MODULE 2
PRINCIPLES OF CARE

Government of Sudan

Training Course on Inpatient Management of Severe Acute Malnutrition

Children 6–59 Months with SAM and Medical Complications

June 2011

This modified version of the 2002 World Health Organisation's *Training Course on Inpatient Management of Severe Acute Malnutrition (SAM)* is the practical application of the 2009 Government of Sudan (GOS) Federal Ministry of Health (FMOH) *Interim Manual Community-Based Management of Severe Acute Malnutrition (November 2009).* The training course is made possible by the generous support of the American people through the support of the Office of U.S. Foreign Disaster Assistance, Bureau for Democracy, Conflict and Humanitarian Assistance, and the Office of Health, Infectious Diseases, and Nutrition, Bureau for Global Health, United States Agency for International Development (USAID), under terms of Cooperative Agreement No. AID-OAA-A-11-00014, through the FANTA-2 Bridge, managed by FHI 360. The contents are the responsibility of FHI 360 and do not necessarily reflect the views of USAID or the United States Government.

Illustrations for modules: Susan Kress

Contents

Acronyms and Abbreviations

AIDS	acquired immune deficiency syndrome
ART	antiretroviral therapy
AWG	average daily weight gain
BMI	body mass index
cm	centimetre(s)
CMAM	Community-Based Management of Acute Malnutrition
CMV	combined mineral and vitamin mix
dl	decilitre(s)
ENA	Essential Nutrition Actions
FMOH	Federal Ministry of Health
g	gram(s)
GOS	Government of Sudan
Hb	haemoglobin
HFA	height-for-age
HIV	human immunodeficiency virus
IGF	insulin growth factor
IM	intramuscular
IMNCI	Integrated Management of Neonatal and Childhood Illness
IU	international unit(s)
IV	intravenous
IYCF	infant and young child feeding
kcal	kilocalorie(s)
kg	kilogram(s)
L	litre(s)
LOS	length of stay
M&R	monitoring and reporting
MAM	moderate acute malnutrition
ml	millilitre(s)
mm	millimetre(s)
MUAC	mid-upper arm circumference
µg	microgram(s)
NG	nasogastric
NGT	nasogastric tube
OPD	outpatient department
ORS	oral rehydration solution
PCV	packed cell volume
PLHIV	people living with HIV
PMTCT	prevention of mother-to-child transmission of HIV
QI	quality improvement
ReSoMal	Rehydration Solution for Malnutrition
RUTF	ready-to-use therapeutic food
SAM	severe acute malnutrition
SFP	supplementary feeding programme
TB	tuberculosis
UNSCN	United Nations Standing Committee on Nutrition
WFA	weight-for-age
WFH	weight-for-height
WFP	World Food Programme
WHO	World Health Organisation

Introduction

This module describes how to recognise a child with severe acute malnutrition (SAM) and outlines the essential components of care. A child with SAM is likely to have many serious health problems in addition to malnutrition. In many cases, these problems may not be clinically apparent. In some cases, the usual treatment for a problem may be harmful or even fatal for a child with SAM. This module describes how the physiology of a child with SAM is different from a child without SAM, and how these differences affect care.

Learning Objectives

This module describes how and allows you to practise the skills needed to identify children with SAM:

- Defining SAM
- Recognising clinical signs of SAM
- Weighing and measuring a child
    - Determining weight
    - Measuring mid-upper arm circumference (MUAC)
    - Measuring height or length
- Identifying a child with SAM
    - Presence of oedema
    - Severe wasting based on MUAC
    - Severe wasting based on low weight-for-height[1] (WFH) z-score
- How does the physiology of SAM affect care of a child?
    - What is reductive adaptation?
    - How does reductive adaptation affect care of the child?
- Overview of the essential components of care
    - Feeding formulas
    - Procedures for successful management of SAM in Inpatient Care
    - Important things **not** to do and why
- Understanding procedures for referral and discharge
    - Criteria for referral and discharge
    - Referral to Outpatient Care
    - Continued treatment with ready-to-use therapeutic food (RUTF) as outpatients
    - Discharge after full recovery

[1] Although the terms ‘length’ and ‘height’ are often used interchangeably in the text of these modules, it should be understood that, if a child is under 2 years old (or if a child’s age is not known and he or she is less than 87 cm tall), recumbent length is measured. If a child is 2 years old or older (or if a child’s age is not known and he or she is 87 cm tall or taller), standing height is measured. If a child 2 years old or older or 87 cm tall or taller is unable to stand, measure recumbent length and subtract 0.7 cm from the length to arrive at a comparable height.

1.0 Defining SAM

Nutrition is a broad term referring to processes involved in eating, digestion and utilisation of food by the body for growth and development, reproduction, physical activity and maintenance of health.

Malnutrition occurs when an individual's dietary intake is not balanced with his or her nutritional needs, harming health, well-being and/or productivity. Malnutrition includes **undernutrition** and **overnutrition.** Undernutrition is defined as a lack of nutrients caused by inadequate dietary intake and/or disease. It encompasses a range of conditions, including acute malnutrition, chronic malnutrition or stunting[2], a mixed form of acute and chronic malnutrition or underweight[3], and deficiencies of micronutrients, such as vitamin A, iron, iodine and zinc. Overnutrition occurs when the body takes in more nutrients than required for normal growth, leading to excessive fat accumulation, presenting a risk to health. Overnutrition conditions include overweight and obesity.

These training modules focus on the severe form of acute malnutrition, SAM, which is a nutrition condition defined by severe wasting (thinness) and/or presence of bilateral pitting oedema. The milder form of acute malnutrition, moderate acute malnutrition (MAM), is defined by moderate wasting. A child with SAM is highly vulnerable to illness and has a high mortality risk. A medical complication in the presence of SAM further increases the risk of death and needs immediate specialised Inpatient Care.

2.0 Recognising Clinical Signs of SAM

You may be familiar with the following conditions that are related to SAM. Clinical signs and anthropometric indicators are used to determine whether or not a child has SAM and should be admitted for treatment, and whether the child should be treated in Outpatient Care or Inpatient Care. Some other clinical signs are used to determine the needed treatments.

Anthropometry is the measurement of the human body, and is used as a proxy measure to assess the nutritional status (reserves in nutrients) of an individual. Anthropometric indicators are commonly used as proxy indicators to classify acute malnutrition because they are objective and easy to measure.

We will first learn about the clinical signs and subsequently about the anthropometric indicators.

[2] Stunting is inadequate height-for-age (HFA), often due to chronic malnutrition. Stunted children should be managed in the community through appropriate infant and young child feeding and care practices for the prevention of malnutrition.

[3] Underweight is inadequate weight-for-age (WFA), often due to a mixed form of acute and chronic malnutrition. An underweight child may be adequate in WFH but low in HFA (short but not thin), or adequate in HFA but low in WFH (thin but not short), or low in both (short and thin), as is very common. Infants and young children should be regularly monitored in the community for growth, and those with signs of growth failure should be identified early and referred for further investigation and support.

2.1 Visible Severe Wasting

A child with severe wasting has lost fat and muscle. A clinical term used for this condition is marasmus. To look for severe wasting, remove the child's clothes. Look at the front view of the child:

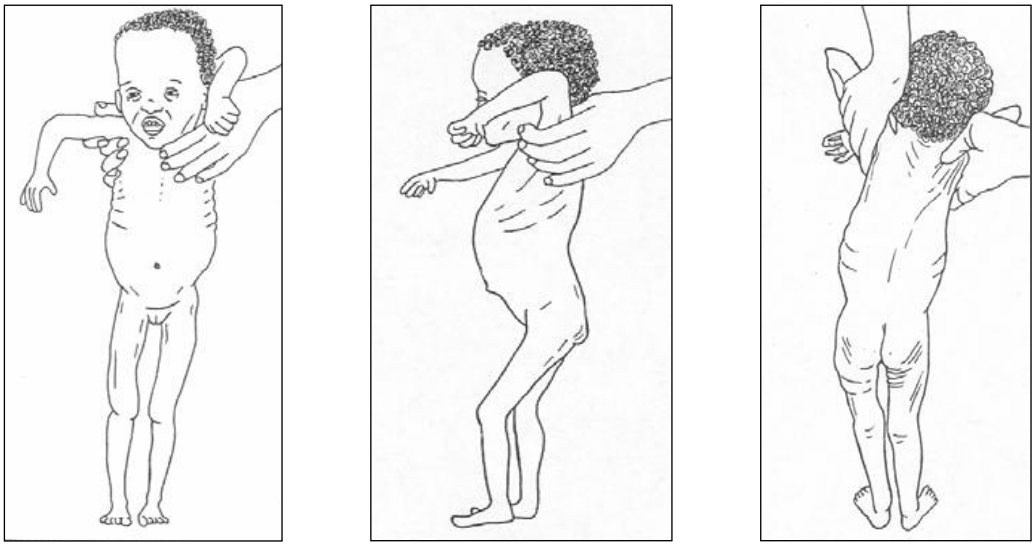
- Is the outline of the child's ribs easily seen?
- Does the skin of the upper arms look loose?
- Does the skin of the thighs look loose?

Look at the back view of the child:

- Are the ribs and shoulder bones easily seen?
- Is flesh missing from the buttocks?

When wasting is extreme, there are folds of skin on the buttocks and thighs. It looks as if the child is wearing 'baggy pants'.

Because a wasted child has lost fat and muscle, he or she will weigh less than healthy children of the same height and will have a low WFH. The child's MUAC reading will also be low.



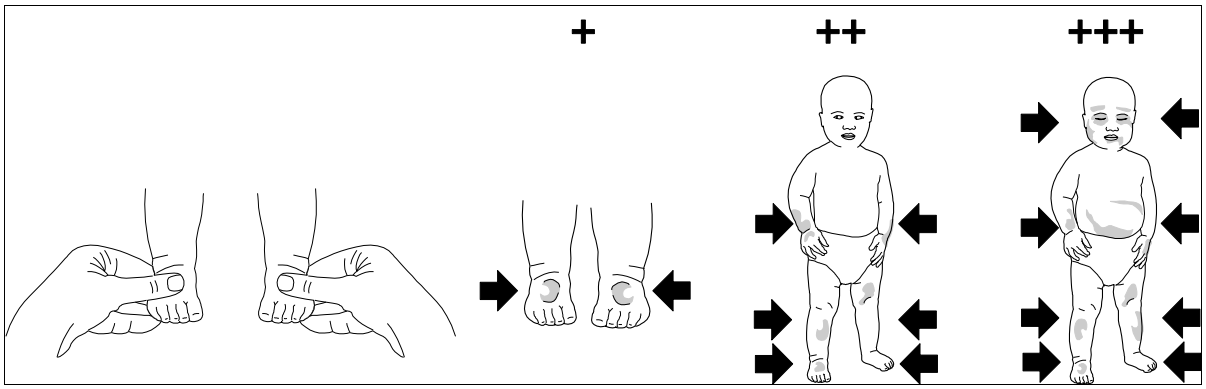
2.2 Bilateral Pitting Oedema

Oedema is an accumulation of fluid in the tissues. Oedema of nutritional origin is characterised by being bilateral and pitting, seen in the feet, lower legs and arms. In severe cases, it may also be seen in the upper limbs and face.

