2006, the World Health Organisation (WHO) introduced a new growth standard (WHO GS) for children 0-60 months of age, which was endorsed in 2009 by WHO and UNICEF for use in the identification of severe acute malnutrition.[3] Cut-off points used to classify the severity of malnutrition are presented as Z-scores (also called *standard deviation* (SD) scores), in line with global recommendations. In 2009, WHO and UNICEF also endorsed the cut-off point of MUAC less than 115 mm/11.5cm (previously the cut-off was 110 mm/11.0cm) as an independent admission criterion for the treatment of *severe acute malnutrition* (SAM). A child with bilateral oedema is always classified with SAM.

Classification of acute malnutrition in children 6-60 months

Nutrition Indicator	Moderate Acute Malnutrition (MAM)	Severe Acute Malnutrition (SAM)
WFH (wasting)	≥ -3 SD & < -2 SD	< -3 SD
MUAC	≥ 115mm & < 125mm (≥ 11.5cm & < 12.5cm)	<115mm (<11.5cm)
MUAC for age/height[4]		< -3 SD
Bilateral Oedema	No	Yes

Measuring malnutrition in older children and adolescents

WHO recommends that acute malnutrition among children and adolescents 5-19 years be assessed by calculating *Body Mass Index* (BMI), and then adjusting for age to generate *BMI-for-age*. BMI is calculated based on the weight (in kg) divided by the square of the height (in m) of the individual. BMI-for-age should be presented as Z-scores based on the 2007 WHO Growth Reference (WHO GR) for children and adolescents 5 to 19 years of age.

Classification of children and adolescents 5-19 years of age

	BMI-for-age Z-score
Severe thinness:	<-3SD
Thinness:	≥ -3 SD & < -2 SD
Overweight:	>+1SD & ≤+2 SD
Obesity:	>+2SD

Measuring malnutrition in adults

Acute malnutrition in adults is assessed by BMI. BMI cannot be used for pregnant women. Sphere guidelines recommend that BMI be adjusted for the ratio of sitting height to standing height, or *Cormic Index*, though this is not often done in practice. MUAC in combination with clinical signs is often used to screen adults for admittance to feeding centres. While cut-offs have been defined for BMI in adults, there is no international consensus on the cut-off points for classifying severe malnutrition in adults using MUAC. The cut-offs shown below are commonly used during emergencies.

[3] WHO and UNICEF. (2009). *WHO child growth standards and the identification of severe acute malnutrition in infants and children A Joint Statement by the World Health Organization and the United Nations Children's Fund*. Geneva: WHO and UNICEF.

[4] MUAC-for-age or MUAC-for-height is not generally used in practice.

Cut-off points for BMI in adults

	Well-nourished	Mild acute malnutrition	Moderate acute malnutrition	Severe acute malnutrition
BMI (WHO 1995)	≥ 18.5	<18 to ≥17	<17 to ≥16	< 16

Classification of acute malnutrition in adults with MUAC

Nutrition Indicator	Moderate Acute Malnutrition (MAM)	Severe Acute Malnutrition (SAM)
MUAC (WHO 1995)	≥ 214 mm and ≤221 mm (women) ≥ 224 mm and ≤231 mm (men)	< 214 mm (women) < 224 mm (men)
MUAC (Ferro-Luzzi 1996)	< 190 mm (women) < 200 mm (men)	<160 mm (women) < 170 mm (men)
MUAC (SCN 2000)	< 185 and ≥ 160 mm plus clinical signs*	< 160 mm
Bilateral Oedema	No	Yes

* Clinical signs include inability to stand, evident dehydration and presence of oedema.

For **pregnant women of any age**, BMI is an inadequate nutritional index because body weight will be due in part to the growing foetus. MUAC is recommended as the preferred nutritional index for pregnant women, since it does not change significantly during pregnancy. The Sphere Minimum Standards recommend a cut-off point of 210 mm (21.0cm) for identification of nutritional risk in pregnant women in emergencies.

Measuring malnutrition in older people

BMI should be assessed and the same cut-off points as for adults applied. There are no global standard or reference populations for adults or the elderly at this time

Key messages

1. Anthropometry is the use of body measurements to assess and classify nutritional status in an individual.
2. Body measurements include: age, sex, weight, height (or length in children 6-23.9 months or under 87 cm in height) and mid-upper arm circumference (MUAC) for individuals 6 months and older.
3. Clinical signs of acute malnutrition include: visible wasting and bilateral oedema.
4. Acute malnutrition among infants less than 6 months of age is assessed using visible signs of wasting and bilateral oedema. Social criteria such as an absent mother or inadequacy of breastfeeding can indicate nutritional risk.
5. Acute malnutrition among children 6-60 months is assessed using the nutritional indices of weight-for-height or weight-for-length (WFH), MUAC, and signs of bilateral oedema.
6. Undernutrition among children and adolescents 5-19 years is assessed using the nutritional index of body mass index for age (BMI-for-age) and clinical signs.
7. Adult undernutrition is assessed through Body Mass Index (BMI) (either adjusted or unadjusted by Cormic index) or MUAC in addition to clinical signs. MUAC is the preferred nutritional index during pregnancy and up to 6 months postpartum.
8. There are numerous issues related to the assessment of undernutrition in the elderly, however BMI is recommended in addition to clinical signs.
9. The use of the 2006 WHO Growth Standards is now recommended over the use of the 1978 National Center for Health Statistics (NCHS) growth reference in the definition of acute malnutrition in children 6-60 months. The use of the 2007 WHO Growth References is recommended for assessment of children and adolescents 5-19 years.
10. Nutrition indices should be presented as Z-scores as opposed to percentage of the median. Percentage of the median is no longer recommended for use in classification of individual nutrition status.
11. Methodologies and protocols for the anthropometric assessment of children 6-59 months of age are more developed than for other age groups, however additional research into best practice and relationship to functional outcomes is ongoing.

PART 2: TECHNICAL NOTES

The technical notes are the second of four parts contained in this module. This module focuses on how acute malnutrition can be measured in individuals using anthropometry (body measurements) and clinical signs (e.g. visible wasting and bilateral oedema) in emergencies. The basic principles of anthropometric assessment are also applicable in non-emergency contexts and preventive programmes.[1] While the assessment of chronic undernutrition is generally not the focus during emergencies, its measurement and classification in children 6-60 months is discussed briefly at the end of the module.

Details on measurement of micronutrient malnutrition (Module 4), population assessment (Module 7 and Module 10), and the use of individual assessment information for admission and discharge into nutrition programmes (Modules 11, 12 and 13) are covered in other modules. The technical notes are intended for people involved in planning and implementation of nutrition programmes for the treatment of acute malnutrition. They provide technical details, highlight challenging areas and provide clear guidance on accepted current practices. Words in italics are defined in the glossary.

Summary

This module is about how acute malnutrition can be measured in individuals using anthropometry (body measurements) and clinical signs (e.g. visible wasting and bilateral oedema). Technical challenges associated with measuring malnutrition are outlined.

These technical notes are based on the following references and Sphere standard in the box below:

- *Anthropometric Indicators Measurement Guide*. (2003). Washington: FANTA.
- *Management of Acute Malnutrition in Infants (MAMI) Project: Technical Review: Current evidence, policies, practices & programme outcomes*. (2010) London: ENN, UCL-CIHD, ACF.
- *Adolescents: Assessment of Nutritional Status in Emergency-affected Populations*. (2000). Geneva: United Nations Standing Committee on Nutrition.
- *Adults: Assessment of Nutritional Status in Emergency-affected Populations*. (2000). Geneva: United Nations Standing Committee on Nutrition.
- *WHO Child Growth Standards: Training Course on Child Growth Assessment, Modules B & C*. (2008). Geneva: WHO.
- *Distance Learning Course: Nutritional Status – Assessment and Analysis*. (2007). Rome: Food and Agriculture Organization.
- *A Manual: Measuring and Interpreting Malnutrition and Mortality*. (2005). Rome: World Food Programme.

How do we assess nutritional status of an individual?

There are four methods to assess an individual's nutritional status, though not all methods are suitable in emergencies. Since nutritional status cannot be observed directly, observable (proxy) indicators are used instead.[2]

[1] While obesity is acknowledged to be an issue of increasing importance globally, it is not addressed in this module because during an emergency, the focus is on acute malnutrition.

[2] Myatt, Mark, Tanya Khara, Steve Collins (2005). *A review of methods to detect cases of severely malnourished children in the community for their admission into community-based therapeutic care programs*. Food and Nutrition Bulletin, vol. 27, no. 3 (supplement)

Key messages

1. Anthropometry is the use of body measurements to assess and classify nutritional status in an individual.
2. Body measurements include: age, sex, weight, height (or length in children 6-23.9 months or under 87 cm in height) and mid-upper arm circumference (MUAC) for individuals 6 months and older.
3. Clinical signs of acute malnutrition include: visible wasting and bilateral oedema.
4. Acute malnutrition among infants less than 6 months of age is assessed using visible signs of wasting and bilateral oedema. Social criteria such as an absent mother or inadequacy of breastfeeding can indicate nutritional risk.
5. Acute malnutrition among children 6-60 months is assessed using the nutritional indices of weight-for-height or weight-for-length (WFH), MUAC, and signs of bilateral oedema.
6. Undernutrition among children and adolescents 5-19 years is assessed using the nutritional index of body mass index for age (BMI-for-age) and clinical signs.
7. Adult undernutrition is assessed through Body Mass Index (BMI) (either adjusted or unadjusted by Cormic index) or MUAC in addition to clinical signs. MUAC is the preferred nutritional index during pregnancy and up to 6 months postpartum.
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9. The use of the 2006 WHO Growth Standards is now recommended over the use of the 1978 National Center for Health Statistics growth reference (NCHS GR) in the definition of acute malnutrition in children 6-60 months. The 2007 WHO Growth References is recommended for use in assessment of children and adolescents 5-19 years.
10. Nutrition indices should be presented as Z-scores as opposed to percentage of the median. Percentage of the median is no longer recommended for use in classification of individual nutrition status.
11. Methodologies and protocols for the anthropometric assessment of children 6-59 months of age are more developed than for other age groups, however additional research into best practice and relationship to functional outcomes is ongoing.

Anthropometry- can be defined as the measurement of physical dimensions and gross composition of the body (height, weight, mid-upper arm circumference, age, sex).[3] The degree of malnutrition is defined by *cut-off points*, in other words individuals falling below a specific cut-off point are classified with a specific degree of malnutrition. The method that is most widely used to assess nutritional status in an individual or population in emergencies is anthropometry.

Biochemical assessment- involves assessing specific components of blood and urine samples of an individual in order to measure specific aspects of an individual's metabolism, for example serum retinol levels to assess vitamin A status. This is generally expensive, time consuming, and not possible in an emergency.

Clinical assessment- involves assessing the physical presentation of signs and symptoms of acute malnutrition, such as *visible wasting* and *bilateral oedema* (fluid retention on both sides of the body). Bilateral oedema is verified when thumb pressure applied on top of both feet for three seconds leaves a pit (indentation) in the foot after the thumb is lifted. The *clinical sign* of bilateral oedema is critical complementary information to anthropometric information because it affects the weight measures. Signs of visible wasting include a thin "old man" face, loose skin around the buttocks that look like "baggy pants," and prominent ribs. Other clinical signs used in the assessment of acute malnutrition are found in Module 3.

Dietary intake- involves assessing the food intake of individuals over a specific period of time (e.g. 24 hours, 7 days) and comparison of overall intake to daily allowances, which is often not possible in emergencies. Proxy indicators of dietary quantity and quality have been developed for use in emergencies. Details of two examples of these can be found in Box 1.

[3] Jelliffe, DB (1966). *The assessment of the nutritional status of the community*. WHO Monograph No. 53. Geneva. WHO.

Sphere standard

Food security and nutrition, Assessment Standard 2: nutrition[4]

Where people are at increased risk of undernutrition, assessments are conducted using internationally accepted methods to understand the type, degree and extent of undernutrition and identify those most affected, those most at risk, and the most appropriate response.

Key actions

- Compile existing information from pre-disaster and initial assessments to highlight the nature and severity of the nutrition situation.
- Identify groups with the greatest nutritional support needs and the underlying factors that potentially affect nutritional status.
- Determine if population level qualitative or quantitative assessments are needed to better measure and understand anthropometric status, micronutrient status, infant and young child feeding, maternal care practices, and associated potential determinants of undernutrition.
- Consider the opinions of the community and other local stakeholders on the potential determinants of undernutrition.
- Include an assessment of national and local capacity to lead and/or support response.
- Use nutrition assessment information to determine if the situation is stable or declining.

Source: The Sphere Project (2011). *Humanitarian Charter and Minimum Standards in Humanitarian Response, Chapter 3: Minimum Standards in Food Security and Nutrition*. Geneva: The Sphere Project.

Box 1: Dietary intake methods in emergencies

For the World Food Programme's (WFP) Emergency Food Security Assessments, calculation of a food consumption score for households is recommended as part of minimum information requirements. The household's food consumption score is based on dietary diversity (the number of food groups eaten in the recall period), food frequency (the number of times that food is consumed in the recall period) and the relative nutritional importance of those foods. The food consumption score is calculated from the types of foods and the frequencies with which they are consumed during a seven day period.[5]

The 2008 Indicators for assessing infant and young child feeding practices also use dietary recall to produce standard estimates of adequate infant and young child feeding practices. These indicators have been successfully collected and used in emergency contexts. One example is minimum dietary diversity for children 6-23 months of age. It is based on 24 hours recall of dietary diversity (the number of food groups eaten). It is then defined as proportion of children 6-23 months of age who receive foods from 4 or more food groups in that period, since this is correlated with better quality diets for both breastfed and non-breastfed children.[6]

There are some limitations to these examples: they do not indicate quantity of the food intake, and are primarily used for population level rather than individual level assessment. Additionally, recent dietary intake may or may not reflect the "normal" intake. This information can however help in understanding the food security aspects underlying malnutrition.

[4] While the Key actions outlined here refer primarily to population level assessment, individual assessment forms the basis for understanding of nutrition status at population level. Population level assessment is covered in more detail in Module 7.

[5] WFP (2009). *Emergency Food Security Assessment Handbook. Second edition*. Rome. WFP.

[6] WHO (2008). *Indicators for assessing infant and young child feeding practices: conclusions of a consensus meeting held 6-8 November 2007 in Washington D.C., USA*. Rome. WHO.

In the context of emergencies, anthropometric status is commonly referred to as *nutritional status*. Of particular interest in emergencies is the anthropometric status of children 6-59 months, given that they are often the most nutritionally vulnerable in the population.

Anthropometric assessment has its limitations. Anthropometry cannot identify micronutrient malnutrition and does not indicate the driving factors underlying malnutrition. Analysis of the underlying causes at the individual and population level is critical to complement anthropometric information.

Three forms of growth failure (undernutrition) in children 0-60 months can be assessed through anthropometry: *wasting* (acute malnutrition); *stunting* (chronic undernutrition); and *underweight* (acute malnutrition and/or chronic undernutrition) (Table 1).

Table 1: Types of undernutrition in children 0-60 months

Acute malnutrition	• Acute malnutrition is indicated by wasting and/or bilateral oedema. • Wasted children are extremely thin (low *weight-for-height* (WFH)[7]. • Wasting is measured by the nutritional index of WFH or *mid upper arm circumference* (MUAC). • Bilateral oedema, found in cases of *kwashiorkor* and *marasmic-kwashiorkor*, is an abnormal infiltration and excess accumulation of serous fluid in connective tissue or in a serous cavity. • Acute malnutrition is the result of recent rapid weight loss or a failure to gain weight due to acute infection and/or inadequate dietary intake. • Acute malnutrition is readily reversible once conditions improve.
Chronic undernutrition	• Chronic undernutrition is indicated by stunting. • Stunted children are short for their age (low *height-for-age* (HFA). • Stunting is measured by the nutritional index of HFA. • Stunted children may have normal body proportions but look younger than their actual age. • Stunting is a slow, cumulative process that develops over a long period as a result of inadequate nutrition or repeated infections, or both. • The presence of stunting does not necessarily mean that current dietary intake or health is inadequate – the growth failure may have occurred at some time in the past. • By two years of age, stunting may be irreversible.
Underweight (acute and/ or chronic)	• Underweight children weigh less than the average weight for children of the same age and sex. • Underweight is measured by the nutritional index of *weight-for-age* (WFA). • Underweight is due to either wasting or stunting or a combination of both.

Each form of growth failure reflects a different condition. It is important to note that one individual can be classified with more than one form of growth failure at the same time. A child that is suffering from *severe acute malnutrition* (SAM) may be both wasted and stunted.

Infants, adolescents, adults and older people can also be malnourished. Assessment tools and methods for identifying malnutrition, as well as understanding of the longer term health and well-being (functional outcomes) based on type and level of malnutrition, are less well defined in these other age groups. Terminology differs as well: acute malnutrition is referred to as "thinness" rather than "wasting" in individuals 5 years and older.

How can we use anthropometric data in emergencies?

Acute malnutrition is the form of growth failure that is of most concern in emergencies. It is often associated with an increased risk of *morbidity* (illness) and *mortality* (death). Wasted children can rapidly deteriorate but will also improve rapidly if treated appropriately, so identifying, preventing and addressing moderate and SAM malnutrition can save lives.

At the individual level, anthropometric data can be used in:

[7] The abbreviation WFH refers to both weight-for-height and weight-for-length.

Individual assessment

1. *Growth monitoring and promotion* which can be part of a mother and child health (MCH) programme where the growth (weight gain) of infants and young children is monitored over time. The indicator most commonly used is WFA (e.g. underweight, which reflects acute malnutrition and/or chronic undernutrition). This information is often some of the only information available at the onset of emergencies.
2. Community level or programme level *nutritional screening*, where each child is assessed for acute malnutrition in order to refer individuals for further medical check-ups or to services such as targeted supplementary programmes (for moderate acute malnutrition (MAM) or therapeutic feeding (for SAM). This activity is common in emergencies where it is critical to identify cases of acute malnutrition in a timely manner. The indicator of choice is MUAC.
3. *Admission and discharge criteria* into targeted supplementary feeding programmes and therapeutic feeding programmes are generally based on anthropometry, as well as identification of bilateral oedema. The anthropometric indicators of choice are MUAC and WFH for children 6-59 months, and among specific age groups, *Body Mass Index* (BMI) or *BMI-for-age*.

At the population level, anthropometric information can be used in:

Population assessment[8]

- *Nutritional surveillance*[9] for famine early warning systems and food security monitoring. Anthropometry can be used to measure changes in nutritional status of populations over time. The indicators used are usually WFH (as a reflection of acute malnutrition) and MUAC (as a reflection of mortality), though HFA (stunting) and WFA (underweight) can also be included as indicators of underlying vulnerability.
- *Rapid Assessments* are generally conducted in the initial stages of an emergency, in order to quickly establish whether there is a major nutrition problem or not and to identify immediate needs. The indicator of choice is MUAC.
- *Anthropometric surveys* can be used during an emergency in order to assess the extent and severity of malnutrition or to estimate the numbers of children who might require supplementary and therapeutic feeding. The main indicator collected is WFH (with collection of MUAC as additional information, generally used for programme planning).

Measuring acute malnutrition of children aged 6-59 months through a representative sample in anthropometric surveys has become one of the most commonly used proxy indicators of population level nutrition status in emergency situations. Acute malnutrition reflects recent conditions, and young children are generally the most nutritionally vulnerable group. The *prevalence* (rate) of acute malnutrition (defined by WFH and bilateral oedema) among children 6-59 months is a sensitive and objective indicator and can be used to reflect the nutritional status of a broader emergency-affected population. The concern, however, is not just for the children who are classified with MAM or SAM, but for the entire population whose nutritional status is sub-optimal.

In some situations, however, other age groups may be nutritionally vulnerable. For example, in Eastern European countries, where the percentage of young children is relatively low compared to adults and older people, older age groups may be at risk of acute malnutrition. Where breastfeeding is disrupted due to the death of, or separation from, the mother, or where exclusive breastfeeding is not being practised, infants under six months may also be at risk of acute malnutrition.

How do we identify and classify degree of acute malnutrition with anthropometry?

Changes in the anthropometric measures of weight and height may not be due to changes in nutritional status, but due to normal growth with age. From birth until the end of adolescence, growth rates can impact weight and height measurements substantially. Growth patterns also differ between males and females. In order to take these differences in growth patterns into account, anthropometric measurements are transformed into *nutritional indices* (e.g. WFH, WFA, HFA, Body Mass Index (BMI), BMI-for-age).

When an individual has bilateral oedema, a clinical sign for SAM, body weight increases because of the fluid retention. As a result, nutritional indices involving weight (WFH, WFA, BMI, BMI-for-age) cannot be interpreted in the same way in oedematous individuals. Generally WFH is not calculated for an individual with oedema in the assessment of acute malnutrition, but can be used in differentiating between cases of kwashiorkor and marasmic kwashiorkor.

[8] For more information on population assessment, see Module 7.

[9] Nutritional surveillance is covered in detail in Module 10

Nutritional indices are compared to expected anthropometric values for an individual of the same sex and age, e.g. a *growth standard or growth reference*. A **standard** is based on prescriptive criteria and involves value or normative judgments. In contrast, a **reference** reflects the expected values in a reference population. The comparison is used to classify the nutritional status of the individual, e.g. whether they have or do not have MAM or SAM, according to specific cut-off points. Other nutritional indices for acute malnutrition, (e.g. MUAC and BMI), are interpreted directly with cut-off points, without comparison to a growth standard or reference.

Prior to 2006, the internationally accepted reference population for calculating nutrition indices among children 0-59 months was the 1978 National Center for Health Statistics (NCHS GR) international reference. In 2006, the World Health Organisation (WHO) introduced a new growth standard (WHO GS) for children 0-60 months of age. Further details are found in Box 2: The new 2006 WHO Growth Standards.

Box 2: The new 2006 WHO Growth Standards

There has been a long-running debate about whether different ethnic groups grow differently, e.g., whether some ethnic groups are 'naturally' shorter or smaller than others. Data used to develop the new 2006 WHO GS show that young children from all over the world under optimal circumstances will grow in a broadly similar pattern and to within the same height and weight range given the same optimal nutritional, environmental, and care conditions.

The 1978 NCHS GR international references were based on the growth patterns of a limited group of American children, most of whom were formula-fed (and thus have different growth patterns from breastfed babies). The mode of infant feeding and other undesirable features of this reference dataset led to calls for the development of an international growth standard.

The 2006 WHO GS are based on the growth patterns of over 8,000 children 0-60 months from Brazil, Ghana, India, Norway, Oman, and the United States. All the children were deemed to have optimal conditions for good growth, including being breastfed exclusively for the first four to six months, having good medical care, and living in smoke-free households.

