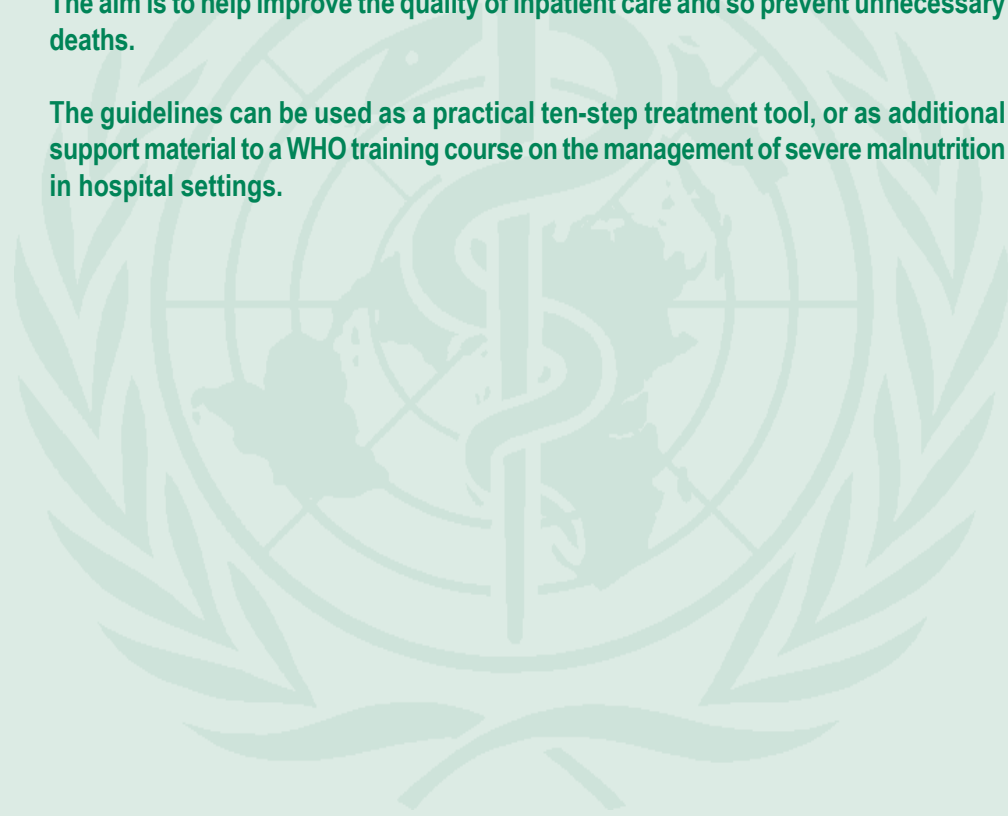
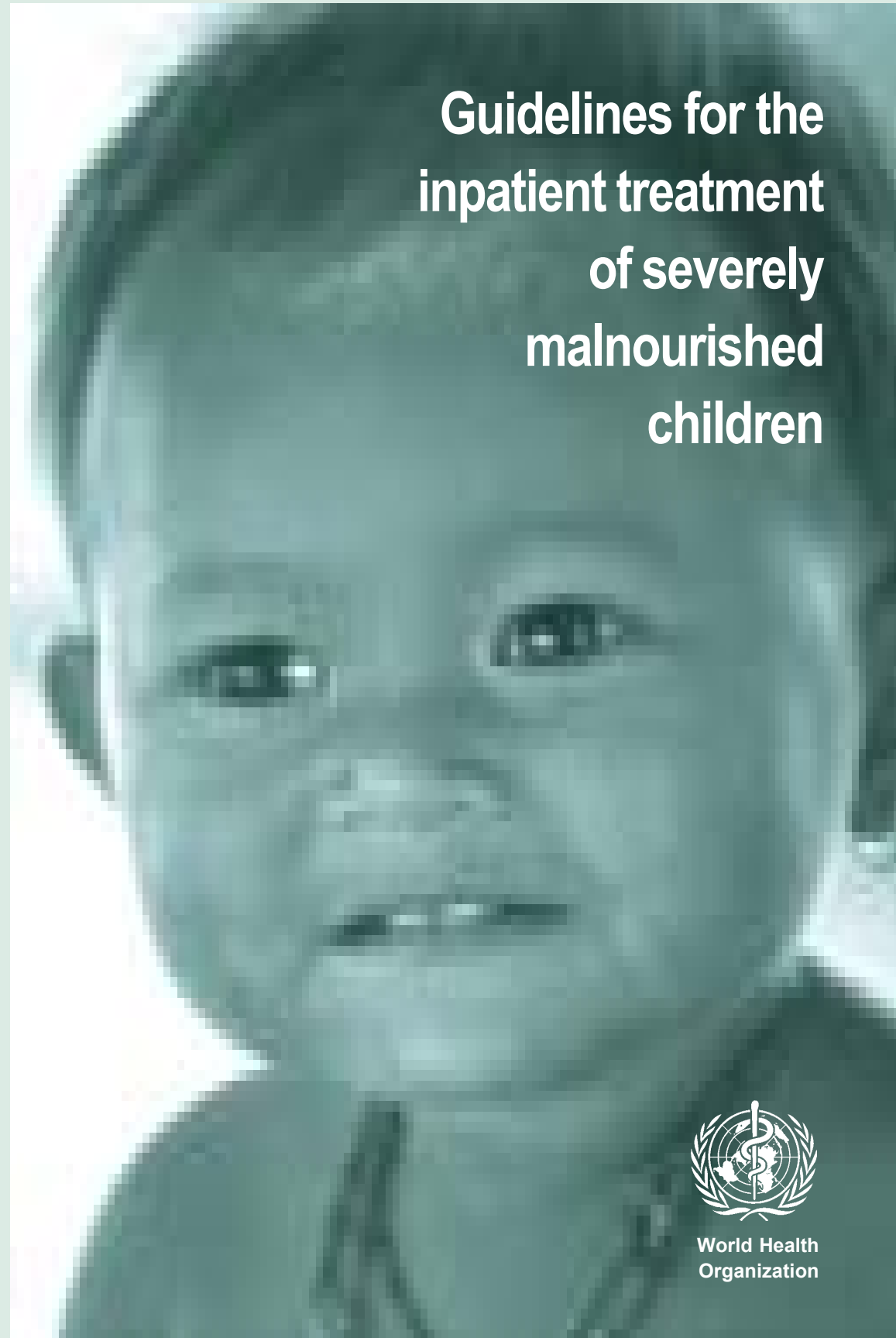


Severely malnourished children need special care. This book provides simple, practical guidelines for treating these children successfully and takes into account the limited resources of many hospitals and health units in developing countries. It is intended for doctors, nurses, dietitians and other health workers with responsibility for the medical and dietary management of severely malnourished children, and for their trainers and supervisors. The guidelines are authoritative and hospitals using them report substantial reductions in mortality. For example, mortality rates of 30-50% have fallen to 5-15%. The instructions are clear, concise, and easy to follow and the information is consistent with other WHO publications. The aim is to help improve the quality of inpatient care and so prevent unnecessary deaths.