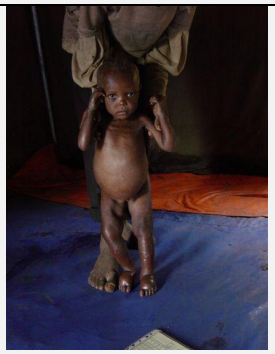
To check for oedema, grasp a foot so that it rests in your hand with your thumb on top of the foot. Press your thumb gently for a few seconds. Do the same to the other foot. The child has bilateral pitting oedema if a pit (dent) remains in both feet when you lift your thumb.

To be considered a sign of SAM, oedema must appear in both feet. If the swelling is in only one foot, it may just be sore or infected. The extent of oedema is commonly graded in the following way:

+ mild: both feet
++ moderate: both feet, plus lower legs, hands or lower arms
+++ severe: generalised oedema, including both feet, legs, hands, arms and face



Pictures of Bilateral Pitting Oedema

Mild (Grade +) This child has bilateral pitting oedema. This is grade + bilateral pitting oedema (mild). However, the child might have grade ++ or +++, so legs and face will also need to be checked.	
Moderate (Grade ++) In this child, both feet plus the lower legs, hands and lower arms are swollen. This is grade ++ bilateral pitting oedema (moderate).	
Severe (Grade +++) This child has grade +++ bilateral pitting oedema (severe). It is generalised, including both feet, legs, arms, hands and face.	

2.3 Appetite

The pathophysiological responses to nutrient depletion in children with SAM are such that liver and metabolic functions are disturbed and dysfunctional, leading to poor appetite. In addition, children with a significant infection lose appetite, especially in the acute phase. This puts children with SAM with poor appetite at higher risk of death.

The appetite is tested upon admission and is repeated at each follow-up visit to the health facility. Later (**Module 4, Feeding**) we will discuss how to conduct the appetite test. A child passes the appetite test if he or she eats an adequate amount of RUTF provided in an adequate environment and eaten within a half hour (Table 1).

Table 1. Appetite Test Pass/Fail Criteria

Pass	Fail
The child eats at least one-third of a packet of RUTF (92 g) or three teaspoons from a pot within 30 minutes.	The child does NOT eat one-third of a packet of RUTF (92 g) or three teaspoons from a pot within 30 minutes.

2.4 Dermatosis

Dermatosis is a condition of the skin. In cases of SAM, it is more common in children that have bilateral pitting oedema than in wasted children. A child with dermatosis may have patches of skin that are abnormally light or dark in colour, shedding of skin in scales or sheets and ulceration of the skin of the perineum, groin, limbs, behind the ears and in the armpits. There may be weeping lesions. There may be a severe rash in the nappy area. Any break in the skin can let dangerous bacteria into the body. When the skin is raw and weeping, this risk is very high.

The extent of dermatosis is described in the following way:

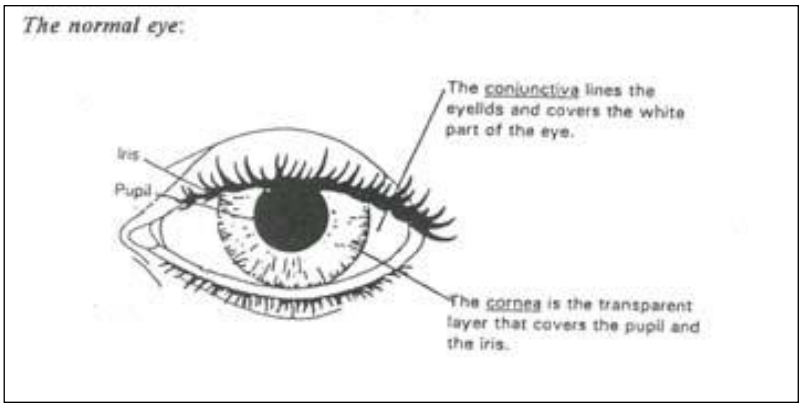
+ mild: discolouration or a few rough patches of skin
++ moderate: multiple patches on arms and/or legs
+++ severe: flaking skin, raw skin, fissures (openings in the skin)

Treatment of dermatosis is discussed in **Module 5, Daily Care**.

2.5 Eye Signs

Children with SAM may have signs of eye infection and/or vitamin A deficiency.

- **Bitot's spots** are superficial foamy white spots on the conjunctiva (white part of the eye). These are associated with vitamin A deficiency.



- **Pus and inflammation** (redness) are signs of eye infection.
- **Corneal clouding** is seen as an opaque appearance of the cornea (the transparent layer that covers the pupil and iris). It is a sign of vitamin A deficiency.
- **Corneal ulceration** is a break in the surface of the cornea. It is a sign of severe vitamin A deficiency. If not treated, the lens of the eye may push out and cause blindness. Corneal ulceration is urgent and requires immediate treatment with vitamin A and atropine (to relax the eye).

Treatment of all eye signs will be discussed in **Module 3, Initial Management**, and **Module 5, Daily Care**.

2.8 Medical Complications in the Presence of SAM

Children with SAM and medical complications are at high risk of death. Any medical complications need to be identified and treated with urgency in Inpatient Care, where specialist expertise is available, as treatment of the medical condition of these children differs from the traditional medical treatment protocols.

The medical complications in the presence of SAM that need an immediate medical intervention are:

- Anorexia, poor appetite
- Intractable vomiting
- Convulsions
- Lethargy, not alert
- Unconsciousness
- Hypoglycaemia
- High fever
- Hypothermia
- Severe dehydration
- Lower respiratory tract infection
- Severe anaemia
- Eye signs of vitamin A deficiency
- Skin lesion

The signs and treatment of medical complications in the presence of SAM are addressed in **Module 3, Initial Management**, but the case definitions that are listed in Table 2 are helpful to understand the correct terms.

Table 2. Case Definitions of Medical Complications with SAM

Medical Complication	Case Definition
Anorexia, poor appetite	Child is not drinking or breastfeeding enough. Child fails RUTF appetite test.
Intractable vomiting*	Child is vomiting after every oral intake.
Convulsions*	During a convulsion, the child has uncontrollable movements of limbs and/or face, and/or rolling eyes and/or loss of consciousness. Ask the mother[4] if the child has had convulsions during this current illness.
Lethargy, not alert*	Child is difficult to wake. Ask the mother if the child is drowsy, shows no interest in what is happening around him/her, does not look at the mother or watch her face when talking or is unusually sleepy.
Unconsciousness*	Child does not respond to painful stimuli (e.g., injection).
Hypoglycaemia	There are often no clinical signs for hypoglycaemia. One sign that does occur in a child with SAM is eyelid retraction: The child sleeps with eyes slightly open.
High fever	Child has a high body temperature—axillary temperature ≥ 38.5° C or rectal temperature ≥ 39° C—taking into consideration the ambient temperature.
Hypothermia	Child has a low body temperature—axillary temperature < 35° C or rectal temperature < 35.5° C—taking into consideration the ambient temperature.
Severe dehydration	For children with SAM, diagnosis of severe dehydration is based on a recent history of diarrhoea, vomiting, high fever or sweating, and on recent appearance of clinical signs of dehydration as reported by the mother.
Lower respiratory tract infection	Child has a cough with difficulty breathing, fast breathing (if child is 2–12 months: 50 breaths per minute or more; if child is 12 months–5 years: 40 breaths per minute or more) or chest in-drawing.
Severe anaemia	Child has palmer pallor or unusual paleness of the skin (compare the colour of the child's palm with the palms of other children); haemoglobin (Hb) < 4 grams per decilitre (g/dl) or if there is respiratory distress and Hb is between 4 and 6 g/dl.
Eye signs of vitamin A deficiency	Stages of xerophthalmia are: conjunctival xerosis or dry, opaque and dull conjunctiva with or without Bitot's spots (foamy material on conjunctiva); corneal xerosis or dry and dull cornea; keratomalacia or ulceration, necrosis, perforation of cornea, leading to total blindness.
Skin lesion	Child has broken skin, fissures or flaking of skin.

* Denotes Integrated Management of Neonatal and Childhood Illness (IMNCI) danger sign.

[4] The term 'mother' is used throughout this module. However, it is understood that the person who is responsible for the care of the child might not always be that child's mother, but rather some other caregiver. However, for the sake of readability, 'mother' means 'mother/caregiver' throughout this module, 'she' means 'she or he' and 'her' means 'her or his'.

Exercise A

In this exercise, you will look at photographs of children and identify signs related to SAM.

Open your photo booklet. Each photo is numbered. For each photo listed below in this exercise, write down all of the following signs you see:

- severe wasting
- oedema
- dermatosis
- eye signs (Bitot's spots, pus, inflammation, corneal clouding, corneal ulceration)

If the child has dermatosis or oedema, try to estimate the degree of severity (+, ++ or +++). If you see none of the signs, write NONE. When everyone in the group has finished, conduct a discussion of the photographs. Photo 1 is described below as an example.

Photo 1: Moderate (++) oedema, seen in feet and lower legs
Severe wasting of upper arms; ribs and collar bones clearly show.

Photo 2:

Photos 3 and 4 (front and back view of same child):

Photo 5:

Photo 6:

Photo 7:

Photo 8:

Photo 9:

Photo 10:

Photo 11:

Photo 12:

Photo 13:

Photo 14:

Photo 15:

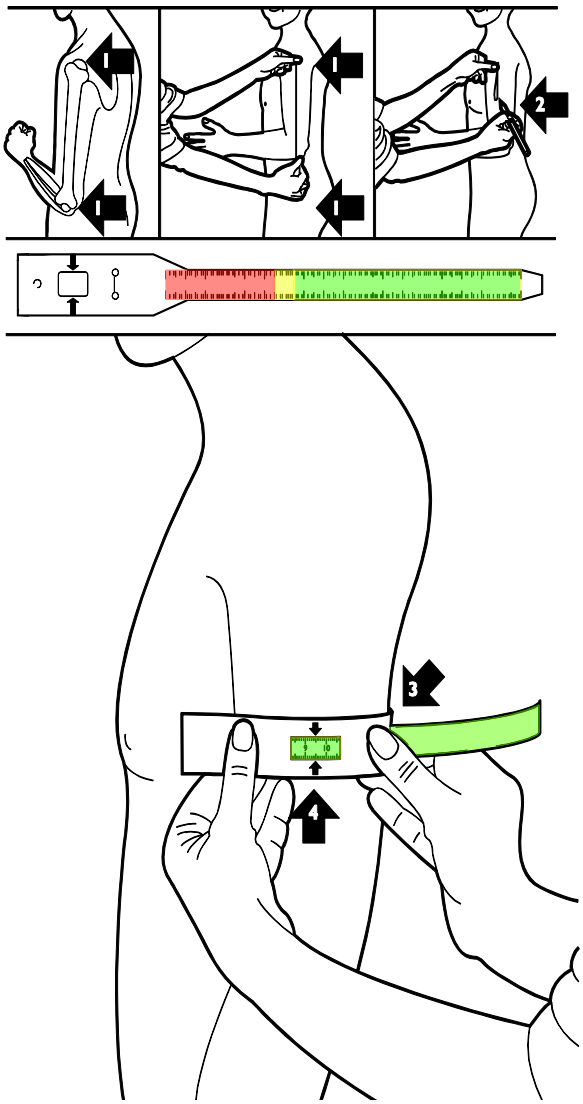
When you have completed this exercise,
tell a facilitator that you are ready for the group discussion.