When the two sets of charts are compared it can be seen that the median rate of growth during the first six months or so of life is expected to be faster when using the new WHO GS. Later in infancy the expected growth rate decreases relative to the NCHS GR. These differences have important implications for the classification of malnutrition, meaning that the classification of anthropometric status in a child will vary based on which comparison population is used, e.g. NCHS GR or WHO GS. The switch from the NCHS GR to the WHO GS has implications for prevalence estimates and numbers of children admitted into selective feeding programmes. Studies indicate that the overall prevalence of *global acute malnutrition* (GAM) (wasting and/or oedema) changes relatively little, but there is a significant increase in the prevalence of SAM. In turn, this means an increase in the number of children eligible for admission into therapeutic feeding programmes.

Currently, the WHO 2006 GS should be used to calculate nutritional indices for children 6-59 months during an emergency.

Source: Seal, Andrew and Marco Kerac (2007). *Operational implications of using 2006 World Health Organization growth standards in nutrition programmes: secondary data analysis*. BMJ, 334, February.

In 2009, WHO and UNICEF endorsed the use of the new WHO GS to identify SAM in children 6-59 months.[10] In 2009, WHO and UNICEF also endorsed MUAC less than 115 mm/11.5cm (previously the cut-off was 110 mm/11.0cm) as an independent admission criterion for the treatment of SAM. The introduction of the WHO GS and the revision of the MUAC cut-off to identify children with SAM will tend to increase the caseload for therapeutic feeding programmes, however at the same time the duration of treatment will decrease since more children will be detected earlier and in a less severe state.

It is important to note that when WFH (WHO GS) and MUAC are both used, only about 40% selected by the one criterion are also selected by the other. This is explained further in the Case example 1: Classification of acute malnutrition: WFH and MUAC in Nepal.

[10] WHO and UNICEF. (2009). *WHO child growth standards and the identification of severe acute malnutrition in infants and children A Joint Statement by the World Health Organization and the United Nations Children's Fund*. Geneva: WHO and UNICEF.

Case example 1: Classification of acute malnutrition: WFH and MUAC in Nepal

WFH and MUAC are anthropometric indicators that are used independently to identify acute malnutrition. On average, only 40% of children will be identified with SAM by both WFH and MUAC.[11] Community outreach and screening to identify children with acute malnutrition often involves two stages, e.g. screening of children with MUAC in the community, followed by assessment based on WFH upon arrival at the programme facility. Based on WFH, some children would not be classified with SAM. These "rejected referrals" would often undermine the relationship between the programme and the community, decreasing coverage of programmes, and failure to treat all acutely malnourished individuals.

Community based management of acute malnutrition (CMAM) was piloted in the Bardiya district of Nepal by Concern Worldwide from November 2008 to December 2009 based on a clear and demonstrated understanding of the nutrition situation. Between May and December, 1,123 children were admitted into 11 outpatient therapeutic feeding programme sites. Analysis of the monthly statistics over that period of 8 months showed that 34.7% of admissions were classified with SAM based on MUAC (<115mm) alone, 22.1% were classified with SAM based on WFH (<-3 standard deviations (SD)) alone, while 43.2% of those admitted were classified with SAM by both MUAC and WFH. Children were admitted based on WFH or MUAC, so rejected referrals were not an issue in this case.

A critical challenge remains in that MUAC has been endorsed as an independent admission criterion for the treatment of SAM, however the evidence base for MUAC-only admissions in the treatment of MAM is less well developed. For this reason, many programmes admit children based on WFH or MUAC.

Source: Guerrero, Saul. (2010). *Final Evaluation of Concern Worldwide/MoHP Community-based Management of Acute Malnutrition (CMAM) Pilot Programme, Bardiya District, Nepal*. Oxford. Valid International.

And M Myatt, A Duffield, A Seal, F Pasteur (2009). *The effect of body shape on weight-for-height and mid-upper arm circumference based case definitions of acute malnutrition in Ethiopian children*. Annals of Human Biology, vol 36, No.1, pp 5-20.

In 2007, WHO introduced the WHO Growth Reference (WHO GR) for children and adolescents 5 to 19 years of age[12]. Previously, there was no single growth reference for the screening, surveillance and monitoring of acute malnutrition in school-aged children and adolescents.[13] The 2007 WHO GR is a reconstruction of the 1978 NCHS GR data, supplemented with data from the 2006 WHO GS sample.[14] The limitation of the 2007 WHO GR for 5-19 years of age is that it does not describe optimal growth under ideal conditions, and is therefore a reference, rather than a standard. In terms of other forms of undernutrition, the 2007 WHO GR contains WFA data for 5-10 years of age, and HFA as well as BMI-for-age data for 5-19 years of age.

There are no global standard or reference populations for adults or older people at this time.

Some countries have their own national growth reference population data. These are not appropriate to use in emergencies. The 2006 WHO GS should be used for the assessment of children 0-60 months, and the 2007 WHO GR should be used in the assessment of children 5-19 years. If these two have not been formally adopted at country level, the benefits of their use versus the NCHS GR and national references should be discussed with relevant stakeholders.

How do we measure acute malnutrition in infants less than 6 months?

Infants less than 6 months are usually not measured anthropometrically in emergencies, with the exception of assessment of birthweight (Box 3) which is not a reflection of acute malnutrition. While WFH can be used as part of the assessment of acute malnutrition in infants less than 6 months, there are no globally agreed anthropometric cut-off points for classification of anthropometric status. In practice, most protocols that include anthropometric assessment of infants less than 6 months use the same WFH cut-off points as those used for children 6-59 months.[15] MUAC is not currently recommended for use in infants less than 6 months.[16] Visible wasting and bilateral oedema are clinical signs of acute malnutrition in this age group.

[11] WHO and UNICEF. (2009). *WHO child growth standards and the identification of severe acute malnutrition in infants and children A Joint Statement by the World Health Organization and the United Nations Children's Fund*. Geneva: WHO and UNICEF.

[12] Technically the 2007 Growth Reference covers from 5 years and one month (61 months) upwards to 19 years.

[13] The BMI-for-age reference was developed in 1991, but only started at 9 years of age and had several drawbacks for use.

[14] http://www.who.int/growthref/en/

[15] The Sphere Project (2011). *Humanitarian Charter and Minimum Standards in Humanitarian Response, Chapter 3: Minimum Standards in Food Security and Nutrition*. Geneva: The Sphere Project.

[16] ENN, UCL-CIHD, ACF (2010) *Management of Acute Malnutrition in Infants (MAMI) Project: Technical Review: Current evidence, policies, practices & programme outcomes*. London. ENN.

Assessment of nutritional status of infants less than 6 months of age for admission into selective feeding programmes has relied primarily on clinical signs (e.g. oedema, visible wasting, too weak to suckle, not gaining weight despite feeding) and risk factors (e.g. insufficient breastmilk, absence of mother). Assessment should include infant feeding practices, particularly access to breastmilk, and any medical conditions in order to determine whether acute malnutrition in this age group may be a problem.

Due to the assumption that infants less than 6 months are breastfeeding and therefore not at nutritional risk, limited progress has been made in further developing anthropometric tools for this age group for the assessment of acute malnutrition in emergencies.[17] Based on data on exclusive breastfeeding rates from different countries, this assumption is not often met. Further work to define tools and methodologies to assess acute malnutrition in emergencies, such as the use of existing tools for breastfeeding assessment, and growth monitoring rather than one off measurements, are being explored (see Challenge 1). Further definition of measurement of acute malnutrition in infants less than 6 months will need to address several operational issues, such as identification of the most appropriate weighing scales[18] and review of cut-off points for classification of acute malnutrition in relation to functional outcomes in this age group.

Challenge 1: Use of the 2006 WHO Growth Standards and the assessment of acute malnutrition in infants less than 6 months

While the evidence base for infants less than 6 months is limited, a secondary analysis was carried out in 2009 as part of the Management of Acute Malnutrition in Infants (MAMI) project. Data from 21 Demographic Health Surveys were analysed using both the NCHS GR and WHO GS. The analysis found that acute malnutrition based on WFH Z-score in infants less than 6 months is a prevalent public health problem. The degree of the problem was found to be larger when based on the WHO GS as opposed to the NCHS GR. Prevalence of SAM increased over three fold and moderate wasting 1.4 fold when transitioning from NCHS GR to the WHO GS (Z-score).[19] At the individual level, this means that more infants less than 6 months will be classified with acute malnutrition when using the WHO GS rather than the NCHS GR.

While the use of Z-scores (see description of Z-scores and percentage of the median in section on children 6-59 months) is recommended over percentage of the median, in practice many selective feeding programmes still admit infants less than 6 months based on percentage of the median. The implication on caseloads for admission with the transition from percentage of the median NCHS GR to Z-scores based on WHO GS is being defined through further research.

How do we measure acute malnutrition in children aged 6-60 months?

The basic information and body measurements needed to assess acute malnutrition in children 6-60 months are: age, sex, weight, height/length, MUAC, and clinical signs of visible wasting and bilateral oedema. The nutritional indices used are WFH and MUAC.

The decision to measure height or length depends on age and physical condition. Height is measured for children more than or equal to 24 months and length for children under 24 months (e.g. 23.9 months and below). If the age of the child is not known, then height should be measured for children more than or equal to 87 cm, and length measured for children under 87 cm. If a child is too sick to stand, length should be measured.

Guidelines for measuring height, length, weight and arm circumference, estimating age, and for diagnosing bilateral oedema can be found in **Annex 1**. Small errors in individual measurements can result in improper classification of nutrition status. Common errors in measurement are included in **Annex 2**.

WFH

The WFH index is used to assess child wasting. It shows how a child's weight compares to the weight of a child of the same length/height and sex in the WHO GS. The recommended method for comparing an individual's measurement with the WHO GS is using Z-score.

[17] WHO has developed Child Growth Standards: Growth Velocity based on Weight, Length and Head Circumference which provide a set of tools for monitoring the rapid and changing rate of growth in early childhood. These have not however been used extensively in emergencies.

[18] Hanging scales are often used in measuring weight of children 6-59 months but are not considered to be suitable for taking weight of infants less than 6 months. Balance beam scales may be the most suitable for both clinical and community work, however there are other types of scales that have not yet been rigorously compared. Digital UNISCALEs measure infant weight by taking the weight of the mother and child, and subtracting the weight of the mother, which has the benefit of ensuring that the child is calmer than when weighed alone.

[19] Ibid.

Box 3: Low Birth weight and assessment of acute malnutrition in infants less than 6 months

The birthweight of a baby is an indicator of the child's future health and nutritional status as well as an indicator of the mother's nutritional and health status. As such, birthweight is an important indicator for programmes aimed at pregnant and lactating women and young children. A child born with a birthweight below 2.5 kg is defined as *low birthweight* (LBW).

Reliable birthweight data are often scarce, particularly during an emergency. Interpretation of available birthweight data needs to be done with caution. For example, data collected at hospitals may be skewed towards better-nourished mothers, who are more likely to give birth in institutions. Fewer women may be able to access hospitals when there is an emergency, so records at the facility level may be incomplete. Variation in the amount of time between birth and the baby being weighed can also introduce measurement bias in birthweight data.

Children with LBW may not necessarily be acutely malnourished. There has been some concern that LBW infants may be artificially classified with a higher degree of wasting when compared to a non LBW infant. The reanalysis of 21 Demographic Health Surveys by the MAMI project reported that the majority of infants less than 6 months were not LBW infants, however there was an elevated risk of subsequently developing both severe and moderate wasting in LBW infants when compared to normal birth weight infants.[20]

The WHO GS are relevant in anthropometric assessment of LBW infants because LBW infants born at greater than or equal to 37 weeks and less than 42 weeks are included in the data set. Research is on-going in order to define the standard rate of catch up growth in LBW infants and the use of the WHO GS in LBW and non LBW infants.

The Z-score is used to describe how far a measurement is from the median, or average.[21] A WFH Z-score calculated for an individual tells exactly how many standard deviation units an individual's weight value is away from of an individual of the same height in the WHO GS. A positive WFH Z-score means that the individual's measurement is higher than the median weight value of an individual of the same height in the WHO GS, while a negative WFH Z-score means that the measurement is lower than the median weight value of an individual of the same height in the WHO GS.

Ninety-five per cent of the WHO GS population has anthropometric Z-scores between -2 and +2, which is within the normal range. If a child's Z-score falls outside the normal range, this signals a deviation from the norm in his or her nutritional status.

Because the distribution of weight-for-height is skewed in the WHO GS, the formula required to calculate the Z-scores based on the WHO GS uses three parameters, and is thus not practical for hand calculation in the field.[22, 23] Sex specific look up tables have been developed to enable classification of nutrition status in relation to cut-off points[24], and freely downloadable software (WHO Anthro[25]) can automatically generate the specific Z-score value. Box 4 outlines the use of look up tables (sample found in Annex 3), and calculation of exact Z-score by hand or computer.

Percentage of the median, on the other hand, also compares to the weight of a child of the same length/height and sex. The measured weight is divided by the median weight of a child of the same length/height, multiplied by 100.

While percentage of the median has been commonly used in the field as the basis for admission criteria into selective feeding programmes, global recommendations issued in May 2009 recommend the use of Z-score instead of percentage of the median for admission and discharge criteria for programmes that treat acute malnutrition.[26] Because of this global recommendation, calculation of percentage of the median is not covered further here, but can be found in Annex 4. There are however some technical issues related to the shift from use of percentage of the median NCHS GR to the use of WHO GS Z-scores (see Box 5).

[20] Management of Acute Malnutrition in Infants (MAMI) Project (2010): Technical Review: Current evidence, policies, practices & programme outcomes. London: ENN, UCL-CIHD, ACF.

[21] The method for calculating Z score is different between normally distributed (e.g. height) versus non-normally distributed measurements (e.g. weight).

[22] This is in contrast to the NCHS GR where calculation of Z score by hand was easily done in the field. The complexity of the calculation in the WHO GS is due to the methodology in the construction of the WHO GS.

[23] Hand calculation is also only possible for children whose Z score falls between -3 and +3 Z score. A separate equation is required for values beyond those parameters, which is not possible by hand.

[24] Simplified sex-combined tables for the NCHS GR were often used in the field in situations where it is important to simplify systems as much as possible.

[25] www.who.int/childgrowth/software/

[26] WHO and UNICEF. (2009). WHO child growth standards and the identification of severe acute malnutrition in infants and children A Joint Statement by the World Health Organization and the United Nations Children's Fund

Box 4: Calculation of weight for height Z-score

A. Using look up tables to identify Z-score range

Separate tables are used for boys and for girls. They come in two forms- full (which include L, M, and S values which are related to the way that the WHO GS were calculated) and simplified field tables. Both can be used for estimation of the category of malnutrition and have similar layout. The sex and age range are clearly noted on the top (eg. Weight-for-height boys 2-5 years, weigh-for-length girls birth to 2 years). The left-most column displays length or height increasing with an interval of 0.5 cm, and subsequent columns have values for weight in kg under columns of -3SD, -2SD, -1SD, median, +1SD, +2SD, +3SD.

Using the table for the correct sex and age group, one looks down the left-most column of length/height until the value of the individual child is found. Then one moves horizontally in the same line to find where the individual's weight is listed, or if not listed, then the two columns between which the value would fall. This will allow determination of the range of values, eg greater than -3 SD and less than -2 SD.

For example, a boy is 3 years old, is 90.6 cm and 10.8 kg.

Using the WFH table for boys 2-5 years, one finds the nearest height value in cm to 90.6. In this case, it is 90.5cm. Moving horizontally and to the right, the value of 10.6 kg falls between 10.3 kg (or -3SD) and 11.1kgs (or -2SD). The Z-score is greater than -3 SD and less than -2 SD.

Weigh-for-height BOYS
2 to 5 years (z-scores)

				Z-scores (weight in kg)			
Heigh (cm)	L	M	S	-3 SD	-2 SD	-1 SD	Median
89.0	-0.3521	12.6495	0.08045	10.0	10.8	11.7	12.6
89.5	-0.3521	12.7683	0.08038	10.1	10.9	11.8	12.8
90.0	-0.3521	12.8864	0.08032	10.2	11.0	11.9	12.9
90.5	-0.3521	13.0038	0.08028	10.3	11.1	12.0	13.0
91.0	-0.3521	13.1209	0.08025	10.4	11.2	12.1	13.1
91.5	-0.3521	13.2376	0.08024	10.5	11.3	12.2	13.2

Given that the tables only show length/height in 0.5 cm increments, it is necessary to round the values.

If length/height ends in 0.1 or 0.2, then you round down to 0.0.

If length/height ends in 0.3 or 0.4, you round up to 0.5

If length/height ends in 0.6 or 0.7, you round down to 0.5.

If length/height ends in 0.8 or 0.9, you round up to the next highest 0.0.

Box 4: Calculation of weight for height Z-score (continued)

B. calculating the Z-score by hand

The full tables, which include values for L, M, and S, have to be used, along with a complicated formula. This formula will also only apply if the child has a Z-score between -3SD and +3 SD. It is not possible to calculate by hand when the Z-score is below -3 SD or above +3SD. It isn't possible to know whether this is the case, so making the calculation by hand can result in wasted time in the field.

The formula for calculation of Z-score (if it falls between -3 and +3 SD) is

$$\text{Z-score} = \frac{(\text{observed value}/M)^{L} - 1}{L \times S}$$

Let's take an example of a girl who is 3 years and 1 month old. Her height is 91.1cm, with a weight of 10.5 kg. Using the lookup tables, the values for L, M, and S for someone with a height of 91.0cm (e.g. 91.1 was rounded down to 91.0) are:

M = 12.8939
L = -0.3833
S = 0.08920

$$\text{Z-score} = \frac{(10.5/12.8939)\ -0.3833 - 1}{(-0.3833 \times 0.08920)}$$

$$= \textbf{-2.26}\ \text{Z-score}$$

C. Calculating the Z-score by computer

The WHO Anthro software has an anthropometric calculator module. It requires the user to enter the date of birth, weight, length or height, to specify how the measurement was made (standing up or lying down), sex, and presence or absence of oedema. The Z-scores (with 2 decimal places) for WFH, HFA, WFA, and BMI for age are generated and can be graphically displayed against the standard curves.

Box 5: NCHS GR percentage of the median and WHO GS Z-scores

The shift from using NCHS GR percentage of the median for admission to programmes to WHO GS Z-scores is recommended. In making the transition, some things to keep in mind are:

Classification: The WHO GS appear to classify children who were previously identified as moderately malnourished by NCHS GR as severely malnourished. When weight is plotted against height, the cut-off of 80% of the median NCHS GR is close to the cut-off of – 3 Z-score WHO GS, while the cut-off of 70% of the median NCHS GR is close to the cut-off – 4 Z-score WHO GS.[27] This difference has been estimated to translate into a 2 to 5 fold increase in admissions. While the WHO GS and the revision of the MUAC cut-off to identify SAM children will increase the caseload for therapeutic feeding programmes, the duration of treatment will decrease since more children will be detected earlier and in a less severe state.

Ease of use: The concept of Z-scores is more complicated than that of percentage of the median. Field workers may find it difficult to adequately calculate and use Z-score information without sufficient training, understanding, and supportive supervision. Since Z-scores using the WHO GS will tend to identify more children with acute malnutrition, field workers may notice that the children that are being admitted (often earlier in terms of level of deterioration) may not look the same in terms of condition as those admitted under NCHS GR percentage of the median, leading them to doubt their classification.

Community understanding: With the shift, many children who were not eligible before will become eligible for admission into programmes to treat acute malnutrition. Without adequate engagement with the community members in terms of explaining the changes, the reasons for the changes and the implications, relationships between the programmes and the community can become strained, putting field level workers in a potentially uncomfortable position.

[27] WHO, UNICEF, WFP and UNHCR (2010). Consultation on the Programmatic Aspects of the Management of Moderate Acute Malnutrition in Children under five years of age: 24-26 February. Geneva: WHO.

MUAC

MUAC is an indicator of wasting and in particular lean body mass.[28] It is a proxy measure of nutrient reserves in muscle and fat. Measurement is not time consuming, and has been documented as an effective predictor of risk of death in children aged 6 to 59 months.[29] MUAC has been endorsed as an independent admission criterion for nutrition programmes addressing SAM.[30] The cut-off was recently modified from less than 110mm (11cm) to less than 115mm (11.5 cm) for classification of SAM.[31] Appropriateness of this shift in terms of identifying severely malnourished children has been documented from the field.[32] MUAC does not respond rapidly when malnourished children are treated. It is less helpful in measuring recovery or improvement of nutritional status over a short period of time.[33]

MUAC does have a bias towards selecting younger rather than older children, who naturally have a smaller arm circumference measurement. This bias is considered acceptable in terms of identifying individuals at risk of mortality and classifying acute malnutrition. MUAC can be adjusted for age and height in order to compensate for this bias towards younger children – WHO GS tables are available for MUAC-for-age – however use of MUAC-for-age and MUAC-for-height is not widespread.

Some operational issues in the use of MUAC persist, as described in **Challenge 2** below. Cut-off points for MUAC are found in Table 2.

Challenge 2: The use of MUAC

MUAC has been successfully used with low-skilled staff given training and supervisory support, and is especially suitable for use in the community. The method is based on a single measurement, as opposed to two measurements (for example weight and height). It does not require heavy material and can be used with a single cut-off for boys and girls.[34] It is increasingly being incorporated into guidelines for the treatment of severe and moderate malnutrition.[35] However, there are drawbacks to using MUAC in emergencies. The chance of inaccurate measurement is high due to differing techniques, and there is limited evidence documenting ethnic differences in MUAC measurements.

At the individual level, MUAC can be used to initially screen individuals for admission to selective feeding programmes. It is an independent admission criterion for treatment of SAM, however it is not currently recommended as a discharge criterion.

At the population level, it is recommended that MUAC information is collected in nutrition surveys for use in programme planning, but that MUAC should not be used as the single measure in anthropometric surveys. Research is underway to determine appropriateness of using MUAC to estimate population level nutrition status.

Classification of acute malnutrition in children (6-60 months)

Cut-off points are used to classify the severity of malnutrition measured through anthropometric indices. The cut-offs for different nutritional indices for children are shown in Table 2.

A child with bilateral oedema is always classified with SAM, however bilateral oedema is a clinical sign of both kwashiorkor (bilateral oedema), as well as marasmic kwashiorkor (severe wasting and bilateral oedema). In order to differentiate between kwashiorkor and marasmic kwashiorkor, there is a need to include explicit identification of wasting. This has previously been defined as:[36]

[28] Young, Helen and Susanne Jaspars (2009). *Review of Nutrition and Mortality Indicators for the IPC: Reference Levels and Decision-making.* Geneva: UNSCN.