The guidelines can be used as a practical ten-step treatment tool, or as additional support material to a WHO training course on the management of severe malnutrition in hospital settings.



Guidelines for the inpatient treatment of severely malnourished children



World Health
Organization

Guidelines for the inpatient treatment of severely malnourished children

Authors¹

Ann Ashworth
Sultana Khanum
Alan Jackson
Claire Schofield



World Health Organization

¹Dr Sultana Khanum, former Regional Adviser, Nutrition for Health and Development, WHO South-East Asia Regional Office
Professor Ann Ashworth & Ms Claire Schofield, London School of Hygiene and Tropical Medicine
Professor Alan Jackson, University of Southampton

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Preface

Poor nutrition severely hinders personal, social and national development. The problem is more obvious among the poor and disadvantaged. The ultimate consequence is millions of severely malnourished children throughout the world. In developing countries an estimated 50.6 million children under the age of five are malnourished. Some are severely malnourished and are admitted to hospital but regrettably the death rate during treatment is as high as 30-50% in some hospitals. With appropriate treatment, as described in these guidelines, this unacceptably high death rate can be reduced to less than 5%. The evidence base for effective prevention and treatment is incontrovertible, but it is not put into practice.

Data from 67 studies worldwide show that the median case fatality rate has not changed for the past five decades, and that one in four severely malnourished children died during treatment in the 1990s. In any decade, however, some centres obtained good results with fewer than 5% dying, whereas others fared poorly with a mortality rate of approximately 50%. This disparity is not due to differences in the prevalence of severe cases of malnutrition, but it is rather the result of poor treatment practices. Where mortality is low a set of basic principles has been followed. High case fatality rates and poor rates of weight gain result from a failure to appreciate that treatment has to be carried out in stages and that the order in which problems are addressed is fundamental to effective care:

- firstly, severe malnutrition represents a medical emergency with an urgent need to correct hypothermia, hypoglycaemia and silent infection;
- secondly, there is an impairment of the cellular machinery. Tissue function cannot be restored unless the machinery is repaired, which includes remedying multiple specific deficiencies. These may not be visible, and often are the consequence of multiple silent infections;
- thirdly, tissue deficits and abnormal body composition are obvious, but cannot be safely corrected until the cellular machinery has been adequately repaired. Rehydration with intravenous fluids can increase mortality, as can manipulation of abnormal blood chemistry. Aggressive attempts to promote rapid weight gain from the start of treatment is also dangerous. Many prescribe a high protein diet for children with kwashiorkor, but this can be fatal. Many prescribe diuretics to get rid of oedema. This procedure can be fatal. Prescribing iron to treat anaemia increases deaths in the initial phase of treatment.

Substantial reductions in mortality rates have been achieved by modifying treatment to take account of the physiological and metabolic changes occurring in severe malnutrition. In the International Centre for Diarrhoeal Disease Research, Bangladesh, after the introduction of a standardized protocol, based on the WHO guidelines, case fatality rate decreased to 9% and subsequently to 3.9% from an earlier 17%. In South Africa, the mortality rate decreased from 30-40% to less than 15%. Emergency relief organizations successfully use the guidelines to treat severe malnutrition in tents. The treatment guidelines described here are therefore applicable not only in hospitals but also in therapeutic feeding centres in emergency situations, and in nutrition rehabilitation centres after initial treatment in hospital.

Sultana Khanum

*Department of Nutrition for Health and Development
World Health Organization*



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Introduction

Every year some 10.6 million children die before they reach their fifth birthday. Seven out of every 10 of these deaths are due to diarrhoea, pneumonia, measles, malaria or malnutrition. The WHO manual *Management of Severe Malnutrition: a manual for physicians and other senior health workers* and the following companion guidelines have been developed to improve inpatient treatment of severe malnutrition. The WHO/UNICEF strategy of Integrated Management of Childhood Illness (IMCI) also aims to reduce these deaths by improving treatment.

Special guidelines are needed because of the profound physiological and metabolic changes that take place when children become malnourished. These changes affect every cell, organ and system. The process of change is called reductive adaptation. Malnourished children do not respond to medical treatment in the same way as if they were well nourished. Malnourished children are much more likely to die, with or without complications, than their well nourished counterparts. With appropriate case management in hospital and follow-up care, the lives of many children can be saved.

The following guidelines set out simple, specific instructions for the treatment of severely malnourished children. The aim is to provide practical help for those responsible for the medical and dietary management of such children. Lack of appropriate care leads to diarrhoea, poor appetite, slow recovery and high mortality. These problems can be overcome if certain basic principles are followed.

Severe malnutrition is defined in these guidelines as the presence of severe wasting (<70% weight-for-height or <-3SD) and/or oedema on both feet. (Appendix 1 provides a weight-for-height reference table.)