3.0 Weighing and Measuring a Child

In addition to looking for visible signs of SAM, it is important to measure a child's height and weight and to compare the child's results to established averages. Anthropometric indicators are commonly used to objectively and promptly classify the nutritional condition of children and are therefore used as key criteria for admission to treatment (and discharge).

3.1 Measuring MUAC

MUAC is a very useful body measurement used for children 6–59 months. MUAC correlates well with muscle mass and, hence, with body nutritional reserves. Moreover, evidence supports the fact that MUAC correlates better with risk of death than WFH does.



It is essential to use the age cut-off of 6 months for MUAC and not to use the height of the child as proxy for age[5].

How to measure MUAC:

1. MUAC is always taken on the left arm. Have the child bend his/her left arm at a 90° angle. Measure the length of the child's upper arm, between the bone at the top of the shoulder and the tip of the elbow. [1]
2. Find the midpoint of the upper arm and mark it with a pen. It is recommended to use a string instead of the MUAC tape to find the midpoint. [2]
3. The child's arm should then be relaxed, falling alongside his/her body. Wrap the MUAC tape around the child's arm at the marked point, such that the entire tape is in contact with the child's skin. It should be neither too tight nor too loose. [3]
4. Feed the end of the tape through the first opening and then through the second opening (or third opening, depending on type of tape is used). The measurement is read from the middle window where the arrows point inward. For numbered tapes, MUAC can be recorded with a precision of 1 mm. For three-colour tapes (red, yellow, green), read the colour that shows through the window at the point the two arrows indicate. [4]

[5] It is not recommended to use a height cut-off as proxy for 6 months of age; in a stunted population, many infants of 6 months or older will have a height less than 65 cm. If the birth date is unconfirmed, use the recall of the mother to estimate the infant's age.

3.2 Measuring a Child's or Infant's Weight

Weigh a child as soon as possible after he or she arrives. If the child is admitted, weigh the child once a day, preferably at about the same time each day. The weighing time should be about 1 hour before or after a feeding.

Tips for Weighing a Child or Infant

- Never weigh a child without explaining the procedure to the mother.
- Children should be weighed and completely naked only in the presence of the mother. Have the mother remove the child's clothes.
- Put a soft cloth or the child's wrapping on the scale to protect the child from the hard and potentially cold surface.
- Read the child's weight when the child is not moving. The child should remain still for the weighing.
- Scales must be cleaned and re-zeroed after each weighing.

An electronic scale is the preferred type of scale to weigh children and infants in Inpatient Care, and should have the following features:

- Is solidly built and durable
- Has a digital readout
- Measures up to 150 kg
- Measures to a precision of 0.1 kg (100 g) for children and to a precision of 0.01 kg (10 g) for infants
- Allows 'tared weighing'

'Tared weighing' means that the scale can be reset to zero ('tared') with a person on it. Thus, a mother can stand on the scale and be weighed, and the scale can then be tared without the mother getting off. While remaining on the scale, a mother can then be given a child to hold and only the child's weight will appear on the scale.

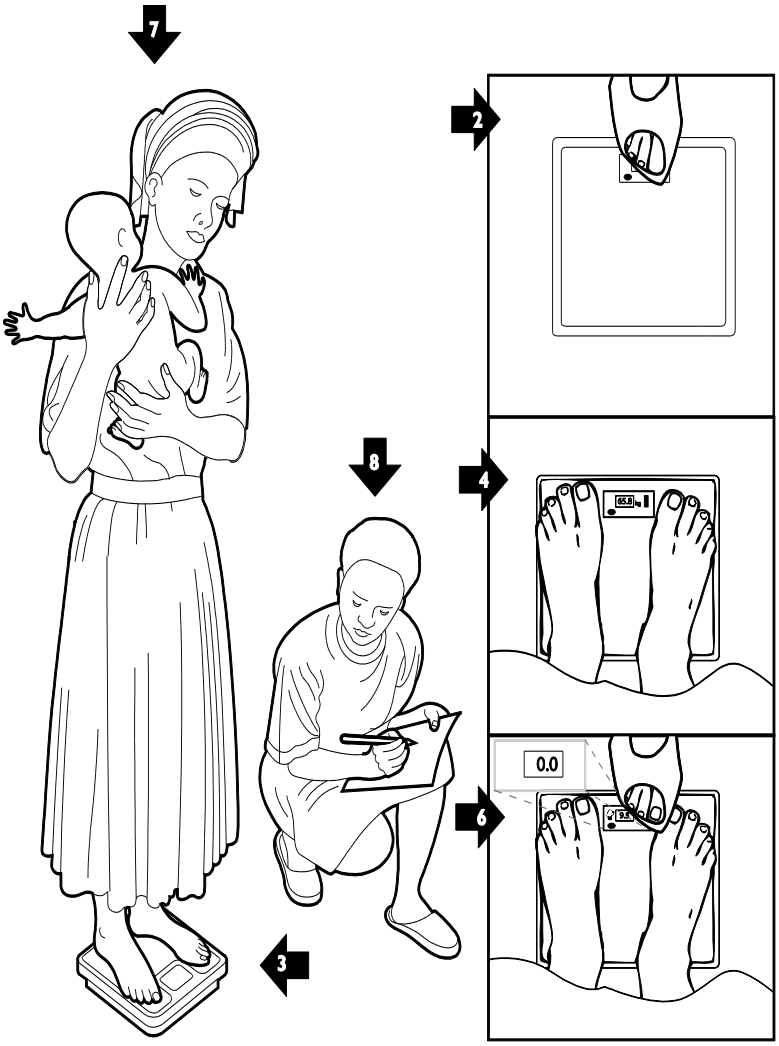
Tared weighing has two clear advantages:

- There is no need to subtract weights to determine the child's weight alone (reducing the risk of error).
- The child is likely to remain calm when held in the mother's arms.

There are many types of scales currently in use. Some can be used for all ages, some should be used only for older children, while others should be used only for infants. The appropriate ages are identified in parentheses after each type of scale.

Solar Electronic Scale (All Ages)

There are solar electronic scales that have all the recommended features listed above, for example, UNICEF's UNISCALE.



Adapted from "How to use the UNISCALE" UNICEF, 2000 and "Weighing a Child Using a Taring Scale" WHO, 2006.

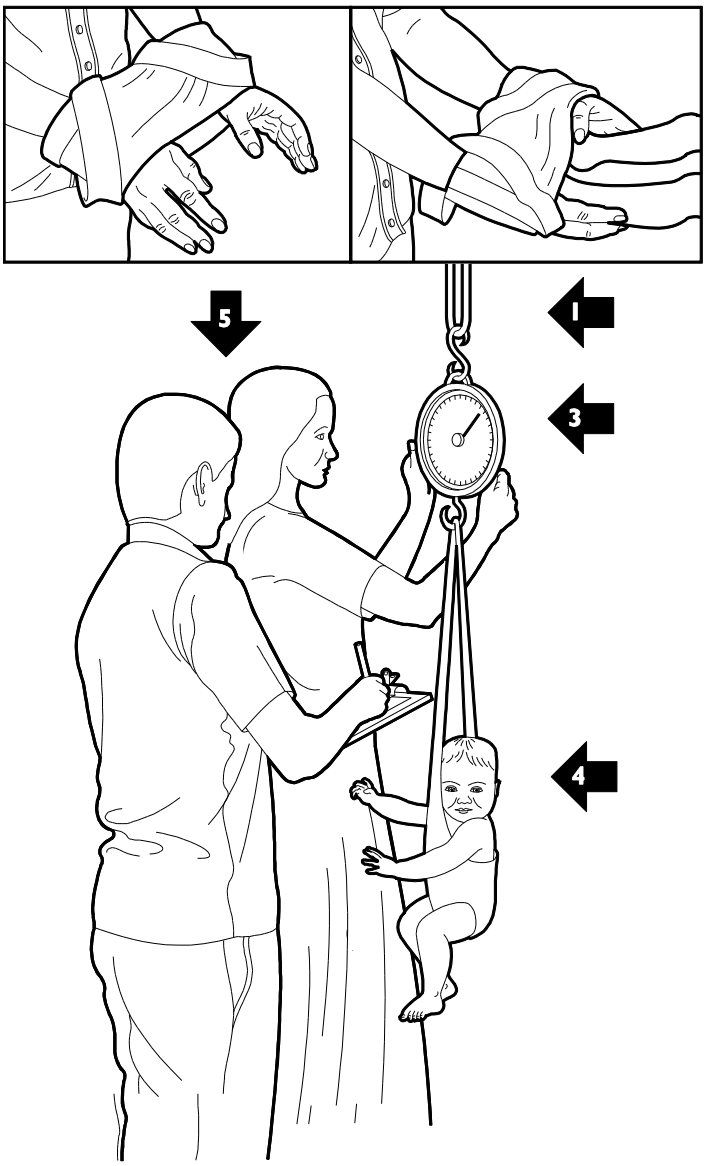
Steps:

1. Be sure that the scale is placed on a flat, hard, even surface. Since the scale is solar powered, there must be enough light to operate the scale.
2. To turn on the scale, cover the solar panel for a second. When the number 0.0 appears, the scale is ready. [2]
3. Check to see that the mother has removed her shoes. [3] You or someone else should hold the naked child wrapped in a blanket.
4. Ask the mother to stand in the middle of the scale, feet slightly apart (on the footprints, if marked), and remain still. The mother's clothing must not cover the display or solar panel. [4]
5. Remind her to stay on the scale even after her weight appears, until the child has been weighed in her arms.
6. With the mother still on the scale and her weight displayed, tare the scale by covering the solar panel for a second. The scale is tared when it displays a figure of an adult and a child and the number 0.0. [6]
7. Gently hand the naked child to the mother and ask her to remain still. [7]
8. The child's weight will appear on the display. Record the weight. Be careful to read the numbers in the correct order (as though you were viewing while standing on the scale rather than upside-down). [8]

Hanging Scale (Pants) (Under 5 Years)

If the UNISCALE is not available, a hanging scale can be used to weigh the child.

The scale should be checked daily against a known weight. To do this, set the scale to zero and weigh objects of known weight (for example, 5.0 kg, 10.0 kg, 15.0 kg). If the measurement does not match that of the known weight to within 10 grams, the springs must be changed or the scale should be replaced.

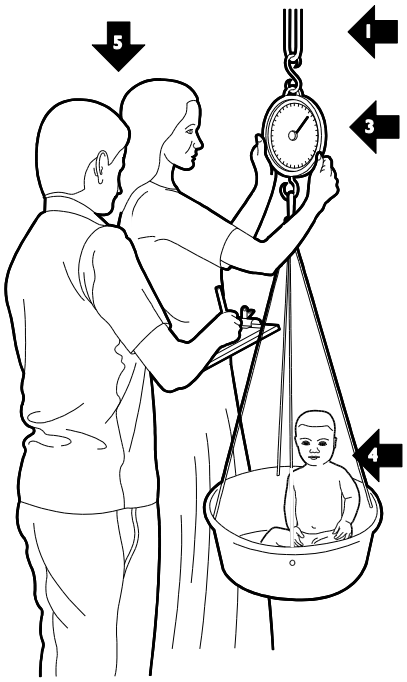


Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children, UN 1986.