[29] IASC Global Nutrition Cluster, and Standing Committee on Nutrition (SCN) Task Force on Assessment, Monitoring, and Evaluation. (2009). Fact sheet on MUAC. Geneva: UNSCN.

[30] WHO, WFP, IASC, UNICEF. (2007). *Community-Based Management of Severe Acute Malnutrition.* Geneva: WHO.

[31] WHO and UNICEF. (2009). *WHO child growth standards and the identification of severe acute malnutrition in infants and children A Joint Statement by the World Health Organization and the United Nations Children's Fund.* Geneva: WHO and UNICEF.

[32] Fernandez, MA, Delchevalerie P, Van Herp M. (2010) *Accuracy of MUAC in the detection of severe wasting with the new WHO growth standards.* Pediatrics July; 126 (1) e195-201.

[33] WHO. *Guidelines for an integrated approach to the nutritional care of HIV-infected children (6 months -14 years).* 2009. Geneva, WHO.

[34] IASC Global Nutrition Cluster, and Standing Committee on Nutrition (SCN) Task Force on Assessment, Monitoring, and Evaluation. (2009). *Fact sheet on MUAC.* Geneva: UNSCN.

[35] ENN, UCL-CIHD, ACF (2010). Management of Acute Malnutrition in Infants (MAMI) Project: *Technical Review: Current evidence, policies, practices & programme outcomes.* London. ENN.

[36] Action Contre La Faim/Prudhon, Claudine (2002). *Assessment and Treatment of Malnutrition in Emergency Situations: Manual of Therapeutic Care and Planning for a Nutritional Programme.* Paris: ACF.

Table 2: Classification of acute malnutrition in children 6-60 months

Nutrition Indicator	Moderate Acute Malnutrition (MAM)	Severe Acute Malnutrition (SAM)
WFH (wasting)	≥ -3 SD & < -2 SD	< -3 SD
MUAC	≥ 115mm & < 125mm (≥ 11.5cm & < 12.5cm)	<115mm (<11.5cm)
MUAC for age/height		< -3 SD
Bilateral Oedema	No	Yes

	Criteria
Kwashiorkor	Bilateral pitting oedema And WFH ≥ -2 Z-scores
Marasmic-kwashiorkor	Bilateral pitting oedema And WFH < -2 Z-scores

As mentioned in Case Example 1 (Nepal), the nutritional indices of WFH and MUAC may not always identify the same children with SAM. Recent research suggests that these differences may be related in part to body shape of population groups (see Challenge 3). For the time being, and until the evidence base is developed, the cut-off points in Table 2 are recommended for classification of acute malnutrition in children 6-59 months.

Challenge 3: Body shape and the use of MUAC and WFH in children 6-59 months

Body shape, in terms of the proportion of the trunk to legs, has been documented to vary among adults. This proportion is measured through the sitting height to standing height ratio (SH/S or SSR). Smaller values of SSR translate into longer limbs and/or shorter trunks, while larger SSR values translate into longer trunks and/or shorter limbs. Correction of WFH for SSR is not currently practiced for children 6-59 months. Recent research has however documented differences in the classification of acute malnutrition in children 6-59 months within the same ethnic group, specifically between livelihood groups, in relation to SSR.

In 2005, an anthropometric survey was conducted in the Belete Weyne district of Somalia by Save the Children – UK. It reported that prevalence estimates for GAM were different when based on WFH Z-score and MUAC in pastoralist and agro-pastoralist livelihood zones. In the riverine-agrarian livelihood zone, however, the estimated prevalence was similar, whether based on WFH Z-score or MUAC. Further research identified that children in the pastoralist and agro-pastoralist livelihood zones had longer limbs and lower SSR than children from the riverine-agrarian livelihood zone.

A more formal study on the relationship between each nutritional index and body shape was carried out among children 24-59 months (as opposed to 6-59 months commonly used in anthropometric surveys). Based on current case definitions and cut-off points, standard WFH Z-score tended to overestimate the prevalence of acute malnutrition in populations with lower SSR body shapes in comparison to MUAC. MUAC was also found to be associated with body shape, though the relationship was weak. Further research is ongoing to define the potential implications of body shape on classification of nutrition status in relation to body shape.

Source: M Myatt, A Duffield, A Seal, F Pasteur (2009).The effect of body shape on weight-for-height and mid-upper arm circumference based case definitions of acute malnutrition in Ethiopian children. Annals of Human Biology: Vol 36, No.1, pp 5-20.

Measuring malnutrition in older children, adults and older people

Increasing attention is being paid to assessing malnutrition in older children, adults and older people, however the tools and protocols to make the assessment are not as well developed as they are for children 6-59 months of age. Women, especially during pregnancy and lactation, have long been considered a nutritionally vulnerable group. In some emergencies, high rates of wasting in adults and older people have been noted. Inclusion of women of reproductive age in anthropometric surveys are increasingly common, but less so in emergencies. Inclusion of older children and adolescents remain relatively rare unless part of a research study.

Children and Adolescents 5-19 years of age

The basic information and body measurements needed to assess acute malnutrition in children 5-19 years of age are: age, sex, weight, and height, in addition to the clinical signs of visible wasting and bilateral oedema. Adolescence, which occurs from around 10 to 18 years of age, is a period of rapid growth and sexual maturation. Rates of change in height and weight are not constant. There are, however, no field-friendly and accurate methodologies for adjusting for sexual maturation in adolescents.

WHO recommends that acute malnutrition among children and adolescents 5-19 years be assessed by calculating BMI, and then adjusting for age to generate BMI-for-age. BMI is calculated based on the weight (in kg) divided by the square of the height (in m) of the individual. (See Box 6 for an example).[37] BMI-for-age should be presented in Z-scores based on the 2007 WHO GR for children 5-19 years.

Recommended cut-off points for BMI-for-age are found in Table 3. Bilateral oedema and visible wasting are also clinical signs of SAM in this age group. Anthropometric measurements should not be used as the sole indicator of malnutrition in adolescents.

Sex specific tables and charts exist, and a sample can be seen in Annex 5. Look up tables are used in the same way as they are in Box 4 (calculation of Z-scores).

Classification of children and adolescents 5-19 years of age

	BMI-for-age Z-score
Severe thinness:	<-3SD
Thinness:	≥ -3 SD & < -2 SD
Overweight:	>+1SD & ≤+2 SD (equivalent to BMI 25 kg/m^2 at 19 years)
Obesity:	>+2SD (equivalent to BMI 30 kg/m^2 at 19 years)

There are no internationally agreed upon cut-offs for MUAC for children 5-19 years; however recent guidelines for the nutritional care of HIV-Infected Children have proposed the following values for screening (pending formal validation):

- In children 5-9 years of age, a MUAC less than 129 mm (-3 z-score according to growth standards for 5 year old boys)
- In children 10-14 years of age, a MUAC less than 160 mm.[38, 39]

[37] Weight for-age is inadequate for monitoring growth beyond childhood due to its inability to distinguish between relative height and body mass. The Sphere Project (2011). *Humanitarian Charter and Minimum Standards in Humanitarian Response, Chapter 3: Minimum Standards in Food Security and Nutrition.* Geneva: The Sphere Project.

[38] WHO 2009. *Guidelines for an integrated approach to the nutritional care of HIV-infected children (6 months -14 years).* Geneva, WHO.

[39] The recommendation for children 10-14 years of age is consistent with WHO (2004). *Acute care. Integrated Management of Adolescent and Adult Illness. Interim Guidelines for First-Level Facility Health Workers at Health Centre and District Outpatient Clinic.* (2004). Geneva, WHO.

At the population level, surveys should only be done on this age group once an analysis of the causes of malnutrition has determined that the nutritional status of young children does not reflect the nutritional status of the general population, and in that case only if adequate human resources and technical support are available.[40] Surveys using BMI-for-age, however, have found unrealistically high levels of adolescent wasting in emergency-affected populations. This may be due to inaccurate age data and the fact that later sexual development affects body proportions among adolescents affected by emergencies. Surveys of older children and adolescents also tend to collect information on specific age ranges relevant for their particular purposes, which can vary based on the context and do therefore not represent a standardised group. No clear thresholds for classifying population level nutrition status based on older child and adolescent nutrition status exist.

Adults (20-59.9 years)

The basic information and body measurements needed to assess acute malnutrition in adults 20-59.9 years are weight, height, and MUAC in addition to the clinical signs of bilateral oedema and visible wasting. In emergencies, undernutrition (chronic energy deficiency) is the form of malnutrition of most concern among adults 20-59.9 years because it reflects recent conditions and can deteriorate quickly, leading to increased risk of morbidity and mortality.

The most useful measure of undernutrition in adults is BMI, an indicator of weight deficit in relation to height. BMI is not compared to a reference population, but is classified directly based on specific cut-off points (Table 4). An example of a BMI calculation is provided in **Box 6**.

Box 6: Example of the calculation of BMI

A young, non-pregnant woman's height is 1.60 m and her weight is 50 kg.

$$\text{BMI} = \frac{\text{Measured weight (kg)}}{\text{Height2 (m2)}}$$

$$= \frac{50\ \text{kg}}{1.6\text{m2}}$$

$$\textbf{BMI} = \textbf{19.5}$$

NB: This woman is not malnourished.

Table 4: Cut-off points for BMI in adults

	Well-nourished	Mild acute malnutrition	Moderate acute malnutrition	Severe acute malnutrition
BMI (WHO 1995)	≥ 18.5kg/m^2	<18 to ≥17kg/m^2	<17 to ≥16kg/m^2	< 16kg/m^2

BMI cannot be used for pregnant women because a pregnant woman's weight will be related to the growth of the baby and changes in the body related to pregnancy. BMI cannot distinguish between acute malnutrition and chronic undernutrition in an individual. There are also daily fluctuations in height (due to compression effect of gravity a person's height is greatest in the morning), weight (depending on fluid and food intake/digestion), and age related changes in body characteristics that affect these measures. BMI should not be calculated for adults with oedema because of the bias introduced by weight of extra body fluids.

Differences in body shape (e.g. sitting height-to-standing height ratio (SSR or SH/S) do impact the classification of acute malnutrition in adults using anthropometry. International guidelines[41] recommend that BMI should be adjusted for SSR, which in adults is called the *Cormic index*. The Cormic index varies between populations and within populations (Challenge 4). Such adjustments can substantially change the prevalence of wasting in adults, and may have important programmatic consequences. While this is recognized technically, this is not commonly practiced and not widely documented (see Case Example 2). Guidance on adjusting for Cormic Index is given in Annex 6.

[40] The Sphere Project (2011). *Humanitarian Charter and Minimum Standards in Humanitarian Response, Chapter 3: Minimum Standards in Food Security and Nutrition.* Geneva: The Sphere Project.

[41] Ibid.

Challenge 4: Variation in body shape in anthropometric measurements in adults

There are differences in adult body shape that vary between groups, even within the same country. In terms of variation between populations, the ratio of leg-length to trunk-length, sometimes called the *sitting height to standing height ratio* (SSR or SH/S) or Cormic index, varies from a ratio of 0.48 in Australian aborigines (e.g., long legs compared to a shorter trunk) to up to 0.55 in the Japanese (e.g., short legs compared to a longer trunk). These differences can have a considerable influence on the value of adult BMI.

Available information on the range of Cormic index in different populations indicates a typical ratio of 0.52-0.53 in European and Indo-Mediterranean populations, 0.54 in Western Pacific regions, and 0.51 to 0.52 in African populations. Practically speaking, a 0.01 difference in the Cormic index translates into a difference in BMI of 1kg/m squared[42]. The SSR can also vary widely within the same population. One example from an aboriginal population reported a range of 0.41 to 0.54 for the Cormic index, translating into a variation of more than 10 kg/m squared dependent on the body shape alone within that one population.

In addition, there are some ethnic groups who appear to be unusually tall and slim, including the Kenyan Samburu and the Dinka from Southern Sudan. As a result, the average adult BMI of these groups is below average, at around 17.6. There is, however, no evidence clearly defining the physiological outcomes associated with the lower BMI of these groups.

Documentation on the impact of these body shape differences on assessment of acute malnutrition in adults is limited, and the understanding of functional outcomes based on these differences is even less well understood.

Case Example 2: Adjusting for the Cormic Index in Somalia, 2009

No national level information on micronutrient status was available in Somalia. In order to address this gap, the Food Security and Nutrition Analysis Unit in collaboration with UNICEF, WFP, WHO, the Ministry of Health and the University College London Centre for International Heath and Development (UCL CIHD) initiated a national, two-stage, stratified, household cluster survey in 2009. Anthropometric information was collected, as well as information on household characteristics, dietary intake, micronutrient status, infant feeding practices, and malaria prevalence.

BMI was calculated for 1,929 non-pregnant women. The mean BMI of the population was 22.5 kg/m^2. The mean Cormic Index was 50.5%. While it was recognized that correction of BMI using the Cormic Index is required for comparison of prevalence data between populations, the different equations available and lack of consensus on the best method for use with Somali populations meant that the report presented unadjusted BMI. Using the cut-off point <18.5 for grade 1 thinness gave an overall prevalence of 21.5% (95% CI 19.4-25.8).

In order to more fully understand the assessment of adults in Somalia, additional analysis was conducted to compare adjusted and non adjusted prevalence of GAM. When BMI was adjusted with the Cormic Index, it reduced GAM prevalence in non pregnant women by 2-3%.

Source: FSNAU, FAO, UCL, WHO, UNICEF, WFP, MOH (2009). National Micronutrient and Anthropometric Survey, and personal communication.

MUAC in adults should also be collected and, in combination with clinical signs, is often used by international agencies to screen adults for admittance to feeding centres. There is no international consensus on the cut-off points for classifying severe malnutrition in adults using MUAC. In practice, the cut-offs shown in Table 5 are commonly used by international agencies during emergencies.

For **pregnant women of any age**, MUAC is recommended as the preferred nutritional index for pregnant women, since it does not change significantly during pregnancy. MUAC has also been found to be a good predictor of risk of giving birth to a low birthweight infant. In practice, cut-off points used for identification of women at nutritional risk range from 210mm (21cm) to 230mm (23cm). The Sphere Minimum Standards recommend a cut-off point of 210mm for identification of nutritional risk in pregnant women in emergencies.[43]

[42] Ibid.

[43] The Sphere Project (2011). *Humanitarian Charter and Minimum Standards in Humanitarian Response, Chapter 3: Minimum Standards in Food Security and Nutrition*. Geneva: The Sphere Project.

Table 5: Classification of acute malnutrition in adults with MUAC

Nutrition Indicator	Moderate Acute Malnutrition (MAM)	Severe Acute Malnutrition (SAM)
MUAC (WHO 1995)[i]	≥ 214 mm and ≤221 mm (women) ≥ 224 mm and ≤231 mm (men)	< 214 mm (women) < 224 mm (men)
MUAC (Ferro-Luzzi 1996)[ii]	< 190 mm (women) < 200 mm (men)	<160 mm (women) < 170 mm (men)
MUAC (SCN 2000)[iii]	< 185 and ≥ 160 mm plus clinical signs[iv]	< 160 mm
Bilateral Oedema	No	Yes

[i] WHO (1995). Physical Status: The Use and Interpretation of Anthropometry – Report of a WHO Expert Committee. Technical Report Series 854. Geneva, WHO.

[ii] Ferro-Luzzi, Anna and W. P. T. James (1996). Adult malnutrition: simple assessment techniques for use in emergencies. British Journal of Nutrition, 75.

[iii] United Nations Standing Committee on Nutrition (2000). Adults: Assessment of Nutritional Status in Emergency-affected Populations. Geneva: SCN.

[iv] Clinical signs include inability to stand, evident dehydration and presence of oedema.

Older people (60 years and above)

The basic information and body measurements needed to assess acute malnutrition in people 60 years and above are weight and height in addition to the clinical signs of bilateral oedema and visible wasting. Older people are a difficult group to define and a particularly difficult group to assess anthropometrically. In developing countries, a person may be considered elderly from the age of 45 years onwards, whereas in developed countries, old age is considered to start at around 60 years of age.

As older people are more likely to be disabled, bedridden or unable to stand straight, accurately measuring height is difficult. Furthermore, declines in height (due to stooping and compression of the vertebrae) occur with age at a rate of 1cm to 2cm per decade after the age of 40, and even more rapidly in older age. Research suggests that measures such as the arm length and knee length can be used to estimate height in older people. However, no standard method of estimating height from these proxy measures has been established.

In emergencies if there is an indication that older people are a particularly vulnerable group, if possible BMI should be assessed and the same cut-off points as for adults applied. Case example 3 provides some insight into the use of other criteria to define nutritional risk in older people.

Anthropometry, stunting and underweight in children 6-60 months[44]

Anthropometry can identify three forms of growth failure (undernutrition): wasting, stunting, and underweight (Table 1). The three nutritional indices of WFH, HFA, and WFA each assess different aspects of growth failure. As a result, they may or may not identify the same children with each form of undernutrition. The WHO GS have separate tables to determine Z-score for HFA and WFA, and are used in the same way as WFH tables.

Stunting: Chronic undernutrition

Stunting, or low height for age (HFA) in children 0-59 months, is commonly used in large scale assessments of population nutrition status in terms of monitoring progress towards development goals. Stunting is generally irreversible after 2 years of age. At the individual and population level, it does not change rapidly. The cut-off points are:

Nutrition Indicator	Moderate stunting	Severe stunting
HFA (stunting)	<-2 SD to ≥-3 SD	< -3 SD

[44] Note that assessment of acute malnutrition, stunting and underweight for infants under 6 months is not well defined using anthropometric cut-offs, although they are included in the WHO GS.

Case Example 3: HelpAge and nutritional assessment in older people

HelpAge has been working in West Darfur, Sudan, for more than 25 years in order to address the needs of older people. Activities were focussed in Internally Displaced Person (IDP) camps. For the purpose of its programming, and taking into account cultural norms, HelpAge defined an older person as someone over 55 years old. In order to target individuals for programmes, they relied on assessment of vulnerability, including social isolation, living with dependents, level of mobility, and lack of a general food distribution ration card.

In May 2006, HelpAge conducted a rapid assessment in order to assess the health and nutrition status of older people living in IDP camps.to identify older people's profiles and their social vulnerability risk factors, as the basis for further programme work.

Anthropometric status was based on MUAC because of the ease of measurement, but anthropometric information was only one factor to define overall vulnerability and follow up programming. Clinical risk factors included bilateral famine oedema, inability to stand, extreme weakness, dehydration or anorexia, while social factors included living alone without family support, physical or mental disability, incapacity to do household activities, very low social economic status or psychological trauma.

Nutrition Status	MUAC (mm)	Clinical Risk Factors	Social Risk Factors	Action needed
Normal	>185	Yes/No	No	Do not admit
High Nutrition Risk	>185	Yes/No	Yes	Community Support Programme
Moderate Malnutrition	160-185	No	Yes/No	Supplementary Feeding Programme
Severe Malnutrition	160-185	Yes	Yes/No	Therapeutic Feeding Programme
Severe Malnutrition	<160	Yes/No	Yes/No	Therapeutic Feeding Programme

The information gathered was used to better target HelpAge programming as well as to advocate with humanitarian programming in other sectors to address the specific vulnerabilities of older people.

Source: HelpAge International (2006). *Rebuilding lives in longer-term emergencies: Older people's experience in Darfur*. London: HelpAge International.
HelpAge International (2006). *Health and Nutrition Rapid Assessment of Older People in West Darfur State, Sudan-Final report*.

Underweight: a composite indicator that includes acute malnutrition and/or chronic undernutrition

Underweight, or low weight for age (WFA), is commonly used in growth monitoring programmes for children 0-59 months. It is also monitored as a key indicator in the Millennium Development Goals. It cannot differentiate between the contribution of acute malnutrition and chronic undernutrition. The cut-off points are:

Nutrition Indicator	Moderate underweight	Severe underweight
WFA (underweight)	<-2 SD to ≥-3 SD	< -3 SD

Multiple anthropometric failures

While the different forms of growth failure have been presented as separate issues, it is possible for one individual to be identified with more than one form of growth failure at the same time. Some underweight children may be identified with stunting and/or wasting, some stunted children may not have any other form of undernutrition, while others might have all three-stunting, wasting, and underweight. Being classified with more than one form of malnutrition is also called *multiple anthropometric failures*. The limited information available suggests that those children with multiple anthropometric failures are more likely to be ill. Of those with multiple anthropometric failures, those that exhibit all three were shown to have the greatest morbidity risk.[45]

[45] Nandy, S, Irving, M, Gordon, D, Subramania, SV, & Davey Smith, G (2005). *Poverty, child undernutrition and morbidity: new evidence from India*. Bulletin of the World Health Organization, 83 (3): 210-216.

There is no single protocol for defining this degree of multiple failures in an individual, the functional outcomes if the child is experiencing multiple anthropometric failures, nor the appropriate action to be taken by the health or nutrition staff at clinic and community level. Each anthropometric indicator has a different meaning, hence to get a comprehensive picture of a child's nutritional status, it would be important to derive all three nutrition indices. This is not always possible in an emergency.

Annex 1: Anthropometric Measurement of Children Aged Six Months to Five Years[46]

It is critical to ensure that training on taking anthropometric measures and identifying presence and grade of bilateral oedema includes both theoretical and practical training. It is also critical to ensure that adequate supervision and assessment of measurement and calculations is available.

WEIGHT

To increase accuracy and precision, two people are needed to measure weight. Weight can be measured using a Salter-type hanging spring scale (as is commonly found in the field) or an electronic scale such as the United Nations Children's Fund (UNICEF) UNISCALE, which is more reliable and allows a child to be measured in the mother/caregiver's arms.

Hanging Spring (Salter) Scale

A 25 kilogram (kg) hanging spring scale, graduated by 0.1 kg, is most commonly used. In the field setting, the scale is hooked to a tree, a tripod or a stick held by two people. In a clinic, it is attached to the ceiling or a stand. Weighing pants (or a weighing hammock for smaller infants) are attached to the scale. Culturally adapted solutions, such as a mother's wrap, basin or grass basket, might be preferable to use to weigh the child. The weighing pants or hammock is suspended from the lower hook of the scale, and the scale is readjusted to zero. The child's clothes are removed and the child is placed in the weighing pants or hammock. The scale should be read at eye level.