The guidelines are divided in five sections:

- A. General principles for routine care (the '10 steps')
- B. Emergency treatment of shock and severe anaemia
- C. Treatment of associated conditions
- D. Failure to respond to treatment
- E. Discharge before recovery is complete

A. GENERAL PRINCIPLES FOR ROUTINE CARE (the '10 Steps')²

There are ten essential steps:

1. Treat/prevent hypoglycaemia
2. Treat/prevent hypothermia
3. Treat/prevent dehydration
4. Correct electrolyte imbalance
5. Treat/prevent infection
6. Correct micronutrient deficiencies
7. Start cautious feeding
8. Achieve catch-up growth
9. Provide sensory stimulation and emotional support
10. Prepare for follow-up after recovery

These steps are accomplished in two phases: an initial **stabilisation phase** where the acute medical conditions are managed; and a longer **rehabilitation phase**. Note that treatment procedures are similar for marasmus and kwashiorkor. The approximate time-scale is given in the box below:

Step	PHASE		
	STABILISATION	REHABILITATION	
	Days 1-2	Days 3-7	Weeks 2-6
1. Hypoglycaemia	→		
2. Hypothermia	→		
3. Dehydration	→		
4. Electrolytes	→		
5. Infection	→		
6. Micronutrients	no iron		with iron
7. Cautious feeding	→		
8. Catch-up growth		→	
9. Sensory stimulation	→		
10. Prepare for follow-up		→	

²Ashworth A, Jackson A, Khanum S, Schofield C. Ten steps to recovery: Child health dialogue, issue 3 and 4, 1996

Step 1. Treat/prevent hypoglycaemia

Hypoglycaemia and hypothermia usually occur together and are signs of infection. Check for hypoglycaemia whenever hypothermia (axillary < 35.0°C; rectal < 35.5°C) is found. Frequent feeding is important in preventing both conditions.

Treatment:

If the child is conscious and dextrostix shows < 3 mmol/l or 54 mg/dl give:

- 50 ml bolus of 10% glucose or 10% sucrose solution (1 rounded teaspoon of sugar in 3.5 tablespoons water), orally or by nasogastric (NG) tube. Then feed starter F-75 (see step 7) every 30 min. for two hours (giving one quarter of the two-hourly feed each time)
- antibiotics (see step 5)
- two-hourly feeds, day and night (see step 7)

If the child is unconscious, lethargic or convulsing give:

- IV sterile 10% glucose (5ml/kg), followed by 50ml of 10% glucose or sucrose by Ng tube. Then give starter F-75 as above
- antibiotics
- two-hourly feeds, day and night

Monitor:

- blood glucose: if this was low, repeat dextrostix taking blood from finger or heel, after two hours. Once treated, most children stabilise within 30 min. If blood glucose falls to < 3 mmol/l give a further 50ml bolus of 10% glucose or sucrose solution, and continue feeding every 30 min. until stable
- rectal temperature: if this falls to < 35.5°C, repeat dextrostix
- level of consciousness: if this deteriorates, repeat dextrostix

Prevention:

- feed two-hourly, start straightaway (see step 7) or if necessary, rehydrate first
- always give feeds throughout the night

Note: If you are unable to test the blood glucose level, assume all severely malnourished children are hypoglycaemic and treat accordingly.

Step 2. Treat/prevent hypothermia

Treatment:

If the axillary temperature is $<35.0^{\circ}\text{C}$, take the rectal temperature using a low reading thermometer.

If the rectal temperature is $<35.5^{\circ}\text{C}$ ($<95.9^{\circ}\text{F}$):

- feed straightaway (or start rehydration if needed)
- rewarm the child: either clothe the child (including head), cover with a warmed blanket and place a heater or lamp nearby (do not use a hot water bottle), or put the child on the mother's bare chest (skin to skin) and cover them
- give antibiotics (see step 5)

Monitor:

- body temperature: during rewarming take rectal temperature two-hourly until it rises to $>36.5^{\circ}\text{C}$ (take half-hourly if heater is used)
- ensure the child is covered at all times, especially at night
- feel for warmth
- blood glucose level: check for hypoglycaemia whenever hypothermia is found

(Appendix 2 provides an example of a chart for recording temperature, pulse and respiratory rates).

Prevention:

- feed two-hourly, start straightaway (see step 7)
- always give feeds throughout the day and night
- keep covered and away from draughts
- keep the child dry, change wet nappies, clothes and bedding
- avoid exposure (e.g. bathing, prolonged medical examinations)
- let child sleep with mother/carer at night for warmth

Note: If a low reading thermometer is unavailable and the child's temperature is too low to register on an ordinary thermometer, assume the child has hypothermia.

Step 3. Treat/prevent dehydration

Note: Low blood volume can coexist with oedema. Do not use the IV route for rehydration except in cases of shock and then do so with care, infusing slowly to avoid flooding the circulation and overloading the heart (see Section B: Emergency treatment).

Treatment:

The standard oral rehydration salts solution (90 mmol sodium/l) contains too much sodium and too little potassium for severely malnourished children. Instead give special **Rehydration Solution for Malnutrition (ReSoMal)**. (For recipe see Appendix 3).

It is difficult to estimate dehydration status in a severely malnourished child using clinical signs alone. So assume all children with watery diarrhoea may have dehydration and give:

- ReSoMal 5 ml/kg every 30 min. for two hours, orally or by nasogastric tube, then
- 5-10 ml/kg/h for next 4-10 hours: the exact amount to be given should be determined by how much the child wants, and stool loss and vomiting. Replace the ReSoMal doses at 4, 6, 8 and 10 hours with F-75 if rehydration is continuing at these times, then
- continue feeding starter F-75 (see step 7)

During treatment, rapid respiration and pulse rates should slow down and the child should begin to pass urine.

Monitor progress of rehydration:

Observe half-hourly for two hours, then hourly for the next 6-12 hours, recording:

- pulse rate
- respiratory rate
- urine frequency
- stool/vomit frequency

Return of tears, moist mouth, eyes and fontanelle appearing less sunken, and improved skin turgor, are also signs that rehydration is proceeding. It

should be noted that many severely malnourished children will not show these changes even when fully rehydrated.

Continuing rapid breathing and pulse during rehydration suggest coexisting infection or overhydration. Signs of excess fluid (overhydration) are increasing respiratory rate and pulse rate, increasing oedema and puffy eyelids. If these signs occur, stop fluids immediately and reassess after one hour.

Prevention:

To prevent dehydration when a child has continuing watery diarrhoea:

- keep feeding with starter F-75 (see step 7)
- replace approximate volume of stool losses with ReSoMal. As a guide give 50-100 ml after each watery stool. (Note: it is common for malnourished children to pass many small unformed stools: these should not be confused with profuse watery stools and do not require fluid replacement)
- if the child is breastfed, encourage to continue

Step 4. Correct electrolyte imbalance

All severely malnourished children have excess body sodium even though plasma sodium may be low (giving high sodium loads will kill). Deficiencies of potassium and magnesium are also present and may take at least two weeks to correct. Oedema is partly due to these imbalances. Do NOT treat oedema with a diuretic.