Steps:

1. Hook the scale to a rope on the ceiling or stand in a clinic, at eye level of the measurer. [1]
2. Before weighing the child, have the mother take all the child's clothes off.
3. Make sure the scale arrow is at 0 ('zero the scale') with the weighing pants hooked on the scale. [3]
4. Place child in the weighing pants and let the child hang freely, touching nothing. Make sure the child is safely in the weighing pants, with one arm in front and one arm behind the straps to help maintain balance. [4]
5. When the arrow is steady, the measurer reads the child's weight in kg at **eye level** to the nearest 100 g (for example, 6.4 kg). Have the assistant repeat the weight for verification and then record it. [5]

Hanging Scale (Bucket) (6–24 Months)

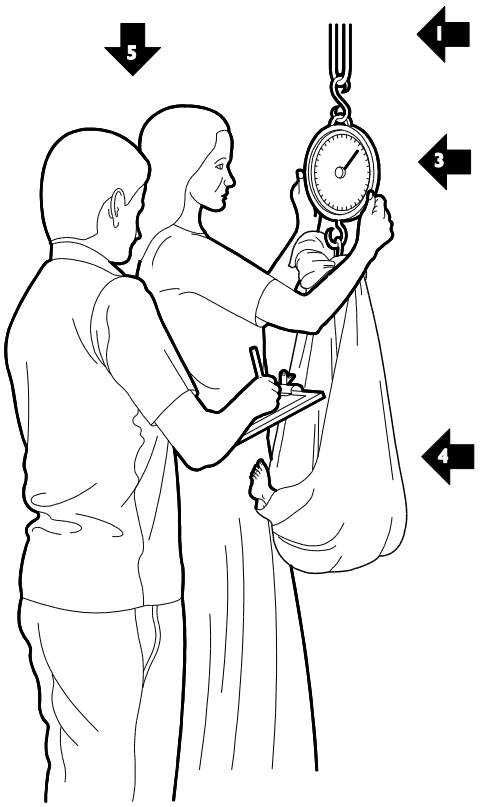


The scale should be checked daily against a known weight. To do this, set the scale to zero and weigh objects of known weight (for example, 5.0 kg, 10.0 kg, 15.0 kg). If the measure does not match the weight to within 10 grams, the springs must be changed or the scale should be replaced.

Steps:

1. Hook the scale to a rope on the ceiling or stand in a clinic, at eye level of the measurer. Put a soft cloth or the child's wrapping in the bucket. [1]
2. Before weighing the child, have the mother take all the child's clothes off.
3. Make sure the scale arrow is at 0 ('zero the scale') with the bucket hooked on the scale. [3]
4. Place child in weighing bucket. [4]
5. When the arrow is steady, the measurer reads the child's weight in kg at **eye level** to the nearest 100 g (for example 5.2 kg). Have the assistant repeat the weight for verification and then record it. [5]

Hanging Scale (Hammock or Cloth) (Infants)

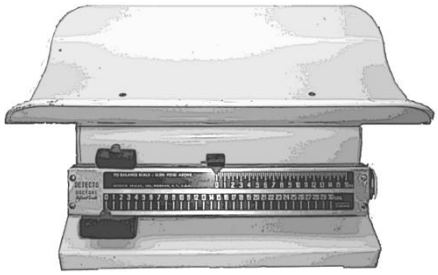


The scale should be checked daily against a known weight. To do this, set the scale to zero and weigh objects of known weight (for example, 5.0 kg, 10.0 kg, 15.0 kg). If the measure does not match the weight to within 10 grams, the springs must be changed or the scale should be replaced.

Steps:

1. Hook the scale to a rope on the ceiling or stand in a clinic, at eye level of the measurer. [1]
2. Before weighing the child, have the mother take all the child's clothes off.
3. Make sure the scale arrow is at 0 ('zero the scale') with the hammock or cloth that will be used hooked on the scale. [3]
4. Place child in hammock or cloth, hook it on the scale and let child hang freely, touching nothing. Make sure the child is safely in the hammock or cloth. [4]
5. When the arrow is steady, the measurer reads the child's weight in kg at **eye level** to the nearest 100 g (for example, 6.4 kg). Have the assistant repeat the weight for verification and the record it. [5]

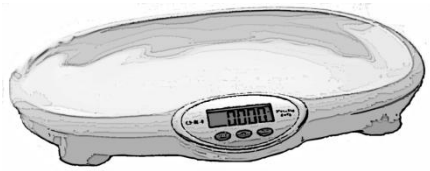
Infant Beam Scale



Steps:

1. Unlock the beam, put a soft cloth or the infant's wrapping on the scale and zero the scale (i.e., make sure that the end of the beam is not touching either the top or the bottom of the hole it fits through).
2. Have the mother remove the infant's clothes and put the infant on the scale. Advise the mother to remain close but not to touch the infant or the scale.
3. Move the weights along the beam until the end of the beam is not touching either the top or the bottom of the hole it fits through.
4. Read and write down the infant's weight with a 10-gram precision (e.g., 2 kg 220 g).
5. Lock the beam and remove the infant.
6. Clean and re-zero the scale.

Infant Bench Scale



Steps:

1. Have the mother remove the infant's clothes and hold the child.
2. Put a soft cloth or the infant's wrapping on the scale and turn it on. Wait until the scale shows zeros.
3. Within 60 seconds of the scale showing zeros, have the mother put the infant on the scale. Advise the mother to remain close but not to touch the infant or the scale. The scale will display the infant's weight.
4. Read and write down the infant's weight with a 10-gram precision (e.g., 3 kg 470 g).
5. Turn off the scale and remove the infant.
6. Clean the scale.

3.3 Measuring a Child's Length/Height

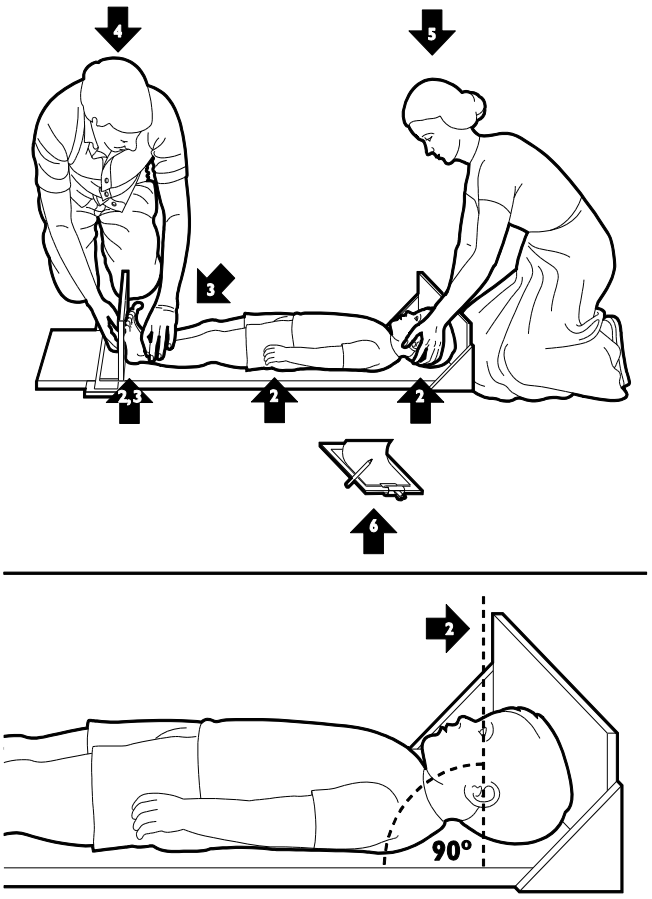
Depending on a child's age and ability to stand, measure the child's length or height. A child's length is measured while he or she is lying down (recumbent). Height is measured while the child is standing upright.

- If a child is under 2 years old or if a child is less than 87 cm tall and his/her age is not known, measure length. Use the Weight-for-Length Look-Up Table.
- If a child is 2 years old or older or if a child is at least 87 cm tall and his/her age is not known, measure standing height. If a child 2 years old or older or at least 87 cm tall is unable to stand, measure recumbent length and subtract 0.7 cm from the length to arrive at a comparable height. Use the Weight-for-Height Look-Up Table.

Whether measuring length or height, the mother should be nearby to soothe and comfort the child.

Length Board (under 2 years *OR* less than 87 cm tall and age is not known *OR* 2 years or older or at least 87 cm tall but unable to stand)

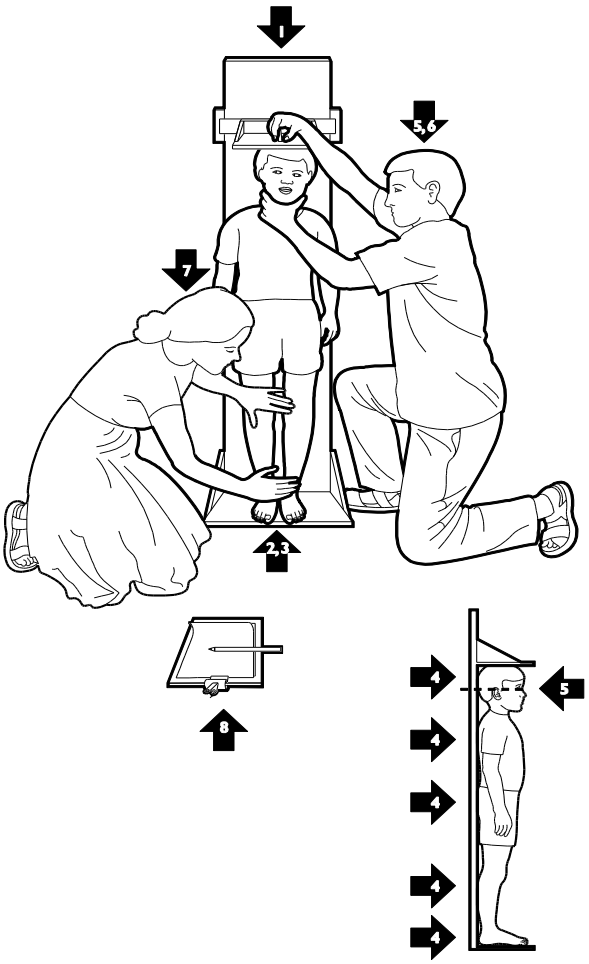
1. Place height board on the ground and remove the child's shoes.
2. Place the child on his/her back in the middle of board, head facing straight up, arms at child's sides and feet at 90° angles to board. [2,3]
3. While holding the child's ankles or knees, move the sliding board up against the bottom of the child's feet. [2,3]
4. Take measurement to nearest 0.1 cm and read out loud.
5. Have the assistant [5], while holding the child's head in place [2], repeat the measurement for verification.
6. The measurer [4] records the height to nearest 0.1 cm. If the child is 2 years old or older or is 87 cm or greater while standing up, be sure to subtract 0.7 cm from measurement. [6]



Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children, UN 1986.