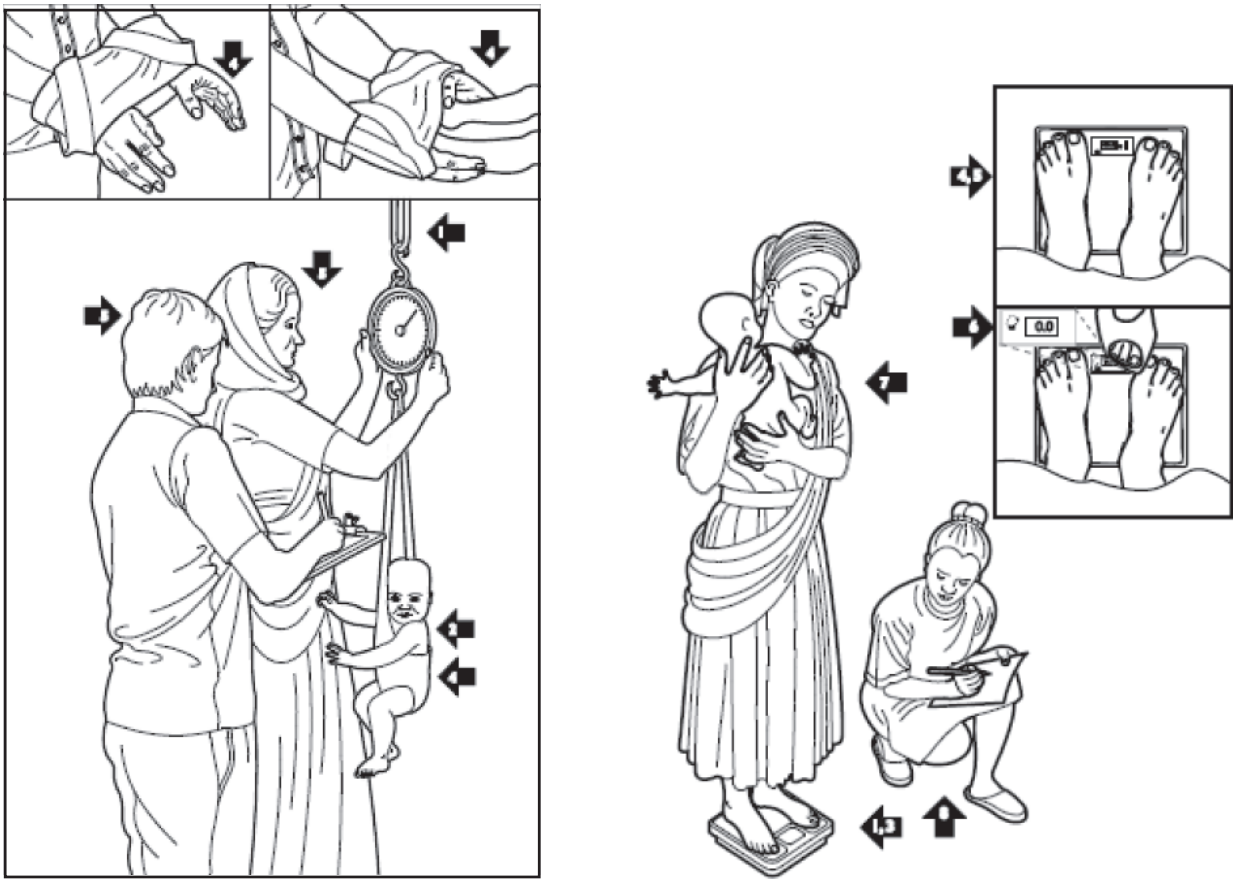
How to use the Salter Scale:

- Before weighing the child, take all his/her clothes off.
- Zero the weighing scales (i.e., make sure the arrow is on 0).
- Place the child in the weighing pants/hammock, making sure the child is touching nothing.
- Read the child's weight. The arrow must be steady and the weight/scale should be read at eye level.
- Record the weight in kg and to the nearest 100 grams (g) (e.g., 6.4 kg).

Considerations when using the Salter Scale:

- The scale should be checked daily against a known weight. To do this, set the scale to zero and weigh objects of known weight (e.g., 5.0 kg, 10.0 kg, 15.0 kg). If the measure does not match the weight to within 10 grams the springs must be changed or the scale should be replaced.
- Make sure the child is safely in the weighing pants or hammock with one arm in front and one arm behind the straps to help maintain balance.
- In cold climates or in certain cultures it might be impossible or impractical to undress a child completely. The average weight of the clothes should be estimated and deducted from the measure. It is helpful to retain similar clothing for girls and boys during weighing to help to standardise weight deductions.
- When the child is steady and settled, the weight is recorded in kg to the nearest 100g. If the child is moving and the needle does not stabilise, the weight should be estimated by recording the value at the midpoint of the range of oscillations. The measurer reads the value on the scale aloud, and the assistant repeats it for verification and records it on the anthropometric form or treatment card. The child is then dressed.

[46] FANTA-2. (2010). *Generic CMAM Job Aids*. Washington DC. Fanta Project. & Mozambique Ministry of Health, UNICEF and FANTA-2 (201). Pacote de Formação para o Programa de Reabilitação Nutricional.



Electronic Scale (e.g., UNISCALE)

The UNISCALE is powered by a lithium battery which should last for one million weighings. It has a solar switch that turns the device on in daylight or a normally lit room. One important feature is that it allows a mother/caregiver to hold the child while the child is being weighed. The scale comes with instructions.

How to use the UNISCALE:

- Regular calibration (e.g. each morning).
- Place the scale on a flat surface in a well-lit area, making sure that all four of the scale's feet are on the ground.
- Remove as much of the child's clothing as possible.
- Wave a hand over the solar switch to turn on the scale. The scale shows a picture of an adult, indicating that it is ready to weigh an adult.
- The mother/caregiver stands on the scale first, without the child. The scale shows the weight and stores it in its memory. The adult remains on the scale.
- Wave a hand over the solar switch again. The scale shows a picture of an adult holding a child indicating that it is ready to weigh an adult with a child.
- Pass the child to be weighed to the adult on the scale. The adult should remain still.
- The scale shows the child's weight.

HEIGHT

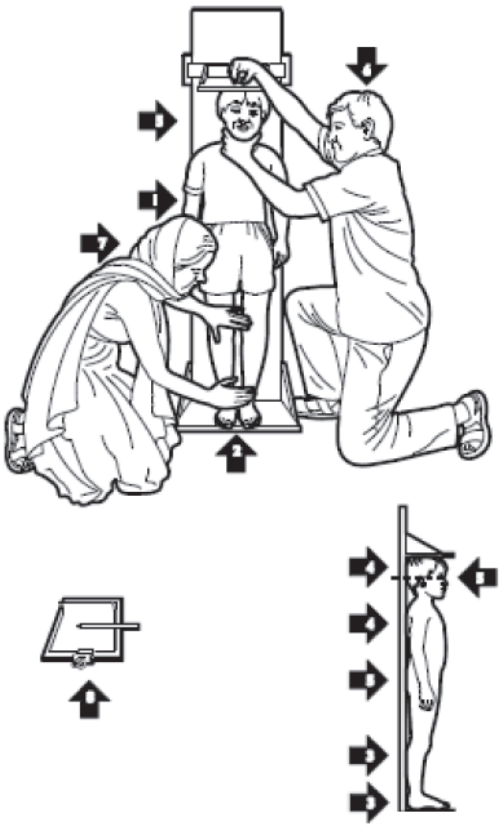
To increase accuracy and precision, two people are always needed to measure length and height.

Children 2 years or older (24 months and upwards) are measured standing up, while those under 2 (23.9 months or below) are measured lying down. If the age is difficult to assess, children with a height of 87 cm tall or above are measured standing and those less than 87 cm are measured lying down (WHO Standards). The difference in recumbent length versus standing height is 0.7cm, meaning that a child who is measured lying down will appear artificially taller than they would if they were measured standing up. The artificial additional height will then tend to overestimate the degree of wasting in that individual. While it is possible to correct for this in the analysis by subtracting 0.7cm from the measurement (e.g. if a child age 2 or older or with a height of 87 cm or above are measured lying down, 0.7 cm is subtracted from the measurement), it is recommended to ensure that children are measured either standing up or lying down according to age (or height cut-offs in the absence of age determination).

For Children 2 Years or Older or With a Height of 87 cm or Greater

Steps for and considerations in measuring HEIGHT (standing up):

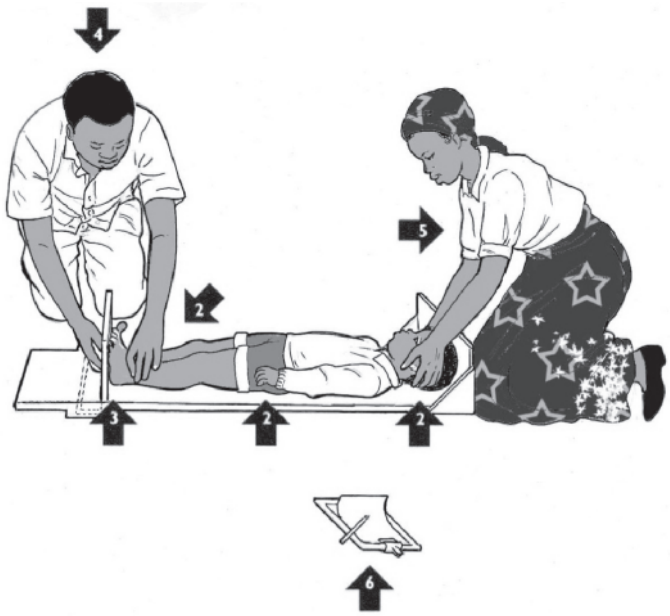
- The child's shoes are removed.
- The child is placed on the height board, standing upright in the middle of the board with arms at his/her sides.
- The assistant firmly presses the child's ankles and knees against the board while the measurer holds the child's head straight.
- The child's heels, back legs, buttocks, shoulders and head should be touching the back of the board, and his or her feet should be close together.
- The child's head should be straight and looking ahead. A line between the ears and eyes should be parallel to the floor.
- The measurement is always made with two people: one assistant is holding the child's legs and feet, and the measurer the child's head. The person holding the head reads the measurement out loud to the nearest 0.1cm. The assistant repeats it for verification and records it on the anthropometric form or treatment card.

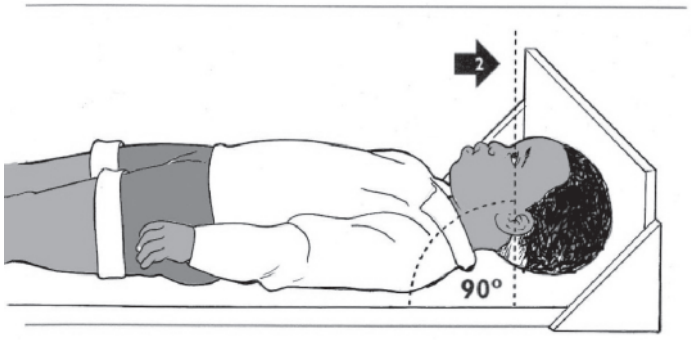


For Children under 2 or With a Height Less Than 87 cm

Steps for and considerations in measuring LENGTH (Lying Down):

- The height board is placed on the ground.
- The child's shoes are removed.
- The child is gently placed on his or her back on the middle of the board, facing straight up with arms at his/her sides and feet at right angles.
- The measurement is always made with two people
- The one assistant holds the sides of the child's head and positions it on the board.
- While holding down the child's ankles or knees, the other person who takes the measurement moves the sliding board up against the bottom of the child's feet and reads the child's length to the nearest 0.1 cm.
- The measurer announces the measurement, and the assistant repeats it for verification and records it on the anthropometric form or treatment card.





MID-UPPER ARM CIRCUMFERENCE OR MUAC

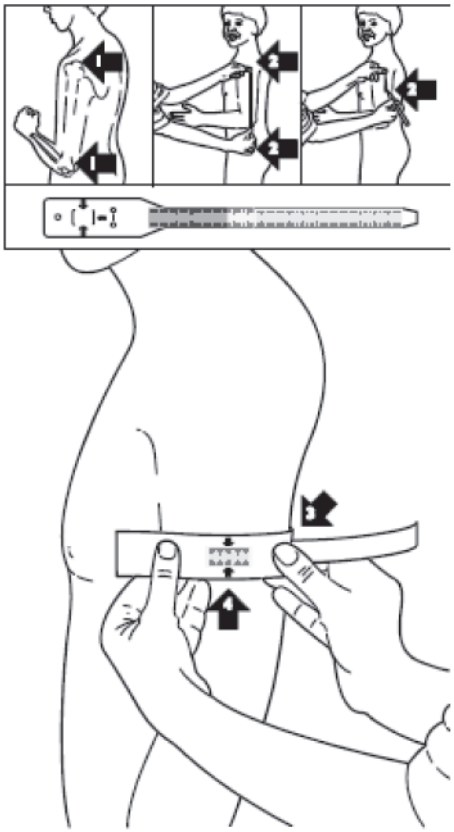
MUAC is used for children 6-59 months. It is essential to use the age cutoff of 6 months for MUAC. It is not recommended to use a height cutoff as proxy for 6 months.[47] If the birth date is unconfirmed, use the recall of the mother/caregiver to estimate the infant's age.

How to measure MUAC:

- The MUAC is always taken on the left arm.
- Measure the length of the child's left upper arm, between the bone at the top of the shoulder and the elbow bone (the child's arm should be bent).
- Mark the middle of the child's upper arm with a pen. It is helpful to use a string to find the midpoint rather than the MUAC tape.
- The child's arm should then be relaxed, falling alongside his/her body.
- Wrap the MUAC tape around the child's arm, such that all of it is in contact with the child's skin. It should be neither too tight, nor too loose.
- Read the MUAC in millimetres (mm).

For the numbered tapes, feed the end of the tape down through the first opening and up through the third opening. **The measurement is read from the middle window where the arrows point inward. MUAC can be recorded with a precision of 1 mm.**

For the simple three-color tape (red, yellow, green), slide the end through the first opening and then through the second opening. Read the colour that shows through the window at the point the two arrows indicate.



[47] In a stunted population many infants 6 months or older will have a height less than 65 centimetres (cm).

Estimating age

Emergency nutrition surveys frequently measure the weight and height of children aged six months to five years. However, in many rural areas of the developing world, the age of children is not known. In general, the younger the child is, the more accurately you can estimate her/his month of birth.

The following methods are helpful for determining or estimating the age of a child, if the mother does not know.

- Look up age in official registers. In rural communities, you normally cannot find local official registers of births or a baptismal certificate book. Instead, some households may have the child's immunization card. If health workers properly recorded the date of birth on the immunization card, then you can copy the date from the card. Therefore, when trying to determine a child's age, you should always ask to see the child's immunization card.
- Use the birth date of a neighbour's child as a reference. If the age of a neighbour's child is known, then you can ask other women whether or not their child was born before or after the reference child.
- Use a local events calendar. A local events calendar shows all the dates on which important events took place during the past five years. It can show local holidays, hailstorms, the opening of a nearby school or clinic and political elections, etc. You should ask the mother whether or not the child was born before or after a certain event, and work out a fairly accurate age in this way.

BILATERAL PITTING OEDEMA

Bilateral pitting oedema can be verified when thumb pressure applied on top of both feet for three seconds leaves a pit (indentation) in the foot after the thumb is lifted. The pit will remain in both feet for several seconds. Bilateral pitting oedema usually starts in the feet and ankles. It is important to test both feet; if the pitting is not bilateral, the oedema is not of nutrition origin. A second person repeats the test to confirm the presence of bilateral pitting oedema.

There are three grades of bilateral pitting oedema. When there is no bilateral pitting oedema, the grade is çabsent.é Grades of bilateral pitting oedema are classified by plus signs.

Grade+

Mild: both feet/ankles

Grade++

Moderate: both feet, plus lower legs, hands, or lower arms

Grade+++

Severe: generalized oedema including both feet, legs, hands, arms and face

Annex 2: Common Measurement Errors

Common errors	Solution
1. All measurements	
Restless child	Postpone measurement. Involve parent in procedure.
Inaccurate reading	Training and retraining stressing accuracy
Recording	Record results immediately after taking measurements and confirm record.
2. Length/height	
Incorrect method for age	Measure length when child is < 2 years or < 87 cm.
Foot wear/headgear	Remove – in privacy if necessary.
Head not in correct plane, chin too high or too close to body	Correct technique and get child to hold head straight by talking to him/her and crouching down to his or her level and looking into his/her eyes. The child will be encouraged to look at you, so position yourself to get head at right angle.
Child not straight along board, knees bent, feet pointing down when lying down	Correct technique with practise and regular retraining. Provide adequate assistance – three people needed. One for head, one for arms and middle and one for knees, feet and measurement taking. Get parent in middle to hold arms and talk to child to calm them.
Sliding board not firmly against heels/head	Settle child. Ensure adequate pressure applied. If measuring a child standing up, move head board to compress hair and ensure head touches board. If measuring a child lying down, move the sliding board to firmly touch the bottom of the feet.
Child not straight along height board – feet apart or knees bent	Don't take measurements while child is struggling. Ensure assistants and parent all help to position child. One for legs and feet, one for head and measurement taking. Parent can talk to child.
3. Weight	
Scale not calibrated	Recalibrate after every measurement.
Child wearing heavy clothing or amulets	Remove in private or make allowances for clothing and amulets by subtracting their weight equivalent from child weight, e.g., 100 g of clothes for underwear.
Child moving or anxious in hanging pants	Wait until child is calm. The more he or she moves and tries to grab measurers, the more likely the measurement is to be up to 1 kg off. One assistant to talk to child and other to position head in front of scales at the right angle to read measurement as soon as the scale stabilizes.
4. MUAC	
Child won't let go of mother	Get mother to hold child on her hip with child's left arm facing measurer.
Mid-upper arm point incorrect	Find tip of shoulder and elbow carefully. Practise finding half way between the two.
MUAC tape too loose or too tight giving an incorrect reading	Practise, supervise and retrain. Get measurer to practice on calm, older children and adults. Demonstrate.

Annex 3: Partial Samples of WHO Growth Standard Look-up Table for Birth – 2 years

World Health Organization

Weight-for-length GIRLS Birth to 2 years (z-scores)

Length (cm)	L	M	S	Z-scores (weight in kg)						
				-3SD	-2SD	-1SD	Median	1SD	2SD	3SD
45.0	-0.3833	2.4607	0.09029	1.9	2.1	2.3	2.5	2.7	3.0	3.3
45.5	-0.3833	2.5457	0.09033	2.0	2.1	2.3	2.5	2.8	3.1	3.4
46.0	-0.3833	2.6306	0.09037	2.0	2.2	2.4	2.6	2.9	3.2	3.5
46.5	-0.3833	2.7155	0.09040	2.1	2.3	2.5	2.7	3.0	3.3	3.6
47.0	-0.3833	2.8007	0.09044	2.2	2.4	2.6	2.8	3.1	3.4	3.7
47.5	-0.3833	2.8667	0.09048	2.2	2.4	2.6	2.9	3.2	3.5	3.8
48.0	-0.3833	2.9741	0.09052	2.3	2.5	2.7	3.0	3.3	3.6	4.0
48.5	-0.3833	3.0636	0.09056	2.4	2.6	2.8	3.1 3.4	3.7	4.1	
49.0	-0.3833	3.1560	0.09060	2.4	2.6	2.9	3.2	3.5	3.8	4.2
49.5	-0.3833	3.2520	0.09064	2.5	2.7	3.0	3.3	3.6	3.9	4.3
50.0	-0.3833	3.3518	0.09068	2.6	2.8	3.1	3.4	3.7	4.0	4.5
50.5	-0.3833	3.4557	0.09072	2.7	2.9	3.2	3.5	3.8	4.2	4.6
51.0	-0.3833	3.5636	0.09076	2.8	3.0	3.3	3.6	3.9	4.3	4.8
51.5	-0.3833	3.6754	0.09080	2.8	3.1	3.4	3.7	4.0	4.4	4.9
52.0	-0.3833	3.7911	0.09085	2.9	3.2	3.5	3.8	4.2	4.6	5.1
52.5	-0.3833	3.9105	0.09089	3.0	3.3	3.6	3.9	4.3	4.7	5.2
53.0	-0.3833	4.0332	0.09093	3.1	3.4	3.7	4.0	4.4	4.9	5.4
53.5	-0.3833	4.1591	0.09098	3.2	3.5	3.8	4.2	4.6	5.0	5.5
54.0	-0.3833	4.2875	0.09102	3.3	3.6	3.9	4.3	4.7	5.2	5.7
54.5	-0.3833	4.4179	0.09106	3.4	3.7	4.0	4.4	4.8	5.3	5.9
55.0	-0.3833	4.5498	0.09110	3.5	3.8	4.2	4.5	5.0	5.5	6.1
55.5	-0.3833	4.6827	0.09114	3.6	3.9	4.3	4.7	5.1	5.7	6.3
56.0	-0.3833	4.8162	0.09118	3.7	4.0	4.4	4.8	5.3	5.8	6.4
56.5	-0.3833	4.9500	0.09121	3.8	4.1	4.5	5.0	5.4	6.0	6.6

WHO Child Growth Standard

Simplified field tables

World Health Organization

Weight-for-length BOYS Birth to 2 years (z-scores)

CM	-3 SD	-2 SD	-1 SD	Me-dian	1 SD	2 SD	3 SD
45.0	1.9	2.0	2.2	2.4	2.7	3.0	3.3
45.5	1.9	2.1	2.3	2.5	2.8	3.1	3.4
46.0	2.0	2.2	2.4	2.6	2.9	3.1	3.5
46.5	2.1	2.3	2.5	2.7	3.0	3.2	3.6
47.0	2.1	2.3	2.5	2.8	3.0	3.3	3.7
47.5	2.2	2.4	2.6	2.9	3.1	3.4	3.8
48.0	2.3	2.5	2.7	2.9	3.2	3.6	3.9
48.5	2.3	2.6	2.8	3.0	3.3	3.7	4.0
49.0	2.4	2.6	2.9	3.1	3.4	3.8	4.2
49.5	2.5	2.7	3.0	3.2	3.5	3.9	4.3
50.0	2.6	2.8	3.0	3.3	3.6	4.0	4.4
50.5	2.7	2.9	3.1	3.4	3.8	4.1	4.5
51.0	2.7	3.0	3.2	3.5	3.9	4.2	4.7
51.5	2.8	3.1	3.3	3.6	4.0	4.4	4.8
52.0	2.9	3.2	3.5	3.8	4.1	4.5	5.0
52.5	3.0	3.3	3.6	3.9	4.2	4.6	5.1
53.0	3.1	3.4	3.7	4.0	4.4	4.8	5.3
53.5	3.2	3.5	3.8	4.1	4.5	4.9	5.4
54.0	3.3	3.6	3.9	4.3	4.7	5.1	5.6
54.5	3.4	3.7	4.0	4.4	4.8	5.3	5.8
55.0	3.6	3.8	4.2	4.5	5.0	5.4	6.0
55.5	3.7	4.0	4.3	4.7	5.1	5.6	6.1
56.0	3.8	4.1	4.4	4.8	5.3	5.8	6.3
56.5	3.9	4.2	4.6	5.0	5.4	5.9	6.5
57.0	4.0	4.3	4.7	5.1	5.6	6.1	6.7
57.5	4.1	4.5	4.9	5.3	5.7	6.3	6.9
58.0	4.3	4.6	5.0	5.4	5.9	6.4	7.1
58.5	4.4	4.7	5.1	5.6	6.1	6.6	7.2
59.0	4.5	4.8	5.3	5.7	6.2	6.8	7.4
59.5	4.6	5.0	5.4	5.9	6.4	7.0	7.6
60.0	4.7	5.1	5.5	6.0	6.5	7.1	7.8
60.5	4.8	5.2	5.6	6.1	6.7	7.1	8.0
61.0	4.9	5.3	5.8	6.3	6.8	7.4	8.1
61.5	5.0	5.4	5.9	6.4	7.0	7.6	8.3
62.0	5.1	5.6	6.0	6.5	7.1	7.7	8.5
62.5	5.2	5.7	6.1	6.7	7.2	7.9	8.6
63.0	5.3	5.8	6.2	6.8	7.4	8.0	8.8
63.5	5.4	5.9	6.4	6.9	7.5	8.2	8.9
64.0	5.5	6.0	6.5	7.0	7.6	8.3	9.1