Give:

- extra potassium 3-4 mmol/kg/d
- extra magnesium 0.4-0.6 mmol/kg/d
- when rehydrating, give low sodium rehydration fluid (e.g. ReSoMal)
- prepare food without salt

The extra potassium and magnesium can be prepared in a liquid form and added directly to feeds during preparation. Appendix 3 provides a recipe for a combined electrolyte/mineral solution. Adding 20 ml of this solution to 1 litre of feed will supply the extra potassium and magnesium required. The solution can also be added to ReSoMal.

Step 5. Treat/prevent infection

In severe malnutrition the usual signs of infection, such as fever, are often absent, and infections are often hidden.

Therefore **give routinely** on admission:

- broad-spectrum antibiotic(s) **AND**
- measles vaccine if child is > 6m and not immunised (delay if the child is in shock)

Note: Some experts routinely give, **in addition** to broad-spectrum antibiotics, metronidazole (7.5 mg/kg 8-hourly for 7 days) to hasten repair of the intestinal mucosa and reduce the risk of oxidative damage and systemic infection arising from the overgrowth of anaerobic bacteria in the small intestine.

Choice of broad-spectrum antibiotics: (see Appendix 4 for antibiotic dosage):

- a) if the child appears to have **no complications** give:
- Co-trimoxazole 5 ml paediatric suspension orally twice daily for 5 days (2.5 ml if weight <6 kg). (5 ml is equivalent to 40 mg TMP+200 mg SMX).

OR

- b) if the child is **severely ill** (apathetic, lethargic) or **has complications** (hypoglycaemia; hypothermia; broken skin; respiratory tract or urinary tract infection) give:
- Ampicillin 50 mg/kg IM/IV 6-hourly for 2 days, then oral amoxicillin 15 mg/kg 8-hourly for 5 days, or if amoxicillin is not available, continue with ampicillin but give orally 50 mg/kg 6-hourly

AND

- Gentamicin 7.5 mg/kg IM/IV once daily for 7 days

If the child **fails to improve clinically within 48 hours**, ADD:

- Chloramphenicol 25 mg/kg IM/IV 8-hourly for 5 days

Where **specific infections are** identified, ADD:

- specific antibiotics if appropriate
- antimalarial treatment if the child has a positive blood film for malaria parasites.

If anorexia persists after 5 days of antibiotic treatment, complete a full 10-day course. If anorexia still persists, reassess the child fully, checking for sites of infection and potentially resistant organisms, and ensure that vitamin and mineral supplements have been correctly given.

Step 6. Correct micronutrient deficiencies

All severely malnourished children have vitamin and mineral deficiencies. Although anaemia is common, do **NOT** give iron initially but wait until the child has a good appetite and starts gaining weight (usually by the second week), as giving iron can make infections worse.

Give:

- Vitamin A orally on Day 1 (for age >12 months, give 200,000 IU; for age 6-12 months, give 100,000 IU; for age 0-5 months, give 50,000 IU) unless there is definite evidence that a dose has been given in the last month

Give daily for at least 2 weeks:

- Multivitamin supplement
- Folic acid 1 mg/d (give 5 mg on Day 1)
- Zinc 2 mg/kg/d
- Copper 0.3 mg/kg/d
- Iron 3 mg/kg/d but only when gaining weight

Appendix 3 provides a recipe for a combined electrolyte/mineral solution. Adding 20 ml of this solution to 1 litre of feed will supply the zinc and copper needed, as well as potassium and magnesium. This solution can also be added to ReSoMal.

Note: A combined electrolyte/mineral/vitamin mix for severe malnutrition is available commercially. This can replace the electrolyte/mineral solution and multivitamin and folic acid supplements mentioned in steps 4 and 6, but still give the large single dose of vitamin A and folic acid on Day 1, and iron daily after weight gain has started.

Step 7. Start cautious feeding

In the **stabilisation phase** a cautious approach is required because of the child's fragile physiological state and reduced homeostatic capacity. Feeding should be started as soon as possible after admission and should be designed to provide just sufficient energy and protein to maintain basic physiological processes. The essential features of feeding in the stabilisation phase are:

- small, frequent feeds of low osmolarity and low lactose
- oral or nasogastric (NG) feeds (never parenteral preparations)
- 100 kcal/kg/d
- 1-1.5 g protein/kg/d
- 130 ml/kg/d of fluid (100 ml/kg/d if the child has severe oedema)
- if the child is breastfed, encourage to continue breastfeeding but give the prescribed amounts of starter formula to make sure the child's needs are met.

The suggested starter formula and feeding schedules (see below) are designed to meet these targets.

Milk-based formulas such as starter F-75 containing 75 kcal/100 ml and 0.9 g protein/100 ml will be satisfactory for most children (see Appendix 5 for recipes). Give from a cup. Very weak children may be fed by spoon, dropper or syringe.

A recommended schedule in which volume is gradually increased, and feeding frequency gradually decreased is:

Days	Frequency	Vol/kg/feed	Vol/kg/d
1-2	2-hourly	11 ml	130 ml
3-5	3-hourly	16 ml	130 ml
6-7+	4-hourly	22 ml	130 ml

For children with a good appetite and no oedema, this schedule can be completed in 2-3 days (e.g. 24 hours at each level). Appendix 6 shows the volume/feed already calculated according to body weight. Appendix 7 gives the feed volumes for children with severe oedema. Use the Day 1 weight to calculate how much to give, even if the child loses or gains weight in this phase.

If, after allowing for any vomiting, intake does not reach 80 kcal/kg/d (105 ml starter formula/kg) despite frequent feeds, coaxing and re-offering, give the remaining feed by NG tube (see Appendices 6 and 7 (Column 6) for intake volumes below which NG feeding should be given). Do not exceed 100 kcal/kg/d in this phase.