Height Board (2 years old or older *OR* at least 87 cm tall *AND* able to stand)

1. Remove the child's shoes and place him/her on the height board, standing upright in the middle of the board with arms at his/her sides. [1]
2. The child's feet should be close together with heels and soles touching the bottom of the board (that is, not standing tiptoe). [2,3]
3. The back of the child's ankles and knees should be firmly pressed toward the board. [4]
4. The child should stand straight, with heels, back of legs, buttocks, shoulder blades and head touching the back of the board. [4]
5. The measurer holds the child's head straight. The child's line of vision should be parallel to the floor. [5]
6. The measurer reads measurement out loud to nearest 0.1 cm. [6]
7. The assistant [7], holding child's legs and feet, repeats the measurement for verification.
8. The measurer records the height to nearest 0.1 cm.[8]



Source: How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children, UN 1986.

4.0 Identifying a Child with SAM

4.1 Determining the Presence of Bilateral Pitting Oedema

Bilateral pitting oedema is a form of SAM. It is a characteristic of kwashiorkor. A combination of bilateral pitting oedema and wasting is a severe condition.

For determining the presence of bilateral pitting oedema, see page 2, Section 2.0, Recognising Clinical Signs of SAM.

Note: The clinical term kwashiorkor will not be used in this course. This course will simply refer to the signs of bilateral pitting oedema.

4.2 Determining Severe Wasting Based on MUAC

Children 6–59 months are classified as severely wasted based on MUAC if their MUAC < 115 mm.

4.3 Determining Severe Wasting Based on WFH

What is a z-score? A z-score is a way of comparing a measurement, in this case a child's WFH, to an 'average' (median). The 'averages' used are the WHO 2006 child growth standards (WHO standards). In the WHO standard population, all children of the same height are distributed around the median weight, some heavier and some lighter. For each height group, there is a standard deviation among the children of the WHO standard population. This standard deviation is expressed as a certain number of kg at each height. The z-score of a child being measured is the number of standard deviations the child's weight is away from the median weight of the WHO standard population at that height group. The Weight-for-Height/Length Look-Up Table Job Aid shows the z-scores for boys and girls of different weights and lengths or heights.

Optional: To learn more about z-scores, how they are calculated and what they mean, refer to **Annex A** of this module.

It is important to consider a child's WFH rather than weight-for-age (WFA). The latter is also affected by stunting. Stunting may cause low WFA when a child has an adequate WFH. Therapeutic feeding can correct wasting but cannot easily correct stunting.

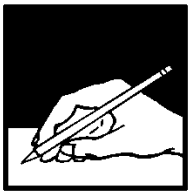
To use the Weight-for-Height/Length Look-Up Table:

- Find the child's length or height in the middle column of the table.
- If the length or height is between those listed, round up or down as follows: If the height/length is 0.5 cm or more greater than the next lower height/length, round up. Otherwise, round down.
- Then look in the left columns for boys or the right columns for girls to find the child's weight.
- Look at the top of the column to see what the child's z-score is.

The child's weight may be between two weights listed in the table and therefore between two z-scores. If so, indicate that the weight is between these scores by writing less than (<). For example, if the score is between −1 z-score and −2 z-score, write < −1 z-score.

Examples of WFH Z-Scores

- A boy is 80 cm in length and weighs 9.2 kg. His score is above −2 z-score and below −1 z-score. Record his z-score as < −1 z-score.
- A girl is 76.5 cm in length and weighs 7.4 kg. Round her length to 77 cm. Her z-score is −3 z-score.
- A girl is 90 cm in height and weighs 10.3 kg. Her weight is between −2 z-score and −3 z-score. Record her z-score as < −2 z-score.



Exercise B

Refer to the z-scores in the Weight-for-Height/Length Look-Up Table Job Aid. Indicate the WFH z-score for each child listed below.

1. Shana, girl, length 63.0 cm, weight 5.0 kg

2. Rico, boy, age 4, height 101.0 cm, weight 11.8 kg

3. Tonya, girl, length 69.8 cm, weight 6.2 kg

4.a Kareem, boy, age 1.8 years, length 82.0 cm, weight 8.5 kg
4.b Kareem, boy, age 2.2 years, length 82.0 cm, weight 8.5 kg
4.c Kareem, boy, and you do not know the age, length 82.0 cm, weight 8.5 kg

When you have completed this exercise,
please discuss your answers with a facilitator.

4.4 Understanding Criteria for Admission to the Management of SAM in Outpatient Care and Inpatient Care

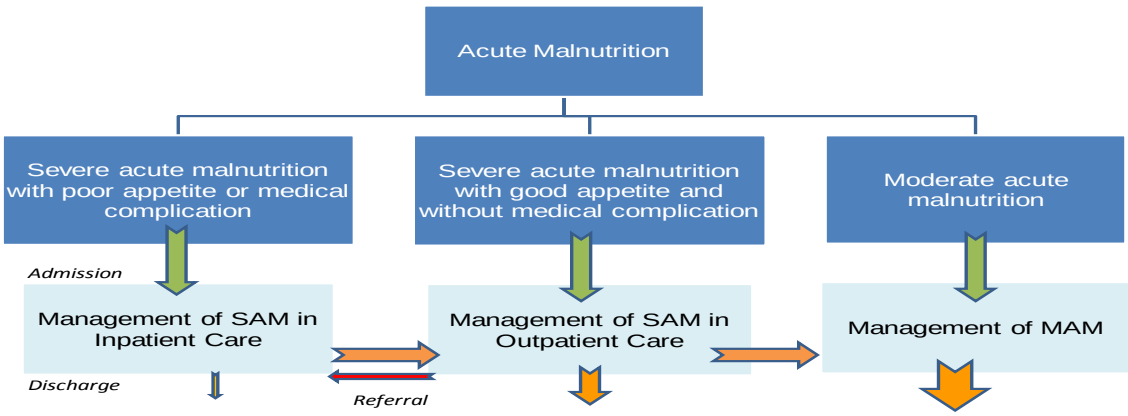


Table 3. Admission Criteria for SAM in Children 6–59 Months for Treatment in Inpatient Care or Outpatient Care

Inpatient Care: **SAM with medical complications**	**Outpatient Care:** **SAM without medical complications**
Bilateral pitting oedema +++ *or* Any grade of bilateral pitting oedema with severe wasting (MUAC < 115 mm or WFH < −3 z-score) *or* SAM <u>with any</u> of the following medical complications: • Anorexia, poor appetite • Intractable vomiting • Convulsions • Lethargy, not alert • Unconsciousness • Hypoglycaemia • High fever (> 38.5° C axillary) • Hypothermia (< 35° C axillary) • Severe dehydration • Persistent diarrhoea • Lower respiratory tract infection • Severe anaemia • Eye signs of vitamin A deficiency • Skin lesion	Bilateral pitting oedema + and ++ *or* Severe wasting (MUAC < 115 mm or WFH < −3 z-score) *and* • Appetite (appetite test passed) • No medical complication • Child clinically well and alert

Note: If there is no Outpatient Care or no access to RUTF, then the recommended admission criteria for treatment in Inpatient Care are:

- MUAC < 115 mm or WFH < –3 z-score *or*
- Bilateral pitting oedema

Reasons for Starting Treatment in Inpatient Care

All children with SAM and poor appetite (failed the appetite test) and/or medical complications (see list in Table 3 above) should be admitted for treatment of SAM in Inpatient Care. Children with SAM and medical complications are in danger of death from hypoglycaemia, hypothermia, fluid overload, and undetected infections. They cannot be treated like other children. Their feeding and fluids must be carefully controlled, or they could die. To ensure the proper feeding and treatment routines, it is critical to keep these children in Inpatient Care until the medical conditions have stabilised and are resolving and the appetite has returned. Any health problem and infection should be treated while in Inpatient Care.

Note about young infants: Infants under 6 months with acute malnutrition should all be treated in Inpatient Care. Children over 6 months of age but with a weight less than 4 kg should also be treated in Inpatient Care.

Low-birth-weight babies are not usually severely wasted or oedematous and so are unlikely to meet the criteria for SAM. Management of low-birth-weight babies is not taught in this course. Low-birth-weight babies should be breastfed.

For additional information on the management of SAM in infants under 6 months, see on pages 55–63 of the Government of Sudan Interim Manual: Community-Based Management of Severe Acute Malnutrition, Version 1.0 (November 2009) (the CMAM Manual), Chapter 5.

PHOTOS

Exercise C

In this exercise, you will look at photographs and consider information about a child to determine if the child should be admitted for the management of SAM. Use the criteria given on the previous page in this module. Refer to the Weight-for-Height/Length Look-Up Table Job Aid, as needed.

Photo 18: This child is a girl, age 20 months. She is 67 cm in length. She weighs 6.5 kg, and has a MUAC of 118 mm. Should she be admitted for the management of SAM? Is she admitted to Inpatient Care or Outpatient Care? Why or why not?

Photo 19: This child is a girl, age 7 months. She is 60 cm in length and weighs 4.2 kg and has a MUAC of 104 mm. Should she be admitted for the management of SAM? Is she admitted to Inpatient Care or Outpatient Care? Why or why not?

Photo 20: This child is a boy, age 18 months. He is 65 cm in length and weighs 4.8 kg and has a MUAC of 108 mm. Should he be admitted for the management of SAM? Is he admitted to Inpatient Care or Outpatient Care? Why or why not?

When you have completed this exercise,
tell a facilitator that you are ready for the group discussion and drill.

5.0 How Does the Physiology of SAM Affect Care of a Child?

A child with SAM must be treated differently than other children because his or her physiology is seriously abnormal due to **reductive adaptation.**

5.1 What Is Reductive Adaptation?

The systems of the body begin to 'shut down' with SAM. The systems slow down and do less so that the body can survive on limited calories. This slowing down is known as reductive adaptation. As the child is treated, the body's systems must gradually 'learn' to function fully again. Rapid changes (such as rapid feeding or fluids) would overwhelm the systems, so feeding must be slowly and cautiously increased.

Optional: To learn more about how reductive adaptation affects the body's systems, refer to the Pathophysiology Basis for the Treatment of SAM Job Aid. A simplified explanation of the implications for care is provided below.

5.2 How Does Reductive Adaptation Affect Care of a Child?

Reductive adaptation affects treatment of a child in a number of ways. Three important implications for care are described below.

Presume and Treat Infection

Nearly all children with SAM have bacterial infections. However, as a result of reductive adaptation, the usual signs of infection may not be apparent, because the body does not use its limited energy to respond in the usual ways, such as inflammation or fever.

Examples of common infections in the child with SAM are ear infection, urinary tract infection and pneumonia. Assume that infection is present and treat all children with SAM with broad spectrum antibiotics. If a specific infection is identified (such as *Shigella*, *Giardiasis*), add specific appropriate antibiotics to those already being given.

Note: Choices of antibiotics will be discussed in the **Module 3, Initial Management**, and are described on Job Aid Medicines Protocols in Inpatient Care.

Do Not Give Iron Early in Treatment

Due to reductive adaptation, a child with SAM makes less haemoglobin (Hb) than usual. Iron that is not used for making Hb is put into storage. Thus, there is 'extra' iron stored in the body, even though the child may appear anaemic. Giving iron early in treatment will not cure anaemia, as the child already has a supply of stored iron.

Giving iron early in treatment can also lead to 'free iron' in the body. Free iron can cause problems in three ways.

- Free iron is highly reactive and promotes the formation of free radicals, which may engage in uncontrolled chemical reactions with damaging effects.
- Free iron promotes bacterial growth and can make some infections worse.
- The body tries to protect itself from free iron by converting it to ferritin. This conversion requires energy and amino acids and diverts these from other critical activities.