CM	-3 SD	-2 SD	-1 SD	Me-dian	1 SD	2 SD	3 SD
64.5	5.6	6.1	6.6	7.1	7.8	8.5	9.3
65.0	5.7	6.2	6.7	7.3	7.9	8.6	9.4
65.5	5.8	6.3	6.8	7.4	8.0	8.7	9.6
66.0	5.9	6.4	6.9	7.5	8.2	8.9	9.7
66.5	6.0	6.5	7.0	7.6	8.3	9.0	9.9
67.0	6.1	6.6	7.1	7.7	8.4	9.2	10.0
67.5	6.2	6.7	7.2	7.9	8.5	9.3	10.2
68.0	6.3	6.8	7.3	8.0	8.7	9.4	10.3
68.5	6.4	6.9	7.5	8.1	8.8	9.6	10.5
69.0	6.5	7.0	7.6	8.2	8.9	9.7	10.6
69.5	6.6	7.1	7.7	8.3	9.0	9.8	10.8
70.0	6.6	7.2	7.8	8.4	9.2	10.0	10.9
70.5	6.7	7.3	7.9	8.5	9.3	10.1	11.1
71.0	6.8	7.4	8.0	8.6	9.4	10.2	11.2
71.5	6.9	7.5	8.1	8.8	9.5	10.4	11.3
72.0	7.0	7.6	8.2	8.9	9.6	10.5	11.5
72.5	7.1	7.6	8.3	9.0	9.8	10.6	11.6
73.0	7.2	7.7	8.4	9.1	9.9	10.8	11.8
73.5	7.2	7.8	8.5	9.2	10.0	10.9	11.9
74.0	7.3	7.9	8.6	9.3	10.1	11.0	12.1
74.5	7.4	8.0	8.7	9.4	10.2	11.2	12.2
75.0	7.5	8.1	8.8	9.5	10.3	11.3	12.3
75.5	7.6	8.2	8.8	9.6	10.4	11.4	12.5
76.0	7.6	8.3	8.9	9.7	10.6	11.5	12.6
76.5	7.7	8.3	9.0	9.8	10.7	11.6	12.7
77.0	7.8	8.4	9.1	9.9	10.8	11.7	12.8
77.5	7.9	8.5	9.2	10.0	10.9	11.9	13.0
78.0	7.9	8.6	9.3	10.1	11.0	12.0	13.1
78.5	8.0	8.7	9.4	10.2	11.1	12.1	13.2
79.0	8.1	8.7	9.5	10.3	11.2	12.2	13.3
79.5	8.2	8.8	9.5	10.4	11.3	12.3	13.4
80.0	8.2	8.9	9.6	10.4	11.4	12.4	13.6
80.5	8.3	9.0	9.7	10.5	11.5	12.5	13.7
81.0	8.4	9.1	9.8	10.6	11.6	12.6	13.8
81.5	8.5	9.1	9.9	10.7	11.7	12.7	13.9
82.0	8.5	9.2	10.0	10.8	11.8	12.8	14.0
82.5	8.6	9.3	10.1	10.9	11.9	13.0	14.2
83.0	8.7	9.4	10.2	11.0	12.0	13.1	14.3
83.5	8.8	9.5	10.3	11.2	12.1	13.2	14.4

Annex 4: Calculation of Z-score for normally distributed measurements (height for age) and percentage of the median

A. Calculation of Z-score by hand for HFA

The distribution of height data is normal, e.g. bell shaped, and uses a more simple equation than for non-normal (weight) information for calculation of Z-score.

In this example, a boy measures 84.2 cm in length and is 27 months old. Based on the WHO GS Height-for-Age for Boys, 2-5 years (Z-scores), the median height for boys of 27 months of age is 89.6 and the SD for the distribution for boys of 27 months of age is 3.2928. Using these values, and the formula provided, it is possible to calculate a height for age Z-score.

1. Z-score

$$\frac{\text{measured height} - \text{median height of 27 month boy in WHO GS population}}{\text{Z-score of the WHO GS population}}$$

$$\frac{84.2-89.6}{3.2928} = \textbf{-1.64 Z-score}$$

B. Calculation of Percentage of the median

Percentage of the median expresses the child's measurements as a percentage of the expected value for the reference population. The percentage of the median will classify slightly fewer children as malnourished compared to when Z-scores are used. Percentage of the median used to be the primary admission and discharge criteria for programmes addressing acute malnutrition.

In this example, a boy measures 84.2 cm in length and weighs 9.9 kg. The reference population data for this example is from the NCHS GR (since calculation of Z-scores is recommended with the WHO GS) and shows that the reference median weight for boys of 84 cm is 11.7 kg and that the SD for the reference distribution for boys of 84 cm is 0.908. Using these values, and the formula provided, it is possible to calculate a weight for height percentage of the median.

2. Percentage of the median

$$\frac{\text{Measured weight} \times 100}{\text{Percentage of the Median} = \text{Median of reference population}}$$

$$\frac{9.9 \text{ kg} \times 100}{11.5 \text{ kg}} = \textbf{86.1\% of the median}$$

Cut-off points for undernutrition based on percentage of the median for children 6-59 months

Nutrition Indicator	Moderate undernutrition	Severe undernutrition
Bilateral oedema	No	Yes
Weight for height (wasting)	≥ 70% to <80%	< 70%
Height for age (stunting)	≥ 85% to <90%	< 85%
Weight for age (underweight)	≥ 60% to <80%	< 60%

Annex 5: Partial Samples of 2007 WHO Growth Reference Look Up Tables for 5-19 Years

World Health Organization

BMI-for-age BOYS 5 to 19 years (z-scores)

Year: month	Month	L	M	S	Z-scores (BMI in kg/m²)						
					-3SD	-2SD	-1SD	Median	1SD	2SD	3SD
5:1	61	-0.7387	15.2641	0.08390	12.1	13.0	14.1	15.3	16.6	18.3	20.2
5:2	62	-0.7621	15.2616	0.08414	12.1	13.0	14.1	15.3	16.6	18.3	20.2
5:3	63	-0.7856	15.2604	0.08439	12.1	13.0	14.1	15.3	16.7	18.3	20.2
5:4	64	-0.8089	15.2605	0.08464	12.1	13.0	14.1	15.3	16.7	18.3	20.3
5:5	65	-0.8322	15.2619	0.08490	12.1	13.0	14.1	15.3	16.7	18.3	20.3
5:6	66	-0.8554	15.2645	0.08516	12.1	13.0	14.1	15.3	16.7	18.4	20.4
5:7	67	-0.8785	15.2684	0.08543	12.1	13.0	14.1	15.3	16.7	18.4	20.4
5:8	68	-0.9015	15.2737	0.08570	12.1	13.0	14.1	15.3	16.7	18.4	20.5
5:9	69	-0.9243	15.2801	0.08597	12.1	13.0	14.1	15.3	16.7	18.4	20.5
5:10	70	-0.9471	15.2877	0.08625	12.1	13.0	14.1	15.3	16.7	18.5	20.6
5:11	71	-0.9697	15.2965	0.08653	12.1	13.0	14.1	15.3	16.7	18.5	20.6
6:0	72	-0.9921	15.3062	0.08682	12.1	13.0	14.1	15.3	16.8	18.5	20.7
6:1	73	-1.0144	15.3169	0.08711	12.1	13.0	14.1	15.3	16.8	18.6	20.8
6:2	74	-1.0365	15.3283	0.08741	12.2	13.1	14.1	15.3	16.7	18.6	20.8
6:3	75	-1.0584	15.3408	0.08771	12.2	13.1	14.1	15.3	16.8	18.6	20.9
6:4	76	-1.0801	15.3540	0.08802	12.2	13.1	14.1	15.4	16.8	18.7	21.0
6:5	77	-1.1017	15.3679	0.08833	12.2	13.1	14.1	15.4	16.9	18.7	21.0
6:6	78	-1.1230	15.3825	0.08865	12.2	13.1	14.1	15.4	16.9	18.7	21.1
6:7	79	-1.1441	15.3978	0.08898	12.2	13.1	14.1	15.4	16.9	18.8	21.2
6:8	80	-1.1649	15.4137	0.08931	12.2	13.1	14.2	15.4	16.9	18.8	21.3
6:9	81	-1.1856	15.4302	0.08964	12.2	13.1	14.2	15.4	17.0	18.9	21.3
6:10	82	-1.2060	15.4473	0.08998	12.2	13.1	14.2	15.4	17.0	18.9	21.4
6:11	83	-1.2261	15.4650	0.09033	12.2	13.1	14.2	15.5	17.0	19.0	21.5
7:0	84	-1.2460	15.4832	0.09068	12.3	13.1	14.2	15.5	17.0	19.0	21.6
7:1	85	-1.2656	15.5019	0.09103	12.3	13.2	14.2	15.5	17.1	19.1	21.7
7:2	86	-1.2849	15.5210	0.09139	12.3	13.2	14.2	15.5	17.1	19.1	21.8

2007 WHO Reference

Simplified field tables

BMI-for-age GIRLS 5 to 19 years (z-scores)

World Health Organization

Year: month	Month	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
5:1	61	11.6	12.7	13.9	16.2	16.8	18.9	21.3
5:2	62	11.6	12.7	13.9	16.2	16.8	18.9	21.4
5:3	63	11.6	12.7	13.9	16.2	16.8	18.9	21.5
5:4	64	11.6	12.7	13.9	16.2	16.8	18.9	21.5
5:5	65	11.7	12.7	13.9	16.2	16.8	19.0	21.6
5:6	66	11.7	12.7	13.9	16.2	16.8	19.0	21.7
5:7	67	11.7	12.7	13.9	16.2	16.8	19.0	21.7
5:8	68	11.7	12.7	13.9	16.3	17.0	19.1	21.8
5:9	69	11.7	12.7	13.9	16.3	17.0	19.1	21.9
5:10	70	11.7	12.7	13.9	16.3	17.0	19.1	22.0
5:11	71	11.7	12.7	13.9	16.3	17.0	19.2	22.1
6:0	72	11.7	12.7	13.9	16.3	17.0	19.2	22.1
6:1	73	11.7	12.7	13.9	16.3	17.0	19.3	22.2
6:2	74	11.7	12.7	13.9	16.3	17.0	19.3	22.3
6:3	75	11.7	12.7	13.9	16.3	17.1	19.3	22.4
6:4	76	11.7	12.7	13.9	16.3	17.1	19.4	22.5
6:5	77	11.7	12.7	13.9	16.3	17.1	19.4	22.6
6:6	78	11.7	12.7	13.9	16.3	17.1	19.5	22.7
6:7	79	11.7	12.7	13.9	16.3	17.2	19.5	22.8
6:8	80	11.7	12.7	13.9	16.3	17.2	19.6	22.9
6:9	81	11.7	12.7	13.9	16.4	17.2	19.6	23.0
6:10	82	11.7	12.7	13.9	16.4	17.2	19.7	23.1
6:11	83	11.7	12.7	13.9	16.4	17.3	19.7	23.2
7:0	84	11.8	12.7	13.9	16.4	17.3	19.8	23.3
7:1	85	11.8	12.7	13.9	16.4	17.3	19.8	23.4
7:2	86	11.8	12.8	14.0	16.4	17.4	19.9	23.5
7:3	87	11.8	12.8	14.0	16.5	17.4	20.0	23.6
7:4	88	11.8	12.8	14.0	16.5	17.4	20.0	23.7
7:5	89	11.8	12.8	14.0	16.5	17.5	20.1	23.9
7:6	90	11.8	12.8	14.0	16.5	17.5	20.1	24.0

Annex 6: Correction of BMI with the Cormic Index (SSR or SH/S)[48]

In order to standardise BMI to take into account changes in SH/S ratio we recommending using the equations below to calculate BMI standardised to the actual SH/S ratio for the population under study.

Male subjects – BMI = 0.78(SH/S) -18.43

Female subjects – BMI = 1.19(SH/S) -40.34

Note: SH/S ratios should be expressed as a percentage The observed BMIs can then be standardised to a SH/S ratio of 0.52 by adding the differences between the observed BMI and BMI standardized for the population SH/S ratio to a BMI standardized to 0.52 using the equation below:

BMISstd = BMI0.52 + (BMIob-BMIes),

Where BMIstd = standardised BMI,
BMI0.52 = estimated BMI at SH/S of 0.52
BMIob = actual BMI
BMIes = estimated BMI at actual SH/S

Examples

1. A Male population "A" has a mean BMI of 18.5 kg m-2 and a mean SH/S ratio of 50%. TheBMI0.52 = 0.78 * 52-18.43 = 22.13. The BMIes = 0.78 * 50-18.43 = 20.57. Therefore the BMIstd = 22.13 + (18.5 - 20.57) = 20.06kg m-2
2. A Female population "A" has a mean BMI of 17.0 kg m-2 and a mean SH/S ratio of 54%. The BMI0.52 = 1.19 * 52-40.34 = 23.92. The BMIes = 1.19 * 54-40.34 = 21.54. Therefore the BMIstd = 21.54 + (17.0 - 23.92) = 14.62 kg m-2

[48] Taken from United Nations Standing Committee on Nutrition (2000). *Adults: Assessment of Nutritional Status in Emergency-affected Populations*. Geneva: SCN.

MODULE 6

Measuring malnutrition: Individual assessment

PART 3: TRAINER'S GUIDE

The trainer's guide is the third of four parts contained in this module. It is NOT a training course. This guide provides guidance on how to design a training course by giving tips and examples of tools that the trainer can use and adapt to meet training needs*. The trainer's guide should only be used by experienced trainers to help develop a training course that meets the needs of a specific audience. The trainer's guide is linked to the technical information found in Part 2 of the module.

Module 6 covers anthropometry as a way of measuring the nutritional status of an individual. It does not include micronutrient status as this is covered in Module 4. Anthropometry is used in both emergency and non-emergency situations. This module can be used to provide a practical training for field workers to carry out measurements to assess nutritional status either as part of a nutrition survey or to identify individuals for selective feeding programmes. It can also provide a short practical briefing on the different anthropometric indices and classifications for senior managers. This module focuses on individual assessment while population assessment (nutrition surveys) is covered in Module 7.

Navigating your way around the guide

The trainer's guide is divided into six sections.

1. **Tips for trainers** provide pointers on how to prepare for and organize a training course.
2. **Learning objectives** set out examples of learning objectives for this module that can be adapted for a particular participant group.
3. **Testing knowledge** contains an example of a questionnaire that can be used to test participants' knowledge either at the start or at the end of a training course.
4. **Classroom exercises** provide examples of practical exercises that can be done in a classroom context either by participants individually or in groups.
5. **Field-based exercises** outline ideas for field visits that may be conducted during a longer training course.

* The images and text in the anthropometric measurement cards are drawn from FANTA-2 (2010). *Generic CMAM Job Aids*. Washington DC: Fanta Project.

CONTENTS

1. Tips for trainers

Step 1: Do the reading!

- Read Part 2: Technical notes of this module.
- Familiarize yourself with the technical terms from the glossary.
- Read through the following key documents (see full references and how to access them in Part 4 of this module):
  - ENN, UCL-CIHD, ACF (2010). *Management of Acute Malnutrition in Infants (MAMI) Project: Technical Review: Current evidence, policies, practices & programme outcomes*. London. ENN.
  - FANTA. (2003). *Anthropometric Indicators Measurement Guide Washington: FANTA*.
  - SCN & CDC (2000). *Adolescents: Assessment of Nutritional Status in Emergency-affected Populations*. Geneva: SCN.
  - United Nations Standing Committee on Nutrition (2000). *Adults: Assessment of Nutritional Status in Emergency-affected Populations*. Geneva: SCN.
  - WFP. (2000). *Food and Nutrition Handbook*. Rome: WFP.
  - WFP & CDC. (2005). *A Manual: Measuring and Interpreting Malnutrition and Mortality*. Rome: WFP.
  - WHO (2008). *WHO Child Growth Standards: Training Course on Child Growth Assessment, Modules B & C*. Geneva: WHO.

Step 2: Know your audience!

- Find out about your participants in advance of the training:
  - How many participants will there be?
  - Do any of the participants already have experience of carrying out anthropometric measurements?
  - Could participants with experience be involved in the sessions by preparing a case study or contribute through describing their practical experience?

Step 3: Design the training!

- Decide how long the training will be and what activities can be covered within the available time. In general, the following guide can be used:
  - A **90-minute** classroom-based training session can provide a basic overview of the different anthropometric indices and classification systems for child and adult undernutrition.
  - A **half-day** classroom-based training session can provide an overview of the various anthropometric indices and classification systems for child and adult undernutrition and include Exercise 2 or 3.
  - A **one-day** classroom-based training session can provide a more in-depth understanding of anthropometry with some practical measurement taking and a case study.
  - Combine Modules 6 and 7 for a two one-day session for participants who require survey training.
- Identify appropriate learning objectives. This will depend on your participants, their level of understanding and experience, and the aim and length of the training.
- Decide exactly which technical points to cover based on the learning objectives that you have identified.
- Divide the training into manageable sections. One session should generally not last longer than an hour.
- Ensure the training is a good combination of activities, e.g., mix PowerPoint presentations in plenary with more active participation through classroom-based exercises, mix individual work with group work.

Step 4: Get prepared!

- Prepare PowerPoint presentations with notes (if they are going to be used) in advance and do a trial run. Time yourself! Recommended PowerPoint presentations that can be adapted from existing sources include (see full references and how to access them in Part 4 of this module):

Existing PowerPoints for a session on measuring malnutrition: individual assessment

	Author	Specific session
1.	FAO. (2007). FAO Food Security Information for Action Distance Learning Material – Food Security Information Systems and Networks; Reporting Food Security Information; Nutritional Status Assessment and Analysis.	Nutritional Status Assessment and Analysis (2.5-3 hours) • Nutritional Status and Food Security • Assessing Status • Nutritional Status Indicators
2.	UNICEF, CDC, Columbia University and Tufts University. (2003). Training for Improved Practice.	Session 3: Basic Concepts
3.	WFP & Feinstein International Famine Centre, T. U. (2001). WFP Food and Nutrition Training Toolbox.	Session 7: Measurement of Malnutrition: Individual Nutritional Assessment (Part I)
4.	WFP & CDC. (2005). Training course: Measuring and Interpreting Malnutrition and Mortality. Rome: WFP.	Day 1: Introduction and anthropometry

- Prepare exercises and case studies. These can be based on the examples given in this trainer's guide but should be adapted to be suitable for the particular training context.
- Find the appropriate equipment for the session such as MUAC tapes, scales and height boards. You will also need the *weight-for-height* (WFH) look-up tables and participants will need calculators.
- Prepare a 'kit' of materials for each participant. These should be given out at the start of the training and should include:
  - Timetable showing break times (coffee and lunch) and individual sessions
  - Handouts including Parts 1, 2 and 4 of this module plus exercises as required
  - Pens and paper

REMEMBER

People remember 20 per cent of what they are told, 40 per cent of what they are told and read, and 80 per cent of what they find out for themselves.

People learn differently. They learn from what they read, what they hear, what they see, what they discuss with others and what they explain to others. A good training is therefore one that offers a variety of learning methods which suit the variety of individuals in any group. Such variety will also help reinforce messages and ideas so that they are more likely to be learned.

2. Learning objectives

Below are examples of learning objectives for a session on measuring malnutrition in individuals. Trainers may wish to develop alternative learning objectives that are appropriate to their particular participant group. The number of learning objectives should be limited; up to five per day of training is appropriate. Each exercise should be related to at least one of the learning objectives.

Examples of learning objectives

At the end of the training, participants will:

- Be familiar with the standard methods used to measure weight, height, mid-upper arm circumference (MUAC) and oedema.
- Understand the classifications of undernutrition in children and adults using different anthropometric indices.
- Be able to identify Z-score ranges for weight-for-height for children 6-59 months using the 2006 WHO Growth Standards simplified field tables for boys and girls
- Be aware of the uses of anthropometric measurements in both emergency and non-emergency contexts.
- Be aware of the limitations of anthropometry.

3. Testing knowledge

This section contains one exercise which is an example of a questionnaire that can be used to test participants' knowledge of anthropometry either at the start or at the end of a training session. The questionnaire can be adapted by the trainer to include questions relevant to the specific participant group.

Exercise 1: What do you know about measuring malnutrition?

What is the learning objective?

- To test participants' knowledge about anthropometry

When should this exercise be done?

- *Either* at the start of a training session to establish knowledge level
- *Or* at the end of a training session to check how much participants' have learned

How long should the exercise take?

- 15 minutes

What materials are needed?

- **Handout 1a:** What do you know about measuring malnutrition?: Questionnaire
- **Handout 1b:** What do you know about measuring malnutrition?: Questionnaire answers

What does the trainer need to prepare?

- Familiarize yourself with the questionnaire questions and answers.
- Add your own questions and answers based on your knowledge of the participants and their knowledge base.

Instructions

Step 1: Give each participant a copy of Handout 1a.

Step 2: Give participants 10 minutes to complete the questionnaire working alone.

Step 3: Give each participant a copy of Handout 1b.

Step 4: Give participants five minutes to mark their own questionnaires and clarify the answers where necessary.

Handout 1a: What do you know about measuring malnutrition?: Questionnaire

Time for completion: 10 minutes

Answer all the questions

Note that for some questions there is only ONE correct answer while for other questions there are SEVERAL correct answers.