Monitor and note:

- amounts offered and left over
- vomiting
- frequency of watery stool
- daily body weight

During the stabilisation phase, diarrhoea should gradually diminish and oedematous children should lose weight. If diarrhoea continues unchecked despite cautious refeeding, or worsens substantially, see section C4 (continuing diarrhoea).

Step 8. Achieve catch-up growth

In the rehabilitation phase a vigorous approach to feeding is required to achieve very high intakes and rapid weight gain of >10 g gain/kg/d. The recommended milk-based F-100 contains 100 kcal and 2.9 g protein/100 ml (see Appendix 5 for recipes). Modified porridges or modified family foods can be used provided they have comparable energy and protein concentrations.

Readiness to enter the rehabilitation phase is signalled by a return of appetite, usually about one week after admission. A gradual transition is recommended to avoid the risk of heart failure which can occur if children suddenly consume huge amounts.

To change from starter to catch-up formula:

- replace starter F-75 with the same amount of catch-up formula F-100 for 48 hours then,
- increase each successive feed by 10 ml until some feed remains uneaten. The point when some remains unconsumed is likely to occur when intakes reach about 30 ml/kg/feed (200 ml/kg/d).

Monitor during the transition for signs of heart failure:

- respiratory rate
- pulse rate

If respirations increase by 5 or more breaths/min and pulse by 25 or more beats/min for two successive 4-hourly readings, reduce the volume per feed (give 4-hourly F-100 at 16 ml/kg/feed for 24 hours, then 19 ml/kg/feed for 24 hours, then 22 ml/kg/feed for 48 hours, then increase each feed by 10 ml as above).

After the transition give:

- frequent feeds (at least 4-hourly) of unlimited amounts of a catch-up formula
- 150-220 kcal/kg/d
- 4-6 g protein/kg/d
- if the child is breastfed, encourage to continue (Note: breast milk does not have sufficient energy and protein to support rapid catch-up growth).

See Appendix 8 for range of volumes for free feeding with F-100.

Monitor progress after the transition by assessing the rate of weight gain:

- weigh child each morning before feeding. Plot weight (Appendix 9 provides example)
- each week calculate and record weight gain as g/kg/d³

If weight gain is:

- poor (<5 g/kg/d), child requires full reassessment (see Section D)
- moderate (5-10 g/kg/d), check whether intake targets are being met, or if infection has been overlooked
- good (>10 g/kg/d), continue to praise staff and mothers

³Calculating weight gain :

The example is for weight gain over 7 days, but the same procedure can be applied to any interval:

* subtract from today's weight (in g) the child's weight 7 days earlier ;

* divide by 7 to determine the average daily weight gain (g/day) ;

* divide by the child's average weight in kg to calculate the weight gain as g/kg/day.

Step 9. Provide sensory stimulation and emotional support

In severe malnutrition there is delayed mental and behavioural development.

Provide:

- tender loving care
- a cheerful, stimulating environment
- structured play therapy 15-30 min/d (Appendix 10 provides examples)
- physical activity as soon as the child is well enough
- maternal involvement when possible (e.g. comforting, feeding, bathing, play)

Step 10. Prepare for follow-up after recovery

A child who is 90% weight-for-length (equivalent to -1SD) can be considered to have recovered. The child is still likely to have a low weight-for-age because of stunting. Good feeding practices and sensory stimulation should be continued at home. Show parent or carer how to:

- feed frequently with energy- and nutrient-dense foods
- give structured play therapy

Advise parent or carer to:

- bring child back for regular follow-up checks
- ensure booster immunizations are given
- ensure vitamin A is given every six months

Appendix 11 provides an example of a Discharge Card.

B. EMERGENCY TREATMENT OF SHOCK AND SEVERE ANAEMIA

1. Shock in severely malnourished children

Shock from dehydration and sepsis are likely to coexist in severely malnourished children. They are difficult to differentiate on clinical signs alone. Children with dehydration will respond to IV fluids. Those with septic shock and no dehydration will not respond. The amount of fluid given is determined by the child's response. Overhydration must be avoided.

To start treatment:

- give oxygen
- give sterile 10% glucose (5 ml/kg) by IV
- give IV fluid at 15 ml/kg over 1 hour. Use Ringer's lactate with 5% dextrose; or half-normal saline with 5% dextrose; or half-strength Darrow's solution with 5% dextrose; or if these are unavailable, Ringer's lactate
- measure and record pulse and respiration rates every 10 minutes
- give antibiotics (see step 5)

If there are signs of improvement (pulse and respiration rates fall):

- repeat IV 15 ml/kg over 1 hour; then
- switch to oral or nasogastric rehydration with ReSoMal, 10 ml/kg/h for up to 10 hours. (Leave IV in place in case required again); Give ReSoMal in alternate hours with starter F-75, then
- continue feeding with starter F-75

If the child fails to improve after the first hour of treatment (15 ml/kg), assume that the child has septic shock. In this case:

- give maintenance IV fluids (4 ml/kg/h) while waiting for blood,
- when blood is available transfuse fresh whole blood at 10 ml/kg *slowly* over 3 hours; then
- begin feeding with starter F-75 (step 7)

If the child gets worse during treatment (breathing increases by 5 breaths or more/min and pulse increases by 25 or more beats/min):

- stop the infusion to prevent the child's condition worsening

2. Severe anaemia in malnourished children

A blood transfusion is required if:

- Hb is less than 4 g/dl
- or if there is respiratory distress and Hb is between 4 and 6 g/dl

Give:

- whole blood 10 ml/kg body weight slowly over 3 hours
- furosemide 1 mg/kg IV at the start of the transfusion

It is particularly important that the volume of 10 ml/kg is not exceeded in severely malnourished children. If the severely anaemic child has signs of cardiac failure, transfuse packed cells (5-7 ml/kg) rather than whole blood.

Monitor for signs of transfusion reactions. If any of the following signs develop during the transfusion, stop the transfusion:

- fever
- itchy rash
- dark red urine
- confusion
- shock

Also monitor the respiratory rate and pulse rate every 15 minutes. If either of them rises, transfuse more slowly. Following the transfusion, if the Hb remains less than 4 g/dl or between 4 and 6 g/dl in a child with continuing respiratory distress, **DO NOT** repeat the transfusion within 4 days. In mild or moderate anaemia, oral iron should be given for two months to replenish iron stores **BUT this should not be started** until the child has begun to gain weight.