Later, as the child recovers and begins to build new tissue and form more red blood cells, the iron in storage will be used and supplements might be needed.

Provide Potassium and Restrict Sodium

Normally, the body uses a lot of energy maintaining the appropriate balance of potassium inside the cells and sodium outside the cells. This balance is critical to maintaining the correct distribution of water inside the cells, around the cells and in the blood.

In reductive adaptation, the 'pump' that usually controls the balance of potassium and sodium runs slower. As a result, the level of sodium in the cells rises, and potassium leaks out of the cells and is lost (for example, in urine or stools). Fluid may then accumulate outside of the cells (as in oedema) instead of being properly distributed through the body.

All children with SAM should be given potassium to make up for what is lost. (They should also be given magnesium, which is essential for potassium to enter the cells and be retained.) Children with SAM already have excess sodium in their cells, so sodium intake should be restricted. If a child has severe and/or persistent diarrhoea and/or dehydration, a special rehydration solution called Rehydration Solution for Malnutrition (ReSoMal) should be used instead of regular or low-osmolarity oral rehydration solution (ORS). ReSoMal has less sodium and more potassium than regular or low-osmolarity ORS.

SHORT ANSWER EXERCISE

Briefly answer these questions as a review of the previous section:

1. When a child has SAM, why is it important to begin feeding slowly and cautiously?

2. Why should all children with SAM be given antibiotics?

3. Why is it dangerous to give iron early in treatment?

4. Why is ReSoMal preferable to regular or low-osmolarity ORS for children with SAM who have severe and/or persistent diarrhoea and/or dehydration?

Tell the facilitator when you are ready to discuss these questions with the group.

6.0 Overview of the Essential Components of Care

6.1 Feeding Formulas: What Are F-75 and F-100?

F-75 is the 'starter' formula therapeutic milk to use during initial management, beginning as soon as possible and continuing for 2–7 days until the child is stabilised. Children with SAM cannot tolerate usual amounts of protein and sodium at this stage (during stabilisation), or high amounts of fat. They may die if given too much protein or sodium. They also need glucose, so they must be given a diet that is low in protein and sodium and high in carbohydrate. F-75 is specially made to meet the child's needs without overwhelming the body's systems in the initial stage of treatment. Use of F-75 prevents deaths. **F-75 contains 75 kcal and 0.9 g protein per 100 ml.**

As soon as the child is stabilised on F-75, F-100 or RUTF are used as a 'catch-up' formula to rebuild wasted tissues. **F-100 contains more calories and protein: 100 kcal and 2.9 g protein per 100 ml.** RUTF is similar in composition to F-100. The only difference is that RUTF has iron added to it.

The compositions of F-75, F-100 and RUTF are described in **Annex B**. Several recipes for preparing F-75 and F-100 locally are given in Table 4 on the following page. The choice of recipe may depend on the availability of ingredients, particularly the type of milk, and the availability of cooking facilities.

The principle behind the recipes is to provide the energy and protein needed for stabilisation and catch-up. For stabilisation (F-75), it is important to provide a formula with the energy and protein as shown (no less and no more). For catch-up (F-100), the recipes show the minimum energy and protein contents needed.

The first three recipes given for F-75 include cereal flour and require cooking. The second part of the table shows recipes for F-75 that can be used if there is no cereal flour or no cooking facility. However, the recipes with no cereal flour have a high osmolarity (415 mOsmol/L) and may not be tolerated well by some children with diarrhoea.

The F-100 recipes do not require cooking as they do not contain cereal flour. (RUTF is 'ready to use' and does not require prior preparation.)

More instructions on how to prepare F-75 and F-100 (and administer RUTF) will be given in **Module 4, Feeding**.

It is hoped that one or more of the recipes can be made in your hospital for treatment in Inpatient Care. If your hospital cannot use any of the recipes due to lack of ingredients, seek expert help to modify a recipe using available ingredients.

Table 4. Recipes for F-75 and F-100

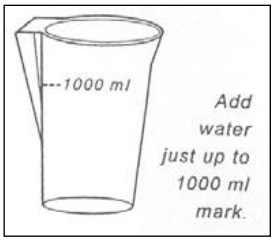
If you have cereal flour and cooking facilities, use one of the top three recipes for F-75:

Alternatives	Ingredients	Amount for F-75
If you have dried skimmed milk	Dried skimmed milk Sugar Cereal flour Vegetable oil Combined mineral and vitamin mix (CMV)* *Water to make 1000 ml*	25 g 70 g 35 g 30 g ½ levelled scoop *1000 ml***
If you have dried whole milk	Dried whole milk Sugar Cereal flour Vegetable oil CMV* *Water to make 1000 ml*	35 g 70 g 35 g 20 g ½ levelled scoop *1000 ml***
If you have fresh cow's milk, or full-cream (whole) long-life milk	Fresh cow's milk, or full-cream (whole) long-life milk Sugar Cereal flour Vegetable oil CMV* *Water to make 1000 ml*	300 ml 70 g 35 g 20 g ½ levelled scoop *1000 ml***

If you do not have cereal flour, or there are no cooking facilities, use one of the following recipes for F-75:		No cooking is required for F-100:
Alternatives	**Ingredients**	**Amount for F-100**
If you have dried skimmed milk	Dried skimmed milk Sugar Vegetable oil CMV* *Water to make 1000 ml*	80 g 50 g 60 g ½ levelled scoop *1000 ml***
If you have dried whole milk	Dried whole milk Sugar Vegetable oil CMV* *Water to make 1000 ml*	110 g 50 g 30 g ½ levelled scoop *1000 ml***
If you have fresh cow's milk, or full-cream (whole) long-life milk	Fresh cow's milk, or full- cream (whole) long-life milk Sugar Vegetable oil CMV* *Water to make 1000 ml*	880 ml 75 g 20 g ½ levelled scoop *1000 ml***

** The contents of the CMV in **Annex B**.*

*** Important note about adding water: Add just the amount of water needed to make 1000 ml of formula. (This amount will vary from recipe to recipe, depending on the other ingredients.) Do not simply add 1000 ml of water, as this will make the formula too dilute. A mark for 1000 ml should be made on the mixing container for the formula, so that water can be added to the other ingredients up to this mark.*



6.2 What Is RUTF?

RUTF is an energy-dense, mineral/vitamin-enriched food that is equivalent to F-100. RUTF is an integral part of Outpatient Care, as it allows children to be treated at home rather than at inpatient treatment centres.

There are currently two forms and several commercial types of RUTF: a lipid-based spread, such as Plumpy'nut®, and a biscuit bar, such as BP 100®. Several countries are producing their own lipid-based RUTF. Their products have similar nutritional quality as F-100 and have been shown to be physiologically similar to commercial forms of F-100 and RUTF.

Plumpy'nut® is a ready-to-eat therapeutic spread presented in individual packets. It is a groundnut paste composed of vegetable fat, peanut butter, skimmed milk powder, lactoserum, maltodextrin, sugar and combined mineral and vitamin mix (CMV).

Instructions for Use

Clean drinking water must be made available to children while they consume ready-to-eat therapeutic spread. The product should be given only to children that can express their thirst.

Recommendations for Use

It is recommended to use the product for the dietetic management of SAM in the transition and rehabilitation phase.

Storage and Packaging

Plumpy'nut® has a shelf life of 24 months from manufacturing date and should be stored in a cool and dry place. It often comes in a 92 g packet that contains 500 kcal. A carton (around 15.1 kg) contains 150 packets.

To learn more, see **Annex B**.

6.3 What Is a Mineral and Vitamin Mix?

A commercial product called CMV is used to provide the necessary minerals and vitamins that is included in each recipe for F-75 and F-100. It is also used in making ReSoMal. The contents of the CMV are listed later in the module. The mix contains potassium, magnesium and other essential minerals.

In case the commercial F-75 or F-100 is not used, CMV **must** be added to the local preparation of F-75 and F-100 to correct the electrolyte and vitamin imbalance.

CMV specifications are provided later in this module. To learn more, see **Annex B**.

SHORT ANSWER EXERCISE

Briefly answer these questions as a review of the previous section:

1. What are two important differences between F-75 and F-100 (and RUTF)?

2. Why is it important to have different formulas (F-75, F-100 and RUTF) for managing SAM?

3. CMV is included in F-75, F-100 and RUTF to correct electrolyte imbalances. What are two important minerals in this mix and why?

4. What is the difference between F-100 and RUTF?

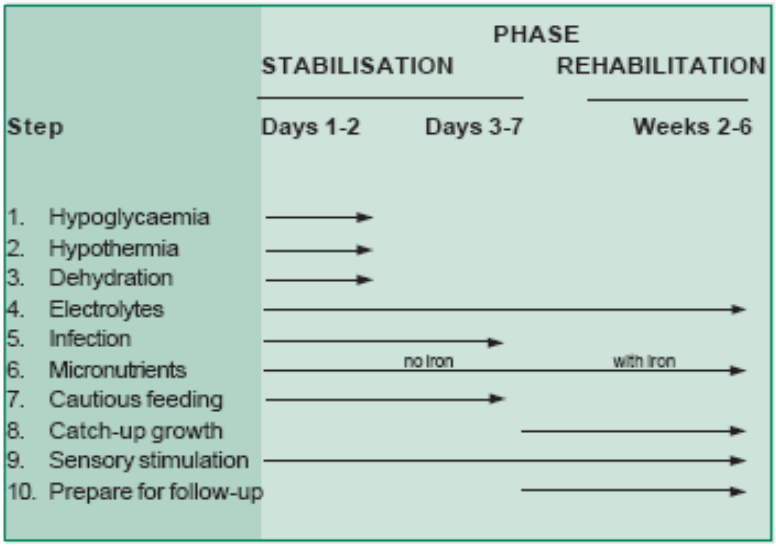
Tell the facilitator when you are ready to discuss these questions with the group.

6.4 Procedure for Successful Management of Children with SAM in Inpatient Care

The following process is essential for successful management of a child with SAM. You will learn how to do these important steps in **Module 3, Initial Management**, **Module 4, Feeding** and **Module 5, Daily Care**. (See also 10 Steps for Inpatient Care Job Aid and Wall Chart).

1. Prevent or treat hypoglycaemia.
2. Prevent or treat hypothermia.
3. Prevent or treat dehydration.
4. Correct electrolyte imbalance.
5. Prevent or treat infections and infestations.
6. Correct micronutrient deficiencies.
7. Start cautious feeding with F-75 to stabilise the child.
8. Increase feeding to recover weight loss, rebuilding wasted tissues through higher protein/calorie feeds with RUTF and/or F-100.
9. Stimulate emotional and sensorial development through loving care and play.
10. Prepare mothers for referral and follow-up in Outpatient Care to continue treatment (or for discharge if full recovery is attained in Inpatient Care).

Figure 2. Overview Treatment of Children with SAM (10 Steps According to the WHO 1999 Protocol for the Management of SAM)



Read pages 40–44 of the CMAM Manual now.

6.5 Important Things NOT to Do and Why

Do not give diuretics to treat oedema. The oedema is due partly to potassium and magnesium deficiencies that may take up to 2 weeks to correct. The oedema will go away with proper feeding that includes potassium and magnesium. Giving a diuretic will worsen the child's electrolyte imbalance and may cause death.