1. Which form of undernutrition is of most concern during an emergency?
   a) Chronic undernutrition or stunting in children 6-59 months
   b) Undernutrition in both adults and children 6-59 months
   c) Acute malnutrition or wasting in children 6-59 months

2. What are the indicator(s) used to measure wasting? *Circle the correct answer.*
   a) MUAC
   b) Weight-for-height index
   c) Height-for-age index
   d) Weight-for-age index

3. A child is measured lying down according to which of the following criteria: *Circle the correct answer*
   a) < 18 months
   b) < 87 cm
   c) > 110 cm
   d) > 25 months
   e) < 24 months

4. Match the following nutritional indices for children 6-59 months a) to g) with the classification of undernutrition I. to VII. below:

a) Weight-for-height index <-2SD and ≥ -3SD	I. Moderate stunting
b) Weight-for-age index <- 3 SD	II. Severe wasting
c) Height-for-age index <-2 SD and ≥ -3SD	III. Moderate wasting
d) Height-for-age index < -3 SD	IV. Moderate underweight
e) Weight-for-age index <-2 SD and ≥ -3SD	V. Moderate wasting
f) MUAC < 115mm	VI. Severe underweight
g) MUAC > 115mm and <125mm	VII. Severe stunting

5. Are the following statements true or false? Write true or false after each sentence.
   a) Infants below the age of six months are difficult to measure.
   b) Acute malnutrition in school aged children adolescents (5-19 year olds) is assessed using the same anthropometric indices as adults.
   c) In some emergencies, adults may be nutritionally assessed through anthropometry.
   d) Anthropometry can be used to assess micronutrient status.
   e) Nutritional indices are never calculated for children 6-59 with oedema.

6. Name two indicators that can be used to assess adult undernutrition. *Write your answer below.*

7. Why are young children often measured in surveys during emergencies? *Circle the correct answer.*
   a) Young children are easier to measure than adults.
   b) Children often show signs of malnutrition first and so act as a proxy for the entire population.
   c) Adults often refuse to be measured.

8. What is a Z-score? Write your answer below.

9. What is the difference between a growth reference and a growth standard? *Write your answer below.*

Handout 1b: What do you know about measuring malnutrition? Questionnaire answers

1. **c)** Acute malnutrition in children reflects recent changes in dietary intake and infection and acts as a 'proxy' for the nutritional status of the entire population.

2. **a)** and **b)**

3. **b)** and **e)**

4. **a)** – **III** (or **V**)
   b) – **VI**
   c) – **I**
   d) – **VII**
   e) – **IV**
   f) – **II**
   g) – **V** (or **III**)

5. **a) True.**
   b) False. Adolescents are difficult to nutritionally assess accurately because of the adolescent growth spurt. They are assessed with body mass index (BMI) for age.
   c) True. In emergencies in some countries or contexts, adults may be at nutritional risk.
   d) False. Anthropometry cannot reflect micronutrient status of an individual.
   e). False. While generally weight-for-height is not calculated for children 6-59 with oedema, it can be helpful to differentiate between individuals with kwashiorkor versus marasmic-kwashiorkor.

6. **Body mass index (BMI) and MUAC.** For pregnant women, MUAC is the only nutritional index that can be used.

7. **b)**

8. **A Z-score** is equivalent to **one standard deviation (SD)** which is the measure of the distance between an individual's value and the expected value of the WHO GS population. Ninety-five per cent of the WHO GS population has an anthropometric SD score between -2 and +2 which is within the normal range.

9. **A standard** is based on prescriptive criteria and involves value or normative judgments. In contrast, a **reference** reflects the expected values in a reference population.

4. Classroom exercises

This section provides examples of practical exercises that can be carried out in a classroom context either by participants individually or in groups. Practical exercises are useful between plenary sessions, where the trainer has done most of the talking, as they provide an opportunity for participants to engage actively in the session. The choice of classroom exercises will depend upon the learning objectives and the time available. Trainers should adapt the exercises presented in this section to make them appropriate to the particular participant group. Ideally, trainers should use case examples with which they are familiar.

Exercise 2: Taking anthropometric measurements of adults

What is the learning objective?

- To be familiar with the standard methods used to measure weight, height and MUAC in adults
- To be able to classify undernutrition in adults using different anthropometric indices

When should this exercise be done?

- After a theory session on assessing undernutrition in adults

How long should the exercise take?

- 30 to 40 minutes

What materials are needed?

- 2 MUAC tapes at least 280 cm long (or normal measuring tapes)
- 1 set adult scales (at least 120kg), ideally an electronic scale
- 1 adult height board (at least 200cm long)
- Calculator
- **Handout 2a:** Measuring adults practical: Instructions
- **Handout 2b:** Measurement recording form – adults
- **Handout 2c:** Measurement instructions and picture cards for MUAC, weight and height

Instructions

Step 1: Get participants into groups of four.

Step 2: Give each participant a copy of Handouts 2a, 2b and 2c.

Step 3: Review with the group techniques for carrying out accurate measurements and how to calculate BMI

Step 4: Give the groups up to 30 minutes to measure MUAC, weight and height and record. Go round the groups and look at their technique, and calculations.

Step 5: Allow 10 minutes for feedback in plenary.

Discussion points for feedback in plenary

➡ Discuss the variance in the measurements of the same adult and methods of resolving differences in measurement, e.g., taking the mean of readings.

Handout 2a: Measuring adults practical: instructions

Time for completion: 15 minutes

Task I: Practise measuring adult MUAC

- Get into groups of four participants.
- Take turns to measure to the nearest 0.1 cm the MUAC of the other three people in the group. Do each measurement twice and record the findings on Handout 2b.
- Compare each other's results and calculate the mean (the average) of the readings.

Time for completion: 15 minutes

Task II: Practice calculating BMI

- Take turns to measure the weight and height of the other three people in the group. Do each measurement twice and record the findings on Handout 2b.
- Calculate the BMI of each person. Use the formula below for this.

$$\text{BMI} = \frac{\text{Measured weight (kg)}}{\text{height2 (m2)}}$$

Example: Weight: 62.5 kg, Height: 1.72 mm

Height squared = 1.72m x 1.72m = 2.96

$$\text{BMI} = \frac{62.5\text{(kg)}}{2.96\text{ (m2)}} = 21.1$$

- Compare each other's results and discuss any differences in the measurements.

Handout 2b: Measurement recording form – adults

Measurer's name: _____

Measurements	Adult measured	MUAC	Weight	Height	BMI
1st recording	1				
2nd recording	1				
Mean					
1st recording	2				
2nd recording	2				
Mean					
1st recording	3				
2nd recording	3				
Mean					

Handout 2c: Measurement instructions and picture cards for MUAC, weight and height

Note: the images have been developed for measuring children 6-59, however the concepts and steps are similar and outlined below.

Mid-upper arm circumference (MUAC) measurements

1. Uncover the left arm as far as the shoulder.
2. Bend the arm and place the lower arm across the stomach.
3. Find the midpoint between the tip of the bone at the back and top of the shoulder and the elbow by finding them with your fingertips first and then marking them with a pen.
4. Measure the distance between the two marked spots while standing behind the individual and divide this measurement by two. This is the mid-upper arm.
5. Release the arm so that it hangs relaxed alongside the body.
6. Wrap the MUAC tape around the arm at this midpoint and measure the circumference.
7. The tape should be comfortably crossed over from 0 mark, not too loose, not too tight.
8. Take the measurement to the nearest 0.1cm where the tape crosses at 0.

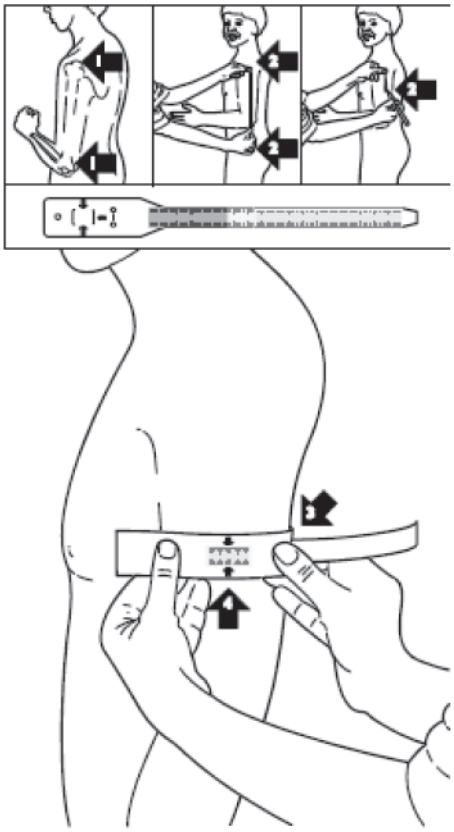
Weight measurements

1. Ensure that the adult scale is placed on a firm surface.
2. Always adjust the 'scale to zero' before weighing.
3. Remove outside clothing and shoes.
4. Read the weight to the nearest 0.1 kg.
5. Repeat the procedure of reading and recording the individual's weight. Record the average of the two measurements.

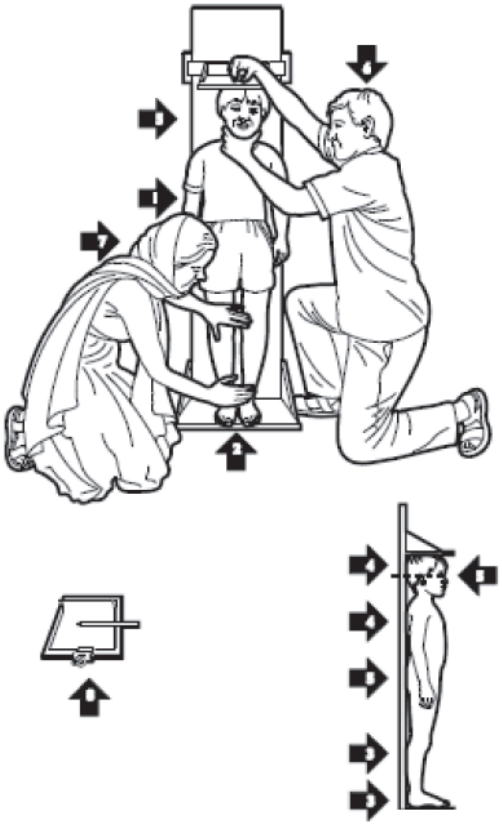
Height measurement

1. Place the measuring board on a smooth level, flat hard surface preferably against a wall.
2. Remove shoes, sandals, socks, headgear or any other heavy items.
3. Ask the individual to stand with his/her back against the measuring board.
4. Position the individual with bare feet together. Check the position of the heels, buttocks, shoulders and back of the head touching the board.
5. Hold the chin so that the individual is looking up straight.
6. Adjust the headpiece so that it is level.
7. Lower the headpiece until it is firm on top of the head. Press gently to ensure that it's in contact with the head.
8. Read the height to the nearest 0.1cm. Record the reading immediately.

MUAC measurement (left arm)



Height measurement



Exercise 3: Interpreting anthropometric data

What is the learning objective?

- To understand the classifications of undernutrition in children and adults using different anthropometric indices

When should this exercise be done?

- After a theoretical session on the different classifications of undernutrition

How long should the exercise take?

- 30 minutes

What materials are needed?

- **Handout 3a:** Interpreting anthropometric data
- **Handout 3b:** Interpreting anthropometric data: Model answers

Instructions

Step 1: Give each participant a copy of Handout 3a.

Step 2: Ask participants to work in pairs.

Step 3: Give the pairs 15 minutes to read and answer the questions in the handout.

Step 4: Allow 15 minutes for feedback in plenary.

Step 5: Give each participant a copy of Handout 3b.

Handout 3a: Interpreting anthropometric data

Time for completion: 15 minutes

Task I: Practise classifying anthropometric indices

The table below has been given to you by a colleague working in the media department of your organization. He or she comes to you for help to interpret the data with the following questions. Answer them and be ready to discuss in plenary.

1. Does this data relate to children or adults?
2. Can you explain what MUAC and BMI are and what the cut-offs indicate?
3. Which population has the highest rate of undernutrition?
4. Do you have any other comments about these population groups?

	Country	District	Population	Undernutrition level
1	**Kenya**	Moyale district	Residents	MUAC < 23.0 = 29.6%
2		Samburu district	Residents	MUAC < 23.0cm = 53.5%
3		Marsabit district	Residents	MUAC < 23.0cm = 36.6%
4	**Somalia**	Gedo region	Residents	MUAC < 18.5cm = 0%
5		Bardera town	Residents	MUAC < 18.5cm = 10.0%
6		Wajid district	Residents	MUAC < 18.5cm = 0.8%
7		Middle Juba	Residents	MUAC < 18.5cm = 3.0%
8	**Uganda**	Karamoja province	Resident agro-pastoral zone	BMI < 16 = 4.4% BMI < 18.5 = 27.3%
9	**Myanmar**	North Rakhine state	Residents	BMI < 16 = 12.7% BMI < 18.5: 27.0% BMI ≥ 25: 1.6%
10	Indonesia	Nias island	Residents	BMI < 18.5 = 8.3% BMI ≥ 25 = 29.0%
11	Nepal	Mugu district	Residents	MUAC ≤ 194mm = 3.8%
12	Pakistan	North west frontier	IDP camps	BMI < 16 = 1.5% BMI < 18.5 = 15.5%
13		Azad Jammu and Kashmir province	IDP camps	BMI < 16 = 2.3% BMI < 18.5 = 14.8%
14	Haiti	Artibonite department	IDPs	BMI < 18.5: 1.6% BMI ≥ 25: 3.6%
15	Occupied Palestinian Territory	Gaza strip	Residents	BMI < 18.5: 0.0% BMI ≥ 25: 3.6%

Handout 3b: Interpreting anthropometric data: Model answers

1. **Does this data relate to children or adults?**

   This table only shows adult undernutrition results expressed as either body mass index or MUAC.

2. **Can you explain what MUAC and BMI are?**

   Two nutritional indices are being used:

   a) MUAC with cut off points for severe (< 18.5 cm) and moderate (< 23 cm) undernutrition

   b) BMI with cut off points for severe (< 16), moderate (≥ 16 to < 18.5) and no nutritional risk (> 25)

   The Nepal results use MUAC < 194 mm which is not an internationally agreed cut-off.

3. **Which population has the highest rate of undernutrition?**

   It is difficult to compare the different populations as the indices used differ as do the cut off points. Clearly Myanmar, Kenya and Uganda show high levels of undernutrition compared to the Gaza Strip.

4. **Do you have any other comments about these population groups?**

   It would be useful to know more about the population groups, whether pregnant women are included, as well as when and how surveys were carried out before making any firm conclusions about the data.

Exercise 4: Calculating weight-for-height/length and classifying anthropometric data for children 6-59 months

What is the learning objective?

- To be able to calculate anthropometric indices using the 2006 WHO Growth Standards.

When should this exercise be done?

- Participants need to be familiar with the anthropometric indicators and indices.

How long should the exercise take?

- 50 minutes

What materials are needed?

- **Handout 4a:** Calculating anthropometric indices
- **Handout 4b:** Calculating anthropometric indices: Model answers

  NOTE: Height and Weight columns are not required for programmes that use only MUAC and bilateral pitting oedema as entry criteria. Adapt the activity to the country context.
- **Handout 4c:** WHO growth standard simplified field tables weight-for-length/height for boys and girls
- **Handout 4d:** Classification of individual nutritional status according to WFH index
- **Handout 4e:** Classification of individual nutritional status according to WFH index: Model answers
- Calculators

Instructions

Step 1: Give each participant a copy of Handouts 4a and 4c.

Step 2: Allow five minutes in plenary to do the exercise using child one as an example.

Step 3: Give participants 10 minutes to complete Handout 4a.

Step 4: Give each participant a copy of Handout 4b.

Step 5: Allow 10 minutes to go through the answers in plenary.

Step 6: Give each participant a copy of Handout 4d.

Step 7: Give participants 15 minutes to complete Handout 4d.

Step 8: Allow 10 minutes to go through the answers in plenary.

Exercise 4: Calculating weight-for-height/length and classifying anthropometric data for children 6-59 months (continued)

Discussion points for feedback in plenary

- Reference weights for boys and girls are different.
- Rounding digits correctly is essential. Children may be misclassified if the tables are not used properly. For example, child 8 could be incorrectly classified as moderate (e.g. -3 Z-score rather than <-3 Z-score).
- One child may be identified with a different level of malnutrition depending on the nutritional index. Order of decision-making for entry to a community-based management of acute malnutrition (CMAM) programme is: 1) bilateral pitting oedema, 2) MUAC and 3) weight-for-height (% of median or z-score). MUAC gets priority over weight for height indices because it used as a screening measure in the community. If child has bilateral pitting oedema, measuring MUAC or weight-for-height is still of use to check for marasmic kwashiorkor.
- Children with oedema are classified as severely malnourished regardless of their weights.
- It is however necessary to calculate weight-for-height or take MUAC measurements on oedematous children in order to differentiate between kwashiorkor and marasmic-kwashiorkor which is a particularly life threatening condition.
- Z-scores are now recommended for admission and discharge criteria into selective feeding programmes, as opposed to percentage of the median.

Handout 4a: Calculating anthropometric indices

Exercise:

1. Using the 2006 WHO Growth Standards simplified field tables, identify the Weight for height/length Z-score range for each child (e.g. <-2 and > -3)
2. Classify each child as normal, moderate or severely acutely malnourished based on a review of all measurements

Child Name	Sex	Bilateral Pitting Oedema	Age (years)	Height (cm)	Weight (kg)	MUAC (mm or colour)	Weight for Height Z-Score range	Classification
Child 1	F		3	98.2	12.5	126		
Child 2	M		5	110.0	14.8	123		
Child 3	M	++	5	102.2	13.5	121		
Child 4	F		4	91.1	9.3	110		
Child 5	M		9 months	69.9	6.7	125		
Child 6	F	+++	4	105.2	18.0	112		
Child 7	F		8 months	68.2	5.0	105		
Child 8	M		1	84.3	8.9	102		
Child 9	F		2	97.2	11.0	109		
Child 10	M	+	1.5	89.7	12.9	130		

Handout 4b: Calculating anthropometric indices: Model answers

Weight-for-Height Z-scores (WHO)

Child Name	Sex	Bilateral Pitting Oedema	Age (years)	Height (cm)	Weight (kg)	MUAC (mm or colour)	Weight for Height Z-Score range	Classification
Child 1	F		3	98.2	12.5	126	> -2	Normal
Child 2	M		5	110.0	14.8	123	< -2 and > -3	Moderate acute malnutrition
Child 3	M	++	5	102.2	13.5	121	> -2	Severe (bilateral pitting oedema)
Child 4	F		4	91.1	9.3	110	< -3	Severe (WFH and MUAC)
Child 5	M		9 months	69.9	6.7	125	< -2 and > -3	Moderate
Child 6	F	+++	4	105.2	18.0	112	> median	Severe (marasmic kwashiorkor- MUAC shows severe wasting)
Child 7	F		8 months	68.2	5.0	105	< -3	Severe (MUAC and WFH)
Child 8	M		1	84.3	8.9	102	<-3 z	Severe (MUAC and WFH)
Child 9	F		2	97.2	11.0	109	= -3 z	Severe (MUAC), WFH = -3 therefore classified as moderate if just looking at WFH
Child 10	M	+	1.5	89.7	12.9	130	> median	Severe (bilateral pitting oedema)

Remark: Order of decision-making for entry to a CMAM programme is: 1) bilateral pitting oedema, 2) MUAC and 3) weight-for-height (% of median or z-score). MUAC gets priority over weight for height indices because it used as a screening measure in the community. If child has bilateral pitting oedema, measuring MUAC or weight-for-height is still of use to check for marasmic kwashiorkor.