C. TREATMENT OF ASSOCIATED CONDITIONS

Treatment of conditions commonly associated with severe malnutrition:

1. Vitamin A deficiency

If the child shows **any eye signs** of deficiency, give orally:

- vitamin A on days 1, 2 and 14 (for age >12 months, give 200,000 IU; for age 6-12 months, give 100,000 IU; for age 0-5 months, give 50,000 IU). If first dose has been given in the referring centre, treat on days 1 and 14 only

If there is **corneal clouding or ulceration**, give additional eye care to prevent extrusion of the lens:

- instil chloramphenicol or tetracycline eye drops (1%) 2-3 hourly as required for 7-10 days in the affected eye
- instil atropine eye drops (1%), 1 drop three times daily for 3-5 days
- cover with eye pads soaked in saline solution and bandage

Note: children with vitamin A deficiency are likely to be photophobic and have closed eyes. It is important to examine the eyes very gently to prevent rupture.

2. Dermatitis

Signs:

- hypo- or hyperpigmentation
- desquamation
- ulceration (spreading over limbs, thighs, genitalia, groin, and behind the ears)
- exudative lesions (resembling severe burns) often with secondary infection, including Candida

Zinc deficiency is usual in affected children and the skin quickly improves with zinc supplementation (see step 6). In addition:

- apply barrier cream (zinc and castor oil ointment, or petroleum jelly or paraffin gauze) to raw areas
- omit nappies so that the perineum can dry

3. Parasitic worms

- give mebendazole 100 mg orally, twice daily for 3 days

4. Continuing diarrhoea

Diarrhoea is a common feature of malnutrition but it should subside during the first week of treatment with cautious feeding. In the rehabilitation phase, loose, poorly formed stools are no cause for concern provided weight gain is satisfactory.

Mucosal damage and **giardiasis** are common causes of continuing diarrhoea. Where possible examine the stools by microscopy. Give:

- metronidazole (7.5 mg/kg 8-hourly for 7 days) if not already given

Lactose intolerance. Only rarely is diarrhoea due to lactose intolerance. Treat only if continuing diarrhoea is preventing general improvement. Starter F-75 is a low-lactose feed. In exceptional cases:

- substitute milk feeds with yoghurt or a lactose-free infant formula
- reintroduce milk feeds gradually in the rehabilitation phase

Osmotic diarrhoea may be suspected if diarrhoea worsens substantially with hyperosmolar starter F-75 and ceases when the sugar content is reduced and osmolarity is <300 mOsmol/l. In these cases:

- use isotonic F-75 or low osmolar cereal-based F-75 (see Appendix 5 for recipe)
- introduce F-100 gradually

5. Tuberculosis (TB)

If TB is strongly suspected (contacts with adult TB patient, poor growth despite good intake, chronic cough, chest infection not responding to antibiotics):

- perform Mantoux test (false negatives are frequent)
- chest X-ray if possible

If test is positive or there is a strong suspicion of TB, treat according to national TB guidelines.

D. FAILURE TO RESPOND TO TREATMENT

Failure to respond is indicated by:

1. High mortality

Case fatality rates vary widely: >20% should be considered unacceptable, 11-20% poor, 5-10% moderate, and <5% good.

If mortality is >5%, determine whether the majority of deaths occur:

- within 24 hours: consider untreated or delayed treatment of hypoglycaemia, hypothermia, septicaemia, severe anaemia or incorrect rehydration fluid or volume
- within 72 hours: check whether the volume of feed is too high or the wrong formulation is used
- at night: consider hypothermia from insufficient covers, no night feeds
- when changing to catch-up F-100: consider too rapid a transition

2. Low weight gain during the rehabilitation phase

Poor:	<5g/kg/d
Moderate:	5-10g/kg/d
Good:	>10 g/kg/d

If weight gain is <5 g/kg/d determine:

- whether this is for all cases (need major management overhaul)
- whether this is for specific cases (reassess child as for a new admission)

Possible causes of poor weight gain are:

a) Inadequate feeding

Check:

- that night feeds are given
- that target energy and protein intakes are achieved: is actual intake (offered minus leftovers) correctly recorded? Is the quantity of feed recalculated as the child gains weight? Is the child vomiting or ruminating?

- feeding technique: is the child fed frequently and offered unlimited amounts?
- quality of care: are staff motivated/gentle/loving/patient?
- all aspects of feed preparation: scales, measurement of ingredients, mixing, taste, hygienic storage, adequate stirring if the ingredients separate out
- that if giving family foods, they are suitably modified to provide >100 kcal/100g (if not, re-modify). If resources for modification are limited, or children are not inpatients, compensate by replacing F-100 with catch-up F-135 containing 135 kcal/100ml (see Appendix 5 for recipe)

b) Specific nutrient deficiencies

Check:

- adequacy of multivitamin composition and shelf-life
- preparation of electrolyte/mineral solution and whether this is correctly prescribed and administered. If in goitrous region, check potassium iodide (KI) is added to the electrolyte/mineral solution (12 mg/2500 ml) or give all children Lugol's iodine (5-10 drops/day)
- that, if modified family foods are substantially replacing F-100, electrolyte/mineral solution is added to the family food (20 ml/day)

c) Untreated infection

If feeding is adequate and there is no malabsorption, some hidden infection can be suspected. Urinary tract infections, otitis media, TB and giardiasis are easily overlooked, hence

- re-examine carefully
- repeat urinalysis for white blood cells
- examine stools
- if possible, take chest X-ray

Alter the antibiotic schedule (step 5) only if a specific infection is identified.

d) HIV/AIDS

In children with HIV/AIDS, good recovery from malnutrition is possible though it may take longer and treatment failures may be common. Lactose intolerance occurs in severe HIV-related chronic diarrhoea. Treatment should be the same as for HIV negative children.

e) Psychological problems

Check for:

- abnormal behaviour such as stereotyped movements (rocking), rumination (self-stimulation through regurgitation) and attention seeking

Treat by giving the child extra care, love and attention. For the ruminator, firmness, but with affection and without intimidation, can assist.