Do not give iron during the initial feeding phase. Add iron only after the child has been on F-100 for 2 days (usually during week 2). As described earlier, giving iron early in treatment can have toxic effects and interfere with the body's ability to resist infection. There is no need to add iron when the child is on RUTF.

Do not give high protein formula (over 1.5 g protein per kg body weight daily). Too much protein in the first days of treatment may be dangerous because the child with SAM is unable to deal with the extra metabolic stress involved. Too much protein could overload the liver, heart and kidneys, and may cause death.

Do not give intravenous (IV) fluids routinely. IV fluids can easily cause fluid overload and heart failure in a child with SAM. Give IV fluids only to children with signs of shock. (Treatment will be described in **Module 3, Initial Management**.)

Be sure that personnel in the emergency treatment area of the hospital know these important things NOT to do, as well as what to do.

SHORT ANSWER EXERCISE

Fill in the blanks based on your reading in the module and the manual:

1. Two conditions that are related and must be treated immediately in a child with SAM are _____ and _____.

2. Cautious feeding with _____ is necessary at first to stabilise the child. Later, _____ or _____ is given to rebuild wasted tissues and gain weight.

3. To correct electrolyte imbalance, it is important to give feeds prepared with a product called _____.

4. If a child with SAM has diarrhoea, a special rehydration solution called _____ should be given. This solution has less _____ and more _____ than regular or low-osmolarity ORS.

Indicate in the blank whether the statement is true or false:

5. _____ Giving iron too early in treatment can have toxic effects.

6. _____ All children with SAM and medical complications should be given antibiotics.

7. _____ Giving IV fluids too quickly can cause heart failure in a child with SAM.

8. _____ Diuretics should be given to reduce oedema.

Check your own answers to this exercise by comparing them to the answers given at the end of this module on page 49.

7.0 Understanding Procedures for Referral and Discharge

7.1 Understanding Criteria for Referral and Discharge in CMAM for Children 6–59 Months

A child is ready for **referral to Outpatient Care** if the following criteria are met:

- Appetite has returned (passed appetite test)
- Medical complication is resolving
- Severe bilateral pitting oedema is decreasing
- Child is clinically well and alert

Note: If the child was admitted due to bilateral pitting oedema and severe wasting, the criterion for referral is bilateral pitting oedema resolved.

In special cases where there is no access to RUTF or when a child remains in Inpatient Care until full recovery, a child is ready for discharge as **cured** from Inpatient Care if the following discharge criteria are met:

- 15% weight gain maintained for 2 consecutive weeks (of the admission weight or weight free of oedema) (to learn more, see the Guidance Table to Identify Target Weight for Discharge from Management of Severe Acute Malnutrition for Children 6–59 Months Job Aid)
- No bilateral pitting oedema for 2 consecutive weeks
- Child is clinically well and alert

It is recommended that the following elements are considered at referral and discharge:

- Health and nutrition education scheme has started (referral) or completed (discharge)
- Eating 75% of RUTF (referral) or appropriate weaning of RUTF or F-100 is reached (discharge)
- Immunisation schedule is updated
- Adequate arrangements for linking the mother and child with the health facility with Outpatient Care (referral) and appropriate community initiatives (e.g., supplementary feeding) (discharge)

Other children that are discharged but did not meet the discharged cured criteria (thus did not recover) are children that:

- **Died** while in treatment
- **Defaulted** or were absent for the third day
- **Did not recover** or did not meet the discharge criteria after 2 months in treatment; during the treatment, these children would have shown signs of non-response to treatment and been referred for medical investigation

Table 5. Criteria for Referral and Discharge in CMAM for Children 6–59 Months

Inpatient Care	Outpatient Care
Referred to Outpatient Care: • Appetite returned (passed appetite test) • Medical complication resolving • Severe bilateral pitting oedema decreasing • Child clinically well and alert (If admitted due to bilateral pitting oedema and severe wasting, additional criterion for referral is bilateral pitting oedema resolved) Discharged cured (special cases who stayed until full recovery): • 15% weight gain maintained for 2 consecutive weeks • Oedema-free for 2 consecutive weeks • Child clinically well and alert	Discharged cured: • 15% weight gain maintained for 2 consecutive weeks (of admission weight or weight free of oedema) • Oedema-free for 2 consecutive weeks • Child clinically well and alert Children are referred to receive supplementary feeding if available

7.2 Referral in Case of Access to Outpatient Care

If Outpatient Care for the management of SAM without medical complications is in place, it is recommended that children be kept in Inpatient Care until their condition is stabilised. It usually requires about 5–10 days for the medical complications to stabilise if medical care and dietary feeding recommendations are followed.

The child should then be referred for Outpatient Care if:

- Appetite has returned
- Medical complications are resolving
- Bilateral pitting oedema is decreasing
- The child is clinically well and alert

If a child leaves before being stabilised, he or she is likely to get worse and have to return, or he or she may die.

7.3 Continued Treatment with RUTF in Outpatient Care

If no Outpatient Care sites for the management of SAM without medical complications are in place in a health facility closer to the child's place of residence, but RUTF is available, it is recommended that the hospital treats the child in its outpatient department and provides support and/or guidance for the mother and the child to reside in the vicinity of the hospital.

7.4 Discharge after Full Recovery

If no Outpatient Care sites for the management of SAM without medical complications are in place in a health facility closer to the child's place of residence, and RUTF is not available, it is recommended that a child be kept in Inpatient Care until full recovery, i.e., reaching the discharge criteria: 15% weight gain of oedema-free admission weight, for two consecutive weighings, free of oedema for 2 weeks and clinically well and alert.

Full recovery usually takes about 2–6 weeks for a child to achieve the target weight if feeding recommendations are followed. It may be difficult to keep children for this long, but the risks of early discharge are great. If a child leaves **before** achieving the discharge criteria, he or she is likely to get worse and have to return.

If early discharge is necessary, many preparations must be made to ensure that the mother can continue care at home. Follow-up visits are essential. There will be a discussion exercise about early discharge situations in ***Module 7, Involving Mothers in Care****.*

Tell the facilitator when you have reached this point in the module. There will be a brief video showing signs of SAM and the transformations that can occur when severely malnourished children are correctly managed. You will also discuss photos 21–29, which show children before and after treatment for SAM. Look at these photos while waiting for the video.

Annex A: Explanation of Z-Scores

What Does a Z-Score Tell Us?

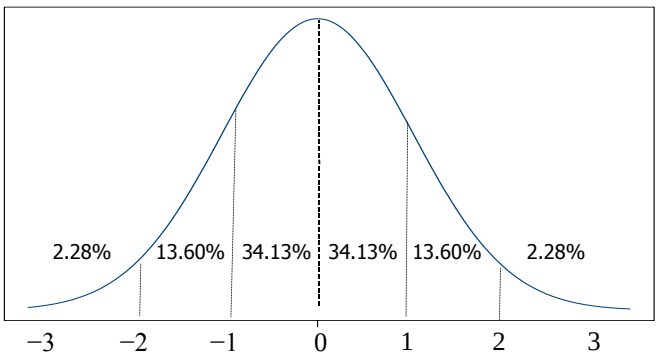
The lines on the growth charts are called z-score lines based on z-scores, also known as standard deviation scores. Z-scores are used to describe how far a measurement is from the median (or average in a normal distribution). For example a WFH z-score of –2.33 means that the child's weight is 2.33 standard deviations below the expected median weight of children of the same height. The child has a lower weight for his/her height compared to the standard and he/she is classified as 'wasted'. A positive z-score indicates that the child's weight is to the right of the median, i.e., the child is heavier compared to the standard.

Z-scores are calculated differently for measurements that are distributed normally and non-normally in the standard population.

Normally Distributed Measurements

The concept of a normal distribution is helpful for understanding what a z-score is. In a normal distribution, most values are grouped around the middle as shown below.

Normal Bell-Shaped Curve Cut into z-score



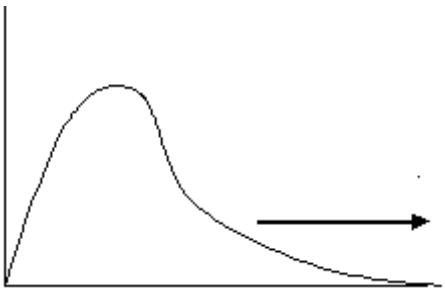
The distribution of heights of all boys (or all girls) of a given age forms a bell-shaped curve, or a normal (or almost normal) distribution. Each segment on the horizontal axis represents one standard deviation or z-score, and the z-scores −1 and 1 are at equal distances in opposite directions from the median. The distance from the median to 1 is half of the distance from the median to 2.

The z-score of an observed point in this distribution is calculated as follows:

$$\text{z-score} = \frac{(\text{observed value}) - (\text{median reference value})}{\text{z-score of the reference population}}$$

Non-Normally Distributed Measurements

Unlike the distribution of height, the distribution of weight has a shape that when graphed looks like a 'deformed' bell whose right side is longer than the left and is described as right-skewed (not normal).



It is more difficult to calculate z-scores for weight-based indicators. Unlike in a normal distribution, distances between adjacent z-scores are not constant.

Calculating the z-score of an observed point involves a series of mathematical calculations that take into account the non-normal distribution of measurements in the standard population. The following formula is used:

$$\text{z-score} = \frac{(\text{observed value} \div \text{M})^{\text{L}} - 1}{\text{L x S}}$$

In this formula, *M*, *L* and *S* are values for the standard population. *M* is the standard median value that estimates the population mean. *L* is the power needed to transform the data to remove skewness (i.e., to normalise the data). *S* is the coefficient of variation (or equivalent).

This formula (sometimes called the LMS formula) is used to calculate z-scores for WFA, WFH and body mass index (BMI)-for-age.

To select children for interventions if they are below specified WFH cut-offs based on WHO standards, the Weight-for-Height/Length Look-Up Table Job Aid should be used.

Annex B: F-75, F-100, RUTF and CMV Specifications

F-75 and F-100 Specifications

Constituent	F-75 Amount in 100 ml	F-100 Amount in 100 ml	F-100-Diluted Amount in 100 ml (approximation)
Energy	75 kcal	100 kcal	74 kcal
Proteins	0.9 g	2.9 g	2.1 g
Lactose	1.3 g	4.2 g	3.1 g
Potassium	3.6 mmol	5.9 mmol	4.1 mmol
Sodium	0.6 mmol	1.9 mmol	1.4 mmol
Magnesium	0.43 mmol	0.73 mmol	0.54 mmol
Zinc	2.0 mg	2.3 mg	1.7 mg
Copper	0.25 mg	0.25 mg	0.1 mg
% of energy from protein	5%	12%	12%
% of energy from fat	32%	53%	53%
Osmolarity	333 mOsmol/L	419 mOsmol/L	310 mOsmol/L

RUTF Specification

Ready-to-use therapeutic food (RUTF) is an integral part of outpatient programmes, as it allows children to be treated at home rather than at inpatient treatment centres. RUTF is an energy-dense, mineral-/vitamin-enriched food, which is equivalent to F-100 therapeutic milk.

There are several commercial types of RUTF, e.g., Plumpy'nut® and BP 100®. Several countries are producing their own RUTF using recipes that are adapted to locally available ingredients, and those products have nutritional quality similar to F-100. They have also been shown to be physiologically similar to both commercial forms of F-100 and RUTF.