Handout 4c: WHO Growth Standard Simplified Ta bles Weight-for-Length/Height for Girls and Boys

Simplified field tables

Weight-for-length GIRLS Birth to 2 years (z-scores)

World Health Organization

CM	-3 SD	-2 SD	-1 SD	Me-dian	1 SD	2 SD	3 SD
45.0	1.9	2.1	2.3	2.5	2.7	3.0	3.3
45.5	2.0	2.1	2.3	2.5	2.8	3.1	3.4
46.0	2.0	2.2	2.4	2.6	2.9	3.2	3.5
46.5	2.1	2.3	2.5	2.7	3.0	3.3	3.6
47.0	2.2	2.4	2.6	2.8	3.1	3.4	3.7
47.5	2.2	2.4	2.6	2.9	3.2	3.5	3.8
48.0	2.3	2.5	2.7	3.0	3.3	3.6	4.0
48.5	2.4	2.6	2.8	3.1	3.4	3.7	4.1
49.0	2.4	2.6	2.9	3.2	3.5	3.8	4.2
49.5	2.5	2.7	3.0	3.3	3.6	3.9	4.3
50.0	2.6	2.8	3.1	3.4	3.7	4.0	4.5
50.5	2.7	2.9	3.2	3.5	3.8	4.2	4.6
51.0	2.8	3.0	3.3	3.6	3.9	4.3	4.8
51.5	2.8	3.1	3.4	3.7	4.0	4.4	4.9
52.0	2.9	3.2	3.5	3.8	4.2	4.6	5.1
52.5	3.0	3.3	3.6	3.9	4.3	4.7	5.2
53.0	3.1	3.4	3.7	4.0	4.4	4.9	5.4
53.5	3.2	3.5	3.8	4.2	4.6	5.0	5.5
54.0	3.3	3.6	3.9	4.3	4.7	5.2	5.7
54.5	3.4	3.7	4.0	4.4	4.8	5.3	5.9
55.0	3.5	3.8	4.2	4.5	5.0	5.5	6.1
55.5	3.6	3.9	4.3	4.7	5.1	5.7	6.3
56.0	3.7	4.0	4.4	4.8	5.3	5.8	6.4
56.5	3.3	4.1	4.5	5.0	5.4	6.0	6.6
57.0	3.9	4.3	4.6	5.1	5.6	6.1	6.8
57.5	4.0	4.4	4.8	5.2	5.7	6.3	7.0
58.0	4.1	4.5	4.9	5.4	5.9	6.5	7.1
58.5	4.2	4.6	5.0	5.5	6.0	6.6	7.3
59.0	4.3	4.7	5.1	5.6	6.2	6.8	7.5
59.5	4.4	4.8	5.3	5.7	6.3	6.9	7.7
60.0	4.5	4.9	5.4	5.9	6.4	7.1	7.8
60.5	4.6	5.0	5.5	6.0	6.6	7.3	8.0
61.0	4.7	5.1	5.6	6.1	6.7	7.4	8.2
61.5	4.8	5.2	5.7	6.3	6.9	7.6	8.4
62.0	4.9	5.3	5.8	6.4	7.0	7.7	8.5
62.5	5.0	5.4	5.9	6.5	7.1	7.8	8.7
63.0	5.1	5.5	6.0	6.6	7.3	8.0	8.8

CM	-3 SD	-2 SD	-1 SD	Me-dian	1 SD	2 SD	3 SD
63.5	5.2	5.6	6.2	6.7	7.4	8.1	9.0
64.0	5.3	5.7	6.3	6.9	7.5	8.3	9.1
64.5	5.4	5.8	6.4	7.0	7.6	8.4	9.3
65.0	5.5	5.9	6.5	7.1	7.8	8.6	9.5
65.5	5.5	6.0	6.6	7.2	7.9	8.7	9.6
66.0	5.6	6.1	6.7	7.3	8.0	8.8	9.8
66.5	5.7	6.2	6.8	7.4	8.1	9.0	9.9
67.0	5.8	6.3	6.9	7.5	8.3	9.1	10.0
67.5	5.9	6.4	7.0	7.6	8.4	9.2	10.2
68.0	6.0	6.5	7.1	7.7	8.5	9.4	10.3
68.5	6.1	6.6	7.2	7.9	8.6	9.5	10.5
69.0	6.1	6.7	7.3	8.0	8.7	9.6	10.6
69.5	6.2	6.8	7.4	8.1	8.8	9.7	10.7
70.0	6.3	6.9	7.5	8.2	9.0	9.9	10.9
70.5	6.4	6.9	7.6	8.3	9.1	10.0	11.0
71.0	6.5	7.0	7.7	8.4	9.2	10.1	11.1
71.5	6.5	7.1	7.7	8.5	9.3	10.2	11.3
72.0	6.6	7.2	7.8	8.6	9.4	10.3	11.4
72.5	6.7	7.3	7.9	8.9	9.5	10.5	11.5
73.0	6.8	7.4	8.0	8.8	9.6	10.6	11.7
73.5	6.9	7.4	8.1	8.9	9.7	10.7	11.8
74.0	6.9	7.5	8.2	9.0	9.8	10.8	11.9
74.5	7.0	7.6	8.3	9.1	9.9	10.9	12.0
75.0	7.1	7.7	8.4	9.1	10.0	11.0	12.2
75.5	7.1	7.8	8.5	9.2	10.1	11.1	12.3
76.0	7.2	7.8	8.5	9.3	10.2	11.2	12.4
76.5	7.3	7.9	8.6	9.4	10.3	11.4	12.5
77.0	7.4	8.0	8.7	9.5	10.4	11.5	12.6
77.5	7.4	8.1	8.8	9.6	10.5	11.6	12.8
78.0	7.5	8.2	8.9	9.7	10.6	11.7	12.9
78.5	7.6	8.2	9.0	9.8	10.7	11.8	13.0
79.0	7.7	8.3	9.1	9.9	10.8	11.9	13.1
79.5	7.7	8.4	9.1	10.0	10.9	12.0	13.3
80.0	7.8	8.5	9.2	10.1	11.0	12.1	13.4
80.5	7.9	8.6	9.3	10.2	11.2	12.3	13.5
81.0	8.0	8.7	9.4	10.3	11.3	12.4	13.7
81.5	8.1	8.8	9.5	10.4	11.4	12.5	13.8

Simplified field tables

Weight-for-length GIRLS Birth to 2 years (z-scores)

World Health Organization

CM	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
82.0	8.1	8.8	9.6	10.5	11.5	12.6	13.9
82.5	8.2	8.9	9.7	10.6	11.6	12.8	14.1
83.0	8.3	9.0	9.8	10.7	11.8	12.9	14.2
83.5	8.4	9.1	9.9	10.9	11.9	13.1	14.4
84.0	8.5	9.2	10.1	11.0	12.0	13.2	14.5
84.5	8.6	9.3	10.2	11.1	12.1	13.3	14.7
85.0	8.7	9.4	10.3	11.2	12.3	13.5	14.9
85.5	8.8	9.5	10.4	11.3	12.4	13.6	15.0
86.0	8.9	9.7	10.5	11.5	12.6	13.8	15.2
86.5	9.0	9.8	10.6	11.6	12.7	13.9	15.4
87.0	9.1	9.9	10.7	11.7	12.8	14.1	15.5
87.5	9.2	10.0	10.9	11.8	13.0	14.2	15.7
88.0	9.3	10.1	11.0	12.0	13.1	14.4	15.9
88.5	9.4	10.2	11.1	12.1	13.2	14.5	16.0
89.0	9.5	10.3	11.2	12.2	13.4	14.7	16.2
89.5	9.6	10.4	11.3	12.3	13.5	14.8	16.4
90.0	9.7	10.5	11.4	12.5	13.7	15.0	16.5
90.5	9.8	10.6	11.5	12.6	13.8	15.1	16.7
91.0	9.9	10.7	11.7	12.7	13.9	15.3	16.9
91.5	10.0	10.8	11.8	12.8	14.1	15.5	17.0
92.0	10.1	10.9	11.9	13.0	14.2	15.6	17.2
92.5	10.1	11.0	12.0	13.1	14.3	15.8	17.4
93.0	10.2	11.1	12.1	13.2	14.5	15.9	17.5
93.5	10.3	11.2	12.2	13.3	14.6	16.1	17.7
94.0	10.4	11.3	12.3	13.5	14.7	16.2	17.9
94.5	10.5	11.4	12.4	13.6	14.9	16.4	18.0
95.0	10.6	11.5	12.6	13.7	15.0	16.5	18.2
95.5	10.7	11.6	12.7	13.8	15.2	16.7	18.4
96.0	10.8	11.7	12.8	14.0	15.3	16.8	18.6
96.5	10.9	11.8	12.9	14.1	15.4	17.0	18.7
97.0	11.0	12.0	13.0	14.2	15.6	17.1	18.9
97.5	11.1	12.1	13.1	14.4	15.7	17.3	19.1
98.0	11.2	12.2	13.3	14.5	15.9	17.5	19.3
98.5	11.3	12.3	13.4	14.6	16.0	17.6	19.5
99.0	11.4	12.4	13.5	14.8	16.2	17.8	19.6
99.5	11.5	12.5	13.6	14.9	16.3	18.0	19.8
100.0	11.6	12.6	13.7	15.0	16.5	18.1	20.0
100.5	11.7	12.7	13.9	15.2	16.6	18.3	20.2
101.0	11.8	12.8	14.0	15.3	16.8	18.5	20.4
101.5	11.9	13.0	14.1	15.5	17.0	18.7	20.6

CM	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
102.0	12.0	13.1	14.3	15.6	17.1	18.9	20.8
102.5	12.1	13.2	14.4	15.8	17.3	19.0	21.0
103.0	12.3	13.3	14.5	15.9	17.5	19.2	21.3
103.5	12.4	13.5	14.7	16.1	17.6	19.4	21.5
104.0	12.5	13.6	14.8	16.2	17.8	19.6	21.7
104.5	12.6	13.7	15.0	16.4	18.0	19.8	21.9
105.0	12.7	13.8	15.1	16.5	18.2	20.0	22.2
105.5	12.8	14.0	15.3	16.7	18.4	20.2	22.4
106.0	13.0	14.1	15.4	16.9	18.5	20.5	22.6
106.5	13.1	14.3	15.6	17.1	18.7	20.7	22.9
107.0	13.2	14.4	15.7	17.2	18.9	20.9	23.1
107.5	13.3	14.5	15.9	17.4	19.1	21.1	23.4
108.0	13.5	14.7	16.0	17.6	19.3	21.3	23.6
108.5	13.6	14.8	16.2	17.8	19.5	21.6	23.9
109.0	13.7	15.0	16.4	18.0	19.7	21.8	24.2
109.5	13.9	15.1	16.5	18.1	20.0	22.0	24.4
110.0	14.0	15.3	16.7	18.3	20.2	22.3	24.7

Simplified field tables

Weight-for-length BOYS Birth to 2 years (z-scores)

World Health Organization

CM	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
45.0	1.9	2.0	2.2	2.4	2.7	3.0	3.3
45.5	1.9	2.1	2.3	2.5	2.8	3.1	3.4
46.0	2.0	2.2	2.4	2.6	2.9	3.1	3.5
46.5	2.1	2.3	2.5	2.7	3.0	3.2	3.6
47.0	2.1	2.3	2.5	2.8	3.0	3.3	3.7
47.5	2.2	2.4	2.6	2.9	3.1	3.4	3.8
48.0	2.3	2.5	2.7	2.9	3.2	3.6	3.9
48.5	2.3	2.6	2.8	3.0	3.3	3.7	4.0
49.0	2.4	2.6	2.9	3.1	3.4	3.8	4.2
49.5	2.5	2.7	3.0	3.2	3.5	3.9	4.3
50.0	2.6	2.8	3.0	3.3	3.6	4.0	4.4
50.5	2.7	2.9	3.1	3.4	3.8	4.1	4.5
51.0	2.7	3.0	3.2	3.5	3.9	4.2	4.7
51.5	2.8	3.1	3.3	3.6	4.0	4.4	4.8
52.0	2.9	3.2	3.5	3.8	4.1	4.5	5.0
52.5	3.0	3.3	3.6	3.9	4.2	4.6	5.1
53.0	3.1	3.4	3.7	4.0	4.4	4.8	5.3
53.5	3.2	3.5	3.8	4.1	4.5	4.9	5.4
54.0	3.3	3.6	3.9	4.3	4.7	5.1	5.6
54.5	3.4	3.7	4.0	4.4	4.8	5.3	5.8
55.0	3.6	3.8	4.2	4.5	5.0	5.4	6.0
55.5	3.7	4.0	4.3	4.7	5.1	5.6	6.1
56.0	3.8	4.1	4.4	4.8	5.3	5.8	6.3
56.5	3.9	4.2	4.6	5.0	5.4	5.9	6.5
57.0	4.0	4.3	4.7	5.1	5.6	6.1	6.7
57.5	4.1	4.5	4.9	5.3	5.7	6.3	6.9
58.0	4.3	4.6	5.0	5.4	5.9	6.4	7.1
58.5	4.4	4.7	5.1	5.6	6.1	6.6	7.2
59.0	4.5	4.8	5.3	5.7	6.2	6.8	7.4
59.5	4.6	5.0	5.4	5.9	6.4	7.0	7.6
60.0	4.7	5.1	5.5	6.0	6.5	7.1	7.8
60.5	4.8	5.2	5.6	6.1	6.7	7.1	8.0
61.0	4.9	5.3	5.8	6.3	6.8	7.4	8.1
61.5	5.0	5.4	5.9	6.4	7.0	7.6	8.3
62.0	5.1	5.6	6.0	6.5	7.1	7.7	8.5
62.5	5.2	5.7	6.1	6.7	7.2	7.9	8.6
63.0	5.3	5.8	6.2	6.8	7.4	8.0	8.8
63.5	5.4	5.9	6.4	6.9	7.5	8.2	8.9
64.0	5.5	6.0	6.5	7.0	7.6	8.3	9.1
64.5	5.6	6.1	6.6	7.1	7.8	8.5	9.3

CM	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
65.0	5.7	6.2	6.7	7.3	7.9	8.6	9.4
65.5	5.8	6.3	6.8	7.4	8.0	8.7	9.6
66.0	5.9	6.4	6.9	7.5	8.2	8.9	9.7
66.5	6.0	6.5	7.0	7.6	8.3	9.0	9.9
67.0	6.1	6.6	7.1	7.7	8.4	9.2	10.0
67.5	6.2	6.7	7.2	7.9	8.5	9.3	10.2
68.0	6.3	6.8	7.3	8.0	8.7	9.4	10.3
68.5	6.4	6.9	7.5	8.1	8.8	9.6	10.5
69.0	6.5	7.0	7.6	8.2	8.9	9.7	10.6
69.5	6.6	7.1	7.7	8.3	9.0	9.8	10.8
70.0	6.6	7.2	7.8	8.4	9.2	10.0	10.9
70.5	6.7	7.3	7.9	8.5	9.3	10.1	11.1
71.0	6.8	7.4	8.0	8.6	9.4	10.2	11.2
71.5	6.9	7.5	8.1	8.8	9.5	10.4	11.3
72.0	7.0	7.6	8.2	8.9	9.6	10.5	11.5
72.5	7.1	7.6	8.3	9.0	9.8	10.6	11.6
73.0	7.2	7.7	8.4	9.1	9.9	10.8	11.8
73.5	7.2	7.8	8.5	9.2	10.0	10.9	11.9
74.0	7.3	7.9	8.6	9.3	10.1	11.0	12.1
74.5	7.4	8.0	8.7	9.4	10.2	11.2	12.2
75.0	7.5	8.1	8.8	9.5	10.3	11.3	12.3
75.5	7.6	8.2	8.8	9.6	10.4	11.4	12.5
76.0	7.6	8.3	8.9	9.7	10.6	11.5	12.6
76.5	7.7	8.3	9.0	9.8	10.7	11.6	12.7
77.0	7.8	8.4	9.1	9.9	10.8	11.7	12.8
77.5	7.9	8.5	9.2	10.0	10.9	11.9	13.0
78.0	7.9	8.6	9.3	10.1	11.0	12.0	13.1
78.5	8.0	8.7	9.4	10.2	11.1	12.1	13.2
79.0	8.1	8.7	9.5	10.3	11.2	12.2	13.3
79.5	8.2	8.8	9.5	10.4	11.3	12.3	13.4
80.0	8.2	8.9	9.6	10.4	11.4	12.4	13.6
80.5	8.3	9.0	9.7	10.5	11.5	12.5	13.7
81.0	8.4	9.1	9.8	10.6	11.6	12.6	13.8
81.5	8.5	9.1	9.9	10.7	11.7	12.7	13.9
82.0	8.5	9.2	10.0	10.8	11.8	12.8	14.0
82.5	8.6	9.3	10.1	10.9	11.9	13.0	14.2
83.0	8.7	9.4	10.2	11.0	12.0	13.1	14.3
83.5	8.8	9.5	10.3	11.2	12.1	13.2	14.4
84.0	8.9	9.6	10.4	11.3	12.2	13.3	14.6
84.5	9.0	9.7	10.5	11.4	12.4	13.5	14.7

Simplified field tables

Weight-for-length BOYS Birth to 2 years (z-scores)

World Health Organization

CM	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
85.0	9.1	9.8	10.6	11.5	12.5	13.6	14.9
85.5	9.2	9.9	10.7	11.6	12.6	13.7	15.0
86.0	9.3	10.0	10.8	11.7	12.8	13.9	15.2
86.5	9.4	10.1	11.0	11.9	12.9	14.0	15.3
87.0	9.5	10.2	11.1	12.0	13.0	14.2	15.5
87.5	9.6	10.4	11.2	12.1	13.2	14.3	15.6
88.0	9.7	10.5	11.3	12.2	13.3	14.5	15.8
88.5	9.8	10.6	11.4	12.4	13.4	14.6	15.9
89.0	9.9	10.7	11.5	12.5	13.5	14.7	16.1
89.5	10.0	10.8	11.6	12.6	13.7	14.9	16.2
90.0	10.1	10.9	11.8	12.7	13.8	15.0	16.4
90.5	10.2	11.0	11.9	12.8	13.9	15.1	16.5
91.0	10.3	11.1	12.0	13.0	14.1	15.3	16.7
91.5	10.4	11.2	12.1	13.1	14.2	15.4	16.8
92.0	10.5	11.3	12.2	13.2	14.3	15.6	17.0
92.5	10.6	11.4	12.3	13.3	14.4	15.7	17.1
93.0	10.7	11.5	12.4	13.4	14.6	15.8	17.3
93.5	10.7	11.6	12.5	13.5	14.7	16.0	17.4
94.0	10.8	11.7	12.6	13.7	14.8	16.1	17.6
94.5	10.8	11.8	12.7	13.8	14.9	16.3	17.7
95.0	110.	11.9	12.8	13.9	15.1	16.4	17.9
95.5	11.1	12.0	12.9	14.0	15.2	16.5	18.0
96.0	11.2	12.1	13.1	14.1	15.3	16.7	18.2
96.5	11.3	12.2	13.2	14.3	15.5	16.8	18.4
97.0	11.4	12.3	13.3	14.4	15.6	17.0	18.5
97.5	11.5	12.4	13.4	14.5	15.7	17.1	18.7
98.0	11.6	12.5	13.5	14.6	15.9	17.3	18.9
98.5	11.7	12.6	13.6	14.8	16.0	17.5	19.1
99.0	11.8	12.7	13.7	14.9	16.2	17.6	19.2
99.5	1109	12.8	13.9	15.0	16.3	17.8	19.4
100.0	12.0	12.9	14.0	15.2	16.5	18.0	19.6
100.5	12.1	13.0	14.1	15.3	16.6	18.1	19.8
101.0	12.2	13.2	14.2	15.4	16.8	18.3	20.0
101.5	12.3	13.3	14.4	15.6	16.9	18.5	20.2
102.0	12.4	13.4	14.5	15.7	17.1	18.7	20.4
102.5	12.5	13.5	14.6	15.9	17.3	18.8	20.6
103.0	12.6	13.6	14.8	16.0	17.4	19.0	20.8
103.5	12.7	13.7	14.9	16.2	17.6	19.2	21.0
104.0	12.8	13.9	15.0	16.3	17.8	19.4	21.2
104.5	12.9	14.0	15.2	16.5	17.9	19.6	21.5

CM	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
105.0	13.0	14.1	15.3	16.6	18.1	19.8	21.7
105.5	13.2	14.2	15.4	16.8	18.3	20.0	21.9
106.0	13.3	14.4	15.6	16.9	18.5	20.2	22.1
106.5	13.4	14.5	15.7	17.1	18.6	20.4	22.4
107.0	13.5	14.6	15.9	17.3	18.8	20.6	22.6
107.5	13.6	14.7	16.0	17.4	19.0	20.8	22.8
108.0	13.7	14.9	16.2	17.6	19.2	21.0	23.1
108.5	13.8	15.0	16.3	17.8	19.4	21.2	23.3
109.0	14.0	15.1	16.5	17.9	19.6	21.4	23.6
109.5	14.1	15.3	16.6	18.1	19.8	21.7	23.8
110.0	14.2	15.4	16.8	18.3	20.0	21.9	24.1

Handout 4d: Classifying individual nutritional status according to WFH index

Time for completion: 10 minutes

Measurements have been taken on the 30 children below, and their Z-scores have been calculated. Based on the Z-score and presence or absence of bilateral oedema, classify the nutritional status of children below as severely or moderately malnourished.

Child	Height/ length (cm)	Weight (kg)	Z-score	Bilateral Oedema	Severe Acute malnutrition	Moderate Acute Malnutrition	No Acute Malnutrition
1	107.0	14.3	-2.10	N			
2	89.5	13.3	0.22	N			
3	99.0	12.3	-2.33	N			
4	101.5	13.7	–	Y			
5	108.0	17.9	-0.12	N			
6	69.5	8.1	-0.26	N			
7	58.0	4.7	-0.66	N			
8	108.5	14.9	–	Y			
9	101.0	14.0	-1.30	N			
10	80.5	11.1	0.22	N			
11	89.5	10.4	-2.17	N			
12	104.0	16.1	-0.41	N			
13	68.5	6.0	-2.67	N			
14	90.5	9.5	-3.19	N			
15	88.5	12.1	-0.61	N			
16	75.0	7.7	-2.42	N			
17	83.5	11.2	-0.34	N			
18	90.5	11.0	-1.90	N			
19	92.5	11.2	-2.08	N			
20	87.5	10.1	-2.18	N			
21	107.0	12.6	-3.21	N			
22	97.5	12.0	-2.23	N			
23	77.5	8.7	-1.81	N			
24	95.5	14.9	–	Y			
25	102.0	13.1	-2.12	N			
26	87.5	12.9	0.36	N			
27	97.5	13.0	-1.46	N			
28	57.5	5.5	1.24	N			
29	109.2	18.1	0.00	N			
30	72.0	8.1	-1.13	N			

Handout 4e: Classifying individual nutritional status according to WFH index: Model answers

Child	Height/ length (cm)	Weight (kg)	Z-score	Bilateral Oedema	Severe Acute malnutrition	Moderate Acute Malnutrition	No Acute Malnutrition
1	107.0	14.3	-2.10	N		X	
2	89.5	13.3	0.22	N			X
3	99.0	12.3	-2.33	N		X	
4	101.5	13.7	–	Y	X		
5	108.0	17.9	-0.12	N			X
6	69.5	8.1	-0.26	N			X
7	58.0	4.7	-0.66	N			X
8	108.5	14.9	–	Y	X		
9	101.0	14.0	-1.30	N			X
10	80.5	11.1	0.22	N			X
11	89.5	10.4	-2.17	N		X	
12	104.0	16.1	-0.41	N			X
13	68.5	6.0	-2.67	N		X	
14	90.5	9.5	-3.19	N	X		
15	88.5	12.1	-0.61	N			X
16	75.0	7.7	-2.42	N		X	
17	83.5	11.2	-0.34	N			X
18	90.5	11.0	-1.90	N			X
19	92.5	11.2	-2.08	N		X	
20	87.5	10.1	-2.18	N		X	
21	107.0	12.6	-3.21	N	X		
22	97.5	12.0	-2.23	N		X	
23	77.5	8.7	-1.81	N			X
24	95.5	14.9	–	Y	X		
25	102.0	13.1	-2.12	N		X	
26	87.5	12.9	0.36	N			X
27	97.5	13.0	-1.46	N			X
28	57.5	5.5	1.24	N			X
29	109.2	18.1	0.00	N			X
30	72.0	8.1	-1.13	N			X

5. Case studies

This section outlines ideas for exercises that can be carried out as part of a field visit. Field visits require a lot of preparation. An organization that is actively involved in programming has to be identified to 'host' the visit. This could be a government agency, an international non-governmental organisation (NGO) or a United Nations agency. The agency needs to identify an area that can be easily and safely visited by participants. Permission has to be sought from all relevant authorities and care taken not to disrupt or take time away from programme activities. Despite these caveats, field-based learning is probably the best way of providing information that will be remembered by participants.

Exercise 5: Taking anthropometric measurements in children

What are the learning objectives?

- To be familiar with the standard methods used to measure weight, height/length, MUAC and oedema
- To understand the classifications of undernutrition in children 6-59 months and adults using different anthropometric indices
- To be able to calculate anthropometric indices based on anthropometric measurements
- To be aware of the uses of anthropometric measurements in both emergency and non-emergency contexts
- To be aware of the limitations of anthropometry

When should this exercise be done?

- As part of a longer course

How long should the exercise take?

- 2 to 3 hours plus travel time to place

What materials are needed?