E. DISCHARGE BEFORE RECOVERY IS COMPLETE

A child may be considered to have recovered and be ready for discharge when she/he reaches 90% weight-for-length. For some children, earlier discharge may be considered if effective alternative supervision is available. Domiciliary care or home-based treatment should be considered only if the following criteria are met:

The child

- is aged >12 months
- has completed antibiotic treatment
- has good appetite and good weight gain
- has taken potassium/magnesium/mineral/vitamin supplement for 2 weeks (or continuing supplementation at home is possible)

The mother/carer

- is not employed outside the home
- is specifically trained to give appropriate feeding (type, amount and frequency)
- has the financial resources to feed the child
- lives within easy reach of the hospital for urgent readmission if the child becomes ill
- can be visited weekly
- is trained to give structured play therapy
- is motivated to follow the advice given

Local health workers

- are trained to support home care
- are specifically trained to examine the child clinically at home, to decide when to refer him/her back to hospital, to weigh the child, and give appropriate advice
- are motivated

When children are being rehabilitated at home, it is essential to give frequent meals with a high energy and protein content. Aim at achieving at least 150 kcal/kg/d and adequate protein intake (at least 4 g/kg/d). This means feeding the child at least 5 times per day with foods that

contain approximately 100 kcal and 2-3 g protein per 100 g. A practical approach would be using simple modifications of the usual home foods. Vitamin, iron and electrolyte/mineral supplements can be continued at home. The carer should be shown how to:

- give appropriate meals at least 5 times daily
- give high energy snacks between meals (e.g. milk, banana, bread, biscuits, peanutbutter)
- assist and encourage the child to complete each meal
- give electrolyte and micronutrient supplements. Give 20 ml (4 teaspoons) of the electrolyte/mineral solution daily. Since it tastes unpleasant, it will probably need to be masked in porridge, or milk (one teaspoon/200 ml fluid)
- breastfeed as often as the child wants

Further reading:

- World Health Organization, *Management of severe malnutrition: a manual for physicians and other senior health workers*. Geneva: World Health Organization, 1999.
- World Health Organization, *Management of the child with a serious infection or severe malnutrition: guidelines for care at the first-referral level in developing countries*. Geneva: World Health Organization, 2000 (WHO/FCH/CAH/00.1).

Appendix 1

Weight-for-Height Reference Table

Boys' weight (kg)					Length ^a (cm)		Girls' weight (kg)			
-4 SD ^b (60%)	-3 SD (70%)	-2 SD (80%)	-1 SD (90%)	Median	Median	-1SD (90%)	-2SD (80%)	-3 SD (70%)	-4 SD (60%)	
1.8	2.1	2.5	2.8	3.1	49	3.3	2.9	2.6	2.2	1.8
1.8	2.2	2.5	2.9	3.3	50	3.4	3.0	2.6	2.3	1.9
1.8	2.2	2.6	3.1	3.5	51	3.5	3.1	2.7	2.3	1.9
1.9	2.3	2.8	3.2	3.7	52	3.7	3.3	2.8	2.4	2.0
1.9	2.4	2.9	3.4	3.9	53	3.9	3.4	3.0	2.5	2.1
2.0	2.6	3.1	3.6	4.1	54	4.1	3.6	3.1	2.7	2.2
2.2	2.7	3.3	3.8	4.3	55	4.3	3.8	3.3	2.8	2.3
2.3	2.9	3.5	4.0	4.6	56	4.5	4.0	3.5	3.0	2.4
2.5	3.1	3.7	4.3	4.8	57	4.8	4.2	3.7	3.1	2.6
2.7	3.3	3.9	4.5	5.1	58	5.0	4.4	3.9	3.3	2.7
2.9	3.5	4.1	4.8	5.4	59	5.3	4.7	4.1	3.5	2.9
3.1	3.7	4.4	5.0	5.7	60	5.5	4.9	4.3	3.7	3.1
3.3	4.0	4.6	5.3	5.9	61	5.8	5.2	4.6	3.9	3.3
3.5	4.2	4.9	5.6	6.2	62	6.1	5.4	4.8	4.1	3.5
3.8	4.5	5.2	5.8	6.5	63	6.4	5.7	5.0	4.4	3.7
4.0	4.7	5.4	6.1	6.8	64	6.7	6.0	5.3	4.6	3.9
4.3	5.0	5.7	6.4	7.1	65	7.0	6.3	5.5	4.8	4.1
4.5	5.3	6.0	6.7	7.4	66	7.3	6.5	5.8	5.1	4.3
4.8	5.5	6.2	7.0	7.7	67	7.5	6.8	6.0	5.3	4.5
5.1	5.8	6.5	7.3	8.0	68	7.8	7.1	6.3	5.5	4.8
5.3	6.0	6.8	7.5	8.3	69	8.1	7.3	6.5	5.8	5.0
5.5	6.3	7.0	7.8	8.5	70	8.4	7.6	6.8	6.0	5.2
5.8	6.5	7.3	8.1	8.8	71	8.6	7.8	7.0	6.2	5.4
6.0	6.8	7.5	8.3	9.1	72	8.9	8.1	7.2	6.4	5.6
6.2	7.0	7.8	8.6	9.3	73	9.1	8.3	7.5	6.6	5.8
6.4	7.2	8.0	8.8	9.6	74	9.4	8.5	7.7	6.8	6.0
6.6	7.4	8.2	9.0	9.8	75	9.6	8.7	7.9	7.0	6.2
6.8	7.6	8.4	9.2	10.0	76	9.8	8.9	8.1	7.2	6.4
7.0	7.8	8.6	9.4	10.3	77	10.0	9.1	8.3	7.4	6.6
7.1	8.0	8.8	9.7	10.5	78	10.2	9.3	8.5	7.6	6.7
7.3	8.2	9.0	9.9	10.7	79	10.4	9.5	8.7	7.8	6.9
7.5	8.3	9.2	10.1	10.9	80	10.6	9.7	8.8	8.0	7.1
7.6	8.5	9.4	10.2	11.1	81	10.8	9.9	9.0	8.1	7.2
7.8	8.7	9.6	10.4	11.3	82	11.0	10.1	9.2	8.3	7.4
7.9	8.8	9.7	10.6	11.5	83	11.2	10.3	9.4	8.5	7.6
8.1	9.0	9.9	10.8	11.7	84	11.4	10.5	9.6	8.7	7.7
7.8	8.9	9.9	11.0	12.1	85	11.8	10.8	9.7	8.6	7.6
7.9	9.0	10.1	11.2	12.3	86	12.0	11.0	9.9	8.8	7.7
8.1	9.2	10.3	11.5	12.6	87	12.3	11.2	10.1	9.0	7.9

^a Length is measured for children below 85 cm. For children 85 cm or more, height is measured. Recumbent length is on average 0.5 cm greater than standing height; although the difference is of no importance to individual children, a correction may be made by subtracting 0.5 cm from all lengths above 84.9 cm if standing height cannot be measured.