Mean Nutrition Value of Plumpy'nut®

Nutrients	For 100 g	Per packet of 92 g	Nutrients	For 100 g	Per packet of 92 g
Energy	545 kcal	500 kcal	Vitamin A	910 µg	840 µg
Proteins	13.6 g	12.5 g	Vitamin D	16 µg	15 µg
Lipids	35.7 g	32.86 g	Vitamin E	20 mg	18.4 mg
Calcium	300 mg	276 mg	Vitamin C	53 mg	49 mg
Phosphorus	300 mg	276 mg	Vitamin B1	0.6 mg	0.55 mg
Potassium	1,111 mg	1,022 mg	Vitamin B2	1.8 mg	1.66 mg
Magnesium	92 mg	84.6 mg	Vitamin B6	0.6 mg	0.55 mg
Zinc	14 mg	12.9 mg	Vitamin B12	1.8 µg	1.7 µg
Copper	1.8 mg	1.6 mg	Vitamin K	21 µg	19.3 µg
Iron	11.5 mg	10.6 mg	Biotin	65 µg	60 µg
Iodine	100 µg	92 µg	Folic acid	210 µg	193 µg
Selenium	30 µg	27.6 µg	Pantothenic acid	3.1 mg	2.85 mg
Sodium	< 290 mg	< 267 mg	Niacin	5.3 mg	4.88 mg

RUTF is suitable for the treatment of severely malnourished children. RUTF should be soft or crushable, palatable and easy for young children to eat without any preparation. At least half of the proteins contained in the product should come from milk products.

Nutrition Composition of RUTF

Moisture content	2.5% maximum
Energy	520–550 kcal/100 g
Proteins	10%–12% total energy
Lipids	45%–60% total energy
Sodium	290 mg/100 g maximum
Potassium	1100–1400 mg/100 g
Calcium	300–600 mg/100 g
Phosphorus (excluding phytate)	300–600 mg/100 g
Magnesium	80–140 mg/100 g
Iron	10–14 mg/100 g
Zinc	11–14 mg/100 g
Copper	1.4–1.8 mg/100 g
Selenium	20–40 µg
Iodine	70–140 µg/100 g
Vitamin A	0.8–1.1 mg/100 g
Vitamin D	15–20 µg/100 g
Vitamin E	20 mg/100 g minimum
Vitamin K	15–30 µg/100 g
Vitamin B1	0.5 mg/100 g minimum
Vitamin B2	1.6 mg/100 g minimum
Vitamin C	50 mg/100 g minimum
Vitamin B6	0.6 mg/100 g minimum
Vitamin B12	1.6 µg/100 g minimum
Folic acid	200 mcg/100 g minimum
Niacin	5 mg/100 g minimum
Pantothenic acid	3 mg/100 g minimum
Biotin	60 µg/100 g minimum
n-6 fatty acids	3%–10% of total energy
n-3 fatty acids	0.3%–2.5% of total energy

Note: Iron is already added to RUTF, but not to F-100.

CMV Composition

Nutritional Value of Commercial CMV (per 6.35 g or 1 levelled scoop)

Vitamins	Minerals
Biotin: 0.2 mg	Vitamin D: 60 µg
Folic acid: 700 µg	Vitamin E: 44 mg
Niacin: 20 mg	Vitamin K: 80 µg
Pantothenic acid: 6 mg	
	Copper: 5.7 mg
Vitamin A: 3,000 µg	Iodine: 154 µg
Vitamin B1: 1.4 mg	Iron: 0 mg
Vitamin B12: 2 µg	Magnesium: 146 mg
Vitamin B2: 4 mg	Potassium: 2340 mg
Vitamin B6: 1.4 mg	Selenium: 94 µg
Vitamin C: 200 mg	Zinc: 40 mg

Answers to Exercises

Possible Answers to Exercise A, page 8

Photo 1: Moderate oedema (++) seen in feet and lower legs.
Severe wasting of upper arms. Ribs and collar bones clearly show.

Photo 2: Severe dermatosis (+++). Note fissure on lower thigh.
Moderate oedema (++) at least. Feet, legs, hands and lower arms appear swollen. The child's face is not fully shown in the photo, but the eyes may also be puffy, in which case the oedema would be severe (+++).

Photos 3–4: These show the front and back of the same child. The child has severe wasting. From the front, the ribs show, and there is loose skin on the arms and thighs. The bones of the face clearly show. From the back, the ribs and spine show; folds of skin on the buttocks and thighs look like 'baggy pants'.

Photo 5: Generalised oedema (+++). Feet, legs, hands, arms and face appear swollen. Probably moderate dermatosis (++). Several patches are visible, but you would have to undress the child to see if there are more patches or any fissures. There may be a fissure on the child's ankle, but it is difficult to tell.

Photo 6: Severe wasting. The child looks like 'skin and bones'. Ribs clearly show. The child's upper arms are extremely thin with loose skin. *(Also note the sunken eyes, a possible sign of dehydration, which will be discussed later.)* There is some discolouration on the abdomen, which may be mild dermatosis; it is difficult to tell from the photo.

Photo 7: Mild dermatosis (+). This child has skin discolouration, often an early skin change in malnutrition. There is some wasting of the upper arms, and the shoulder blades show, but wasting does not appear severe.

Photo 8: Pus, a sign of eye infection.

Photo 9: Corneal clouding, a sign of vitamin A deficiency.

Photo 10: Bitot's spot, a sign of vitamin A deficiency.
Inflammation (redness), a sign of infection.

Photo 11: Corneal clouding, a sign of vitamin A deficiency. The irregularity in the surface suggests that this eye almost has an ulcer.

Photo 12: Corneal ulcer (indicated by arrow), emergency sign of vitamin A deficiency. If not treated immediately with vitamin A and atropine, the lens of the eye may push out and cause blindness. This photo also shows inflammation, a sign of infection.

Photo 13: Since only the legs are visible, we cannot tell the extent of oedema. Both feet and legs are swollen, so it is at least ++. Notice the 'pitting' oedema in lower legs.

Photo 14: Moderate (++) dermatosis. Note patches on hands and thigh. You would have to undress the child to see how extensive the dermatosis is.
Generalised oedema (+++). Legs, hands, arms and face appear swollen.

Photo 15: Severe (+++) dermatosis and wasting (upper arms). Moderate (++) oedema (both feet), lower legs, possibly hands.

Additional photos discussed in relation to eye signs:

Photo 16 Shows a photophobic child; his eyes cannot tolerate light due to vitamin A deficiency. The child's eyes must be opened gently for examination. He is likely to have corneal clouding as in Photo 9.

For contrast, Photo 17 shows a baby with healthy, clear eyes.

Answers to Exercise B, page 20

1. Shana: < −3 z-score

2. Rico: < −3 z-score

3. Tonya: < −3 z-score

4. a. Kareem: = −3 z-score
   b. Kareem: < −3 z-score
   c. Kareem: = −3 z-score

Answers to Exercise C, page 23

Photo 18: This child should be classified as having SAM. Her MUAC is more than 115 mm and her weight-for-length is more than −3 z-score, but she has oedema of both feet, as well as the lower legs (at least moderate ++ oedema). If the child has appetite and no medical complications, she is admitted to Outpatient Care. If the child has no appetite or medical complications, then she is admitted to Inpatient Care.

Photo 19: This child should be classified as having SAM. Her weight-for length is less than −3 z-score and MUAC is less than 115 mm. The child has no apparent oedema. After testing the appetite and checking for signs of medical complications, it will be decided if the child will be admitted to Inpatient Care or Outpatient Care.

Photo 20: This child should be classified as having SAM. He has a MUAC less than 115 mm and WFH less than −3 z-score. The child has no apparent oedema. Point out that if the child has a good appetite and no medical complications, he should be treated in Outpatient Care. If there is poor appetite or if there are medical complications, he should be treated in Inpatient Care. It would be

important to remove his shirt to examine him. Notice that the mother in this photo is also extremely thin.

Answers to Short Exercise, page 26

1. When a child has SAM, why is it important to begin feeding slowly and cautiously?

   Because the systems slow down ('reductive adaptation'), the body's systems must gradually 'learn' to function fully again. Rapid changes (such as rapid feeding or fluids) would overwhelm the systems, so feeding must be conducted slowly and cautiously.

2. Why should all children with SAM be given antibiotics?

   Because nearly all children with SAM have bacterial infections. In addition, as a result of reductive adaptation, the usual signs of infection may not be apparent, because the body does not use its limited energy to respond in the usual ways, such as inflammation or fever. So, assume that infection is present and treat all children with SAM with broad spectrum antibiotics.

3. Why is it dangerous to give iron early in treatment?

   Giving iron early in treatment will not cure anaemia, as the child already has a supply of stored iron, and giving iron early in treatment can also lead to 'free iron' in the body. Free iron can cause problems: promoting the formation of free radicals, promoting bacterial growth and causing some infections to get worse. In addition, the body tries to protect itself from free iron by converting it to ferritin, and this conversion requires energy and amino acids and diverts these from other critical activities.

4. Why is ReSoMal preferable to regular or low-osmolarity ORS for children with SAM who have severe and/or persistent diarrhoea and/or dehydration?

   ReSoMal has less sodium and more potassium than regular or low-osmolarity ORS and children with SAM already have excess sodium in their cells, so sodium intake should be restricted.

Answers to Short Exercise, page 30

1. What are two important differences between F-75 and F-100 (and RUTF)?

   F-75 contains fewer calories than F-100 (and RUTF): 75 kcal per 100 ml instead of 100 kcal per 100 ml.

   F-75 contains less protein than F-100 (and RUTF): 0.9 g per 100 ml instead of 2.9 g per 100 ml.

2. Why is it important to have different formulas (F-75, F-100 and RUTF) for managing SAM?

   Children with SAM cannot tolerate usual amounts of protein and sodium, or high amounts of fat. F-75 is needed as a 'starter' formula so that the body will not be overwhelmed in the initial stage of treatment. When the child is stabilised, he or she can tolerate more protein and fat. F-100 or RUTF is then used to 'catch up' and rebuild wasted tissues.

3. CMV is included in F-75, F-100 and RUTF to correct electrolyte imbalance. What are two important minerals in this mix and why?

   Potassium and magnesium. These are needed to correct electrolyte imbalance in the cells. More potassium is needed in the cells, and magnesium is essential for potassium to enter the cells and be retained.

4. What is the difference between F-100 and RUTF?

   RUTF is an energy- and nutrient-dense ready-to-use food that has the same specifications as F-100, with iron added to it.

Answers to Short Exercise, page 33

Fill in the blanks:

1. Two conditions that are related and must be treated immediately in a child with SAM are hypoglycaemia and hypothermia.

2. Cautious feeding with F-75 is necessary at first to stabilise the child. Later, F-100 or RUTF is given to rebuild wasted tissues and gain weight.

3. To correct electrolyte imbalance, it is important to give feeds prepared with a product called combined mineral vitamin mix (CMV).

4. If a child with SAM has diarrhoea, a special rehydration solution called ReSoMal should be given. This solution has less sodium and more potassium than regular or low-osmolarity ORS.

   Note: ReSoMal also has more sugar than regular or low-osmolarity ORS.

5. True

6. True

7. True

8. False Diuretics should never be given to reduce oedema. With correct feeding, the oedema will eventually go away.