- 2 child MUAC tapes (usually 150cm; can be colour coded)
- 1 set Salter scales (25kg and measuring to nearest 0.1kg) and weighing pants
- 1 child height board (65.0-130.0cm)
- Calculator
- **Handout 5a:** Taking anthropometric measurements of children
- **Handout 5b:** Child anthropometric recording form
- **Handout 5c:** Measurement instructions and picture cards for length and oedema
- **Handout 5d:** Common sources of error in taking anthropometric measurements

Instructions

Step 1: Distribute Handouts 5a, 5b, 4c and 2c.

Step 2: Divide participants into groups of three.

Step 3: Allow 90 minutes for groups to complete Handouts 5a and 5b.

Step 4: Go around to the groups and look at their technique and their recordings and provide support as needed.

Step 5: Allow 30 minutes for feedback in plenary.

Step 6: Give each participant a copy of Handout 5d to highlight some of the most common mistakes made when measuring MUAC, weight, height and length. Discuss suggestions on how to address these mistakes.

Handout 5a: Ta king anthropometric measurements of children

Time for completion: 30 minutes

Practise measuring child MUAC individually.

- Measure the MUAC of six children to the nearest mm using the MUAC tape you have been given and record your answers in Handout 5b. Measure each child twice.

Time for completion: 60 minutes

Practise measuring weight and height, checking for bilateral oedema, and calculating weight-for height index.

- Measure the weight and height/length of six children and record your answers in Handout 5b. Measure each child twice.
- Check each child for the clinical sign of bilateral oedema.
- Calculate weight-for-height Z-scores range (e.g. < -2 and > -3 Z-scores) for each of the six children.
- If a laptop is available, use WHO Anthro 2005 to generate the actual Z-score value.

Be ready to discuss results in plenary when your trainer asks you to.

Handout 5b: Child anthropometric recording form

Measurer's name: _____

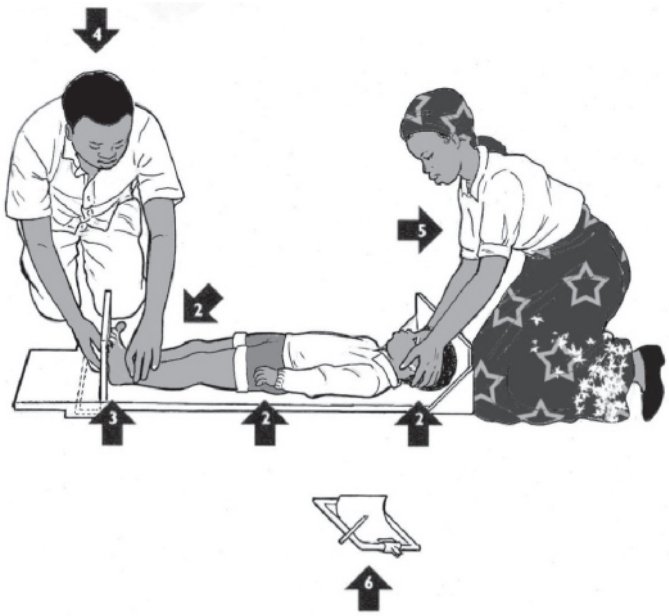
Measurements	Child No.	Age (mth.)	MUAC	Weight	Height	Bilateral Oedema	WFH Z-score range
1st recording	1						
2nd recording							
1st recording	2						
2nd recording							
1st recording	3						
2nd recording							
1st recording	4						
2nd recording							
1st recording	5						
2nd recording							
1st recording	6						
2nd recording							
AGREED MEASURE (CHECKED BY TRAINER)							

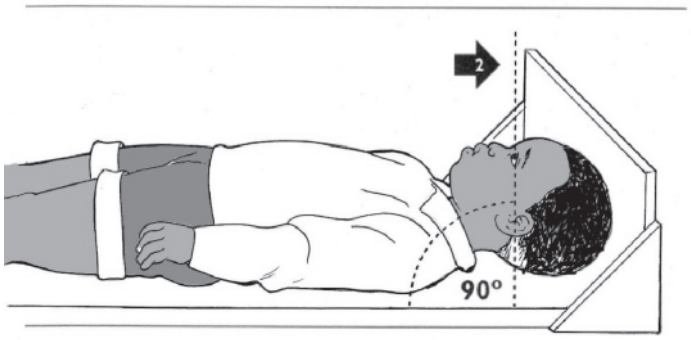
Handout 5c: Measurement instructions and picture cards for length and bilateral oedema

Length measurements

Length is measured for children under 2 years OR whose height is below 87cm if age cannot be accurately determined.

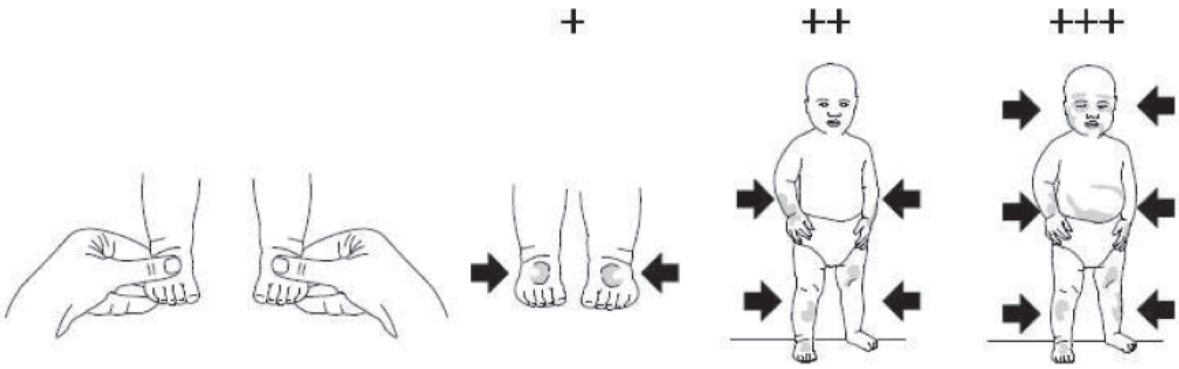
1. Place height board on the ground and remove child's shoes.
2. Place child on his/her back in middle of board, head facing straight up, arms at child's sides and feet at right angles to board.
3. While holding child's ankles or knees, move sliding board up against bottom of child's feet.
4. Take measurement to nearest 0.1 cm and read out loud.
5. Assistant, holding head in place, repeats the measurement for verification.
6. If child is 2 years or older or 87 cm or above standing up, subtract 0.7 cm from measurement.





Identifying bilateral oedema

1. Hold the child's feet and press thumbs on top of both feet using normal pressure. Count to 3 and then lift your thumbs. If no pit shows or if a pit only shows in one foot, the child does not have bilateral pitting oedema. If a pit shows in both feet, go to Step 2.
2. Continue the same test on the lower legs, hands and lower arms. If no pitting appears in these areas, then the child is said to have Grade + or mild bilateral pitting oedema. Mild bilateral pitting oedema only shows in the feet. If pitting appears in these areas, go to Step 3.
3. Look for swelling in the face, especially around the eyes. If no swelling appears in the face, then the child is said to have Grade ++, or moderate, bilateral pitting oedema. If swelling appears in the face, the child is said to have Grade +++ or severe bilateral pitting oedema.
4. Have a second person repeat the test to confirm results.



Handout 5d: Common sources of error in taking anthropometric measurements

Common errors	Solution
1. All measurements	
Restless child	Postpone measurement. Involve parent in procedure.
Inaccurate reading	Training and retraining stressing accuracy
Recording	Record results immediately after taking measurements and confirm record.
2. Length/height	
Incorrect method for age	Measure length when child is < 2 years or < 87 cm.
Foot wear/headgear	Remove – in privacy if necessary.
Head not in correct plane, chin too high or too close to body	Correct technique and get child to hold head straight by talking to him/her and crouching down to his or her level and looking into his/her eyes. The child will be encouraged to look at you, so position yourself to get head at right angle.
Child not straight along board, knees bent, feet pointing down when lying down	Correct technique with practise and regular retraining. Provide adequate assistance – three people needed. One for head, one for arms and middle and one for knees, feet and measurement taking. Get parent in middle to hold arms and talk to child to calm them.
Sliding board not firmly against heels/head	Settle child. Ensure adequate pressure applied. If measuring a child standing up, move head board to compress hair and ensure head touches board. If measuring a child lying down, move the sliding board to firmly touch the bottom of the feet.
Child not straight along height board – feet apart or knees bent	Don't take measurements while child is struggling. Ensure assistants and parent all help to position child. One for legs and feet, one for head and measurement taking. Parent can talk to child.
3. Weight	
Scale not calibrated	Recalibrate after every measurement.
Child wearing heavy clothing or amulets	Remove in private or make allowances for clothing and amulets by subtracting their weight equivalent from child weight, e.g., 100 g of clothes for underwear.
Child moving or anxious in hanging pants	Wait until child is calm. The more he or she moves and tries to grab measurers, the more likely the measurement is to be up to 1 kg off. One assistant to talk to child and other to position head in front of scales at the right angle to read measurement as soon as the scale stabilizes.
4. MUAC	
Child won't let go of mother	Get mother to hold child on her hip with child's left arm facing measurer.
Mid-upper arm point incorrect	Find tip of shoulder and elbow carefully. Practise finding half way between the two.
MUAC tape too loose or too tight giving an incorrect reading	Practise, supervise and retrain. Get measurer to practice on calm, older children and adults. Demonstrate.

PART 4: TRAINING RESOURCE LIST

The training resource list is the fourth of four parts contained in this module. It provides a comprehensive list of reference material relevant to this module including guidelines, training courses and reference manuals. Part 4 provides background documents for trainers who are preparing training material.

What can you expect to find here?

1. An inventory of existing **guidelines** and **manuals** listed alphabetically by agency name with details about their availability.
2. A list of known **training resources** listed alphabetically by agency name with details about:
   - Overall content
   - Intended use
   - Target audience
   - Length of time the course session has been designed for

Please note that some of these have been developed prior to 2006. As such, they do not reflect recent changes in anthropometric assessment following the introduction of the 2006 WHO Growth Standard (0-59 months), the 2007 WHO Growth Reference for older children and adolescents, nor the 2009 Joint Statement on the use of the WHO Growth Standard in the assessment of severe acute malnutrition and the use of MUAC <115mm in the definition of severe acute malnutrition.

Guidelines and manuals

1. **FANTA (2003). *Anthropometric Indicators Measurement Guide*. Washington: FANTA.**
   Guidelines on how to collect and analyse anthropometric data through nutrition surveys. These guidelines were designed for maternal and child health programme monitoring and draw extensively on materials from the Anthropometry Resource Centre, funded by the Food and Agriculture Organization's Southern African Development Community (SADC). The guideline includes a glossary of related terms in the references section. Of particular relevance:
   Part 1. Introduction
   Part 2. Anthropometric and annual monitoring indicators
   Part 3. Collecting anthropometric data through surveys
   Part 4. Weighing and measuring equipment
   Part 5. Taking measurements
   Part 6. Comparison of anthropometric data to reference standards
   Part 7. Data analysis
   Availability: downloadable pdf version in English
   Contact: www.fantaproject.org

2. **FSAU & FAO (2005). *Nutrition, a Guide to Data Collection, Analysis, Interpretation and Use*. Rome: FAO.**
Manual aimed at mid-level managers in all sectors who would like to better understand nutrition information and its use. The manual sets out all the steps involved in nutrition data collection and analysis including practical guidance for use by survey enumerators, health facility workers and other field workers. Additional materials have also been prepared to support the use of the manual during training. Of particular relevance:
Chapter 3. Measuring nutritional status
Chapter 4. Methods of nutritional assessment and analysis
Chapter 5. Analysis and interpretation of the nutrition situation
Appendices
Availability: downloadable pdf format in English.
Contact: www.fsnau.org

3. **HelpAge International and African Regional Development Centre (2001). *Addressing the Nutritional Needs of Older People in Emergency Situations in Africa: Ideas for Action*. Nairobi: HelpAge International.**
Report bringing together some of the key issues affecting the nutrition of older people in emergencies and offers some suggestions for ways in which the rights and needs of older people can be more effectively addressed. The report is divided into six main sections that seek to provide an overview of the main nutritional issues facing older people in emergencies and that give recommendations for ways in which these can be addressed. The report draws on nutrition protocols used for other age groups, adapting them to reflect the needs of older people. Recommendations are made on the basis of research from various countries and from field experience that shows the ways in which older people are excluded and gives examples of how action can be taken to promote their inclusion. The report highlights the gaps that exist in knowledge and information about the nutritional needs of older people and presents recommendations as to how these might be addressed. Of particular relevance:
Chapter 5. Risk Factors affecting the Nutritional Status of Older People in Emergencies
Availability: Downloadable pdf format in English
Contact: www.helpage.org and www.unscn.org

4. **ODI/Young and Jaspars (2006). *The Meaning and Measurement of Malnutrition in Acute Emergencies*. Network Paper No. 56. London: ODI.**
Technical paper aimed at non-technical humanitarian actors, especially decision-makers, to understand, interpret and use nutritional data by looking at how it is collected, analysed and used. It also looks at how technical issues are linked to pragmatic institutional constraints. Of particular relevance:
Chapter 1. Introduction
Chapter 2. Basic concepts
Chapter 3. The uses of data on acute malnutrition
Chapter 4. Estimating malnutrition in emergency-affected populations
Chapter 5. Interpretation and decision-making
Availability: Downloadable pdf file in English
Contact: www.odi.org.uk

5. **SCN & CDC (2000). *Adolescents: Assessment of Nutritional Status in Emergency-affected Populations*. Geneva: SCN.**
This supplement discusses the assessment of undernutrition in adolescents in emergency situations with a focus on acute undernutrition. The World Health Organization (WHO) defines adolescents as persons aged 10 to 19 years old. This is one of the few publications on this age group. Of particular relevance:
Chapter 1. Introduction and background to anthropometry
Chapter 2. Current WHO recommendations
Chapter 3. Which anthropometric index?
Chapter 4. Possible solutions for the future
Annex 1: Median and 70% of median weight for various heights, for male and female adolescents
Availability: Downloadable pdf format in English
Contact: www.unscn.org

6. **United Nations Standing Committee on Nutrition (2000). *Adults: Assessment of Nutritional Status in Emergency-affected Populations*. Geneva: SCN.**
   This supplement describes simple techniques suitable for the assessment of the nutritional status of adults aged 20 to 60 years in emergency-affected populations. The BMI (body mass index), MUAC (mid-upper arm circumference) and clinical models are assessed for their usefulness in determining the prevalence of chronic undernutrition in adults at the population level, and also for screening severely undernourished adults for entrance to feeding clinics.
   Of particular relevance:
   Chapter 2. Measuring nutritional status in adults
   Chapter 3. Clinical signs for screening acute malnutrition
   Chapter 5. General summary: suggested indicators for assessing adult undernutrition in the field
   Availability: Downloadable pdf format in English
   Contact: www.unsystem.org/SCN

7. **WFP (2005). *Food and Nutrition Handbook*. Rome: WFP.**
   Manual designed to enable staff to assess and analyze the nutrition situation in their country or region. It aims to help manage the design, implementation, monitoring and evaluation of interventions. It is designed as a standalone document, but can be used with the WFP basic training course in nutrition in emergencies. Of particular relevance:
   Chapter 5. Measuring malnutrition and nutrition surveys
   Chapter 6. Food and nutrition assessments
   Availability: Cannot be downloaded. Printed version available in English
   Contact: www.wfp.org

8. **WFP & CDC (2005). *A Manual: Measuring and Interpreting Malnutrition and Mortality*. Rome: WFP.**
   Manual is for World Food Programme (WFP) staff and aims to provide guidance on issues relating to nutrition and mortality surveys, and to standardise survey methodologies. It is aimed at WFP staff involved in nutrition-related data collection and intervention as well as WFP consultants and partners. A six-day training course has been developed to accompany it (separate reference). Of particular relevance:
   Chapter 1. Defining and measuring malnutrition
   Chapter 2. Defining and measuring mortality
   Chapter 3. Designing a survey
   Chapter 4. Using and interpreting survey results for decision making
   Chapter 5. Ethical issues
   Chapter 6. The end point: example of a good survey report
   Availability: Downloadable pdf version in English.
   Contact: www.wfp.org

9. **WHO Anthro (Version 3.1 June 2010) and macros**
   This freely available software can be run on personal computers and mobile devices with Windows operating systems. The software has three modules: anthropometric calculator, individual assessment, and nutritional survey. Macros for statistical software packages (SPSS, SAS and STATA) are also provided in order to support nutrition survey data analysis. A manual for use of the software is also provided. Of particular relevance:
   Anthropometric calculator function
   Availability: Downloadable pdf manual and software in English.
   Contact: www.who.int

Training courses

10. **FANTA (2008). *Training guide for community-based management of acute malnutrition (CMAM)*. Washington DC. FANTA.**
    The training guide was developed for health care managers and health care providers working in CMAM programmes. It provides an overview of key concepts related to planning and implementation of CMAM programme relevant to both emergency and non-emergency contexts. A trainer's guide as well as participant handout material has been developed.
    Of particular relevance:
    Module 2: Defining and Measuring Acute Malnutrition.
    Availability: Downloadable pdf version in English.
    Contact: www.fantaproject.org

11. **FAO (2007).** ***FAO Food Security Information for Action Distance Learning Material – Food Security Information Systems and Networks; Reporting Food Security Information; Nutritional Status Assessment and Analysis*****. Rome: FAO**
Distance learning materials designed for self-paced e-learning, developed by international experts to support capacity building and on-the-job training and workshops at national and local level in food security information systems and networks. Free of charge registration provides access to the materials. As of 31 October 2010, twelve separate courses are available. Of particular relevance:
Nutritional status assessment and analysis (2 hours)
Availability: CD-Rom in English and French
Contact: www.fao.org

12. **WHO (2006).** ***Training course on Child Growth Assessment*****. Geneva: WHO (Final update in 2008).**
This course has been designed for health care providers who measure and assess the growth of children or supervise these activities. It teaches the skills and knowledge needed to measure the weight and length/height of children; plot and interpret growth measurements; and counsel mothers about growth and feeding. Course participants may include paediatricians, family practice physicians, nurses, clinical officers, health assistants, and nutritionists working in the public and private sectors. The core of the course includes three instructional modules intended to be completed in sequence, for example, in a 3.5-day training session. Of particular relevance:
Module B. Measuring a child's growth
Module C. Interpreting growth indicators
Module D. Counselling on growth and feeding
Availability: Downloadable pdf in English.
Anthropometry training video demonstrates measurement of child weight, length, height and arm circumference, and adult weight and height (available in English, French, Spanish).
Availability: downloadable file in English, Spanish, French; forthcoming in Russian and Albanian. Also on CD-ROM and in print plus an anthropometry training video
Contact: www.who.int

Other resources:

13. **ENN, UCL-CIHD, ACF (2010).** ***Management of Acute Malnutrition in Infants (MAMI) Project: Technical Review: Current evidence, policies, practices & programme outcomes*****. London. ENN.**
The MAMI project was an interagency effort that aimed to investigate the management of acutely malnourished infants under 6 months in emergency programmes in order to develop the evidence base for effectively managing acute malnutrition in this age group. The scale of the problem, review of operational guidelines and treatment, as well as key issues to be explored are detailed in the full report.
Availability: Downloadable in English.
Contact: www.ennonline.net

14. **FANTA (2006)** ***Out with the old? In with the New? Implications of the new 2006 Child Growth Standards*****. Washington DC. Fanta Project.**
This powerpoint presentation provides information on what the new WHO child growth standards are, why they were developed, and how the new WHO child growth standards may affect population-level data for program monitoring, evaluation, and decision making.
Availability: Downloadable in English.
Contact: www.fantaproject.org

15. **IASC Global Nutrition Cluster, and Standing Committee on Nutrition (SCN) Task Force on Assessment, Monitoring, and Evaluation. (2009)** ***Fact sheet on the implementation of 2006 WHO Child Growth Standards for emergency nutrition programmes for children aged 6-59 months*****. Geneva: UNSCN.**
The fact sheet is aimed at policy makers, donors and field workers in order to address the most common questions related to the introduction of the new WHO GS.
Availability: Downloadable pdf in English, French, Arabic and Spanish.
Contact: www.unscn.org

16. **IASC Global Nutrition Cluster, and Standing Committee on Nutrition (SCN) Task Force on Assessment, Monitoring, and Evaluation. (2009).** ***Fact sheet on MUAC*****. Geneva: UNSCN.**
The fact sheet is part of an effort to compile key information on food and nutrition security indicators or measures. It is aimed at policy makers, donors, and field workers.
Availability: Downloadable pdf in English.
Contact: www.unscn.org

17. **SCN Working Group on Nutrition in Emergencies (2007).** ***Draft Statement on the Use of the WHO 2006 Growth Standards in Emergency Nutrition Programmes*****. Geneva: SCN.**
Draft statement issued on behalf of all the agencies (United Nations and non-governmental) who are members of the working group.
Availability: Downloadable pdf format in English
Contact: www.unscn.org

18. **WHO (1995).** ***Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. Technical Report Series No. 854*****. Geneva: WHO.**
The report covers the evidence base and major recommendations for the use and interpretation of anthropometric indicators for all age groups.
Availability: Downloadable pdf in English.
Contact: www.who.int

19. **WHO, WFP, IASC, UNICEF. (2007).** ***Joint Statement on Community-Based Management of Severe Acute Malnutrition*****. Geneva: WHO.**
The joint statement endorses the community-based management of acute malnutrition approach as an effective method to treat severe acute malnutrition.
Availability: Downloadable pdf in English and French.
Contact: www.who.int and www.unicef.org

20. **WHO and UNICEF. (2009).** ***WHO child growth standards and the identification of severe acute malnutrition in infants and children A Joint Statement by the World Health Organization and the United Nations Children's Fund*****. Geneva: WHO and UNICEF.**
The joint statement presents rationale and recommended cut-off points for the identification of severe acute malnutrition in children 6-60 months of age using weight for height Z-scores with the new WHO Growth Standards and MUAC. It also briefly introduces programmatic implications of the operationalization of these recommendations.
Availability: Downloadable pdf in English and French.
Contact: www.who.int and www.unicef.org

21. **Young, Helen and Susanne Jaspars (2009).** ***Review of Nutrition and Mortality Indicators for the IPC: Reference Levels and Decision-making*****. Geneva: UNSCN.**
The document provides a review of a range of anthropometric indicators, their strengths and weaknesses, and thresholds for action. The review was specifically in reference to the use of nutrition and mortality indicators in the Integrated Phase Classification (IPC) system, but provides an up to date summary of anthropometric indicators.
Availability: Downloadable pdf in English.
Contact: www.odi.org.uk

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