^b SD: standard deviation score (or Z-score). Although the interpretation of a fixed percent-of-median value varies across age and height, and although generally the two scales cannot be compared, the approximate percent-of-median values for -1 and -2 SD are 90% and 80% of median, respectively (Gorstein *J et al. Issues in the assessment of nutritional status using anthropometry*. Bulletin of the World Health Organization, 1994, 72:273-283).

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8.3	9.4	10.5	11.7	12.8	88	12.5	11.4	10.3	9.2	8.1
8.4	9.6	10.7	11.9	13.0	89	12.7	11.6	10.5	9.3	8.2
8.6	9.8	10.9	12.1	13.3	90	12.9	11.8	10.7	9.5	8.4
8.8	9.9	11.1	12.3	13.5	91	13.2	12.0	10.8	9.7	8.5
8.9	10.1	11.3	12.5	13.7	92	13.4	12.2	11.0	9.9	8.7
9.1	10.3	11.5	12.8	14.0	93	13.6	12.4	11.2	10.0	8.8
9.2	10.5	11.7	13.0	14.2	94	13.9	12.6	11.4	10.2	9.0
9.4	10.7	11.9	13.2	14.5	95	14.1	12.9	11.6	10.4	9.1
9.6	10.9	12.1	13.4	14.7	96	14.3	13.1	11.8	10.6	9.3
9.7	11.0	12.4	13.7	15.0	97	14.6	13.3	12.0	10.7	9.5
9.9	11.2	12.6	13.9	15.2	98	14.9	13.5	12.2	10.9	9.6
10.1	11.4	12.8	14.1	15.5	99	15.1	13.8	12.4	11.1	9.8
10.3	11.6	13.0	14.4	15.7	100	15.4	14.0	12.7	11.3	9.9
10.4	11.8	13.2	14.6	16.0	101	15.6	14.3	12.9	11.5	10.1
10.6	12.0	13.4	14.9	16.3	102	15.9	14.5	13.1	11.7	10.3
10.8	12.2	13.7	15.1	16.6	103	16.2	14.7	13.3	11.9	10.5
11.0	12.4	13.9	15.4	16.9	104	16.5	15.0	13.5	12.1	10.6
11.2	12.7	14.2	15.6	17.1	105	16.7	15.3	13.8	12.3	10.8
11.4	12.9	14.4	15.9	17.4	106	17.0	15.5	14.0	12.5	11.0
11.6	13.1	14.7	16.2	17.7	107	17.3	15.8	14.3	12.7	11.2
11.8	13.4	14.9	16.5	18.0	108	17.6	16.1	14.5	13.0	11.4
12.0	13.6	15.2	16.8	18.3	109	17.9	16.4	14.8	13.2	11.6
12.2	13.8	15.4	17.1	18.7	110	18.2	16.6	15.0	13.4	11.9
12.5	14.1	15.7	17.4	19.0	111	18.6	16.9	15.3	13.7	12.1
12.7	14.4	16.0	17.7	19.3	112	18.9	17.2	15.6	14.0	12.3
12.9	14.6	16.3	18.0	19.6	113	19.2	17.5	15.9	14.2	12.6
13.2	14.9	16.6	18.3	20.0	114	19.5	17.9	16.2	14.5	12.8
13.5	15.2	16.9	18.6	20.3	115	19.9	18.2	16.5	14.8	13.0
13.7	15.5	17.2	18.9	20.7	116	20.3	18.5	16.8	15.0	13.3
14.0	15.8	17.5	19.3	21.1	117	20.6	18.9	17.1	15.3	13.6
14.3	16.1	17.9	19.6	21.4	118	21.0	19.2	17.4	15.6	13.8
14.6	16.4	18.2	20.0	21.8	119	21.4	19.6	17.7	15.9	14.1
14.9	16.7	18.5	20.4	22.2	120	21.8	20.0	18.1	16.2	14.3
15.2	17.0	18.9	20.7	22.6	121	22.2	20.3	18.4	16.5	14.6
15.5	17.4	19.2	21.1	23.0	122	22.7	20.7	18.8	16.8	14.9
15.8	17.7	19.6	21.5	23.4	123	23.1	21.1	19.1	17.1	15.1
16.1	18.0	20.0	21.9	23.9	124	23.6	21.6	19.5	17.4	15.4
16.4	18.4	20.4	22.3	24.3	125	24.1	22.0	19.9	17.8	15.6
16.7	18.7	20.7	22.8	24.8	126	24.6	22.4	20.2	18.1	15.9
17.0	19.1	21.1	23.2	25.2	127	25.1	22.9	20.6	18.4	16.2
17.3	19.4	21.5	23.6	25.7	128	25.7	23.3	21.0	18.7	16.4
17.6	19.8	21.9	24.1	26.2	129	26.2	23.8	21.4	19.0	16.7
17.9	20.1	22.3	24.5	26.8	130	26.8	24.3	21.8	19.4	16.9

^a Length is measured for children below 85 cm. For children 85 cm or more, height is measured. Recumbent length is on average 0.5 cm greater than standing height; although the difference is of no importance to individual children, a correction may be made by subtracting 0.5 cm from all lengths above 84.9 cm if standing height cannot be measured.

^b SD: standard deviation score (or Z-score). Although the interpretation of a fixed percent-of-median value varies across age and height, and although generally the two scales cannot be compared, the approximate percent-of-median values for -1 and -2 SD are 90% and 80% of median, respectively (Gorstein J et al. *Issues in the assessment of nutritional status using anthropometry*. Bulletin of the World Health Organization, 1994, 72:273-283).

Appendix 2 Monitoring records (temperature, respiratory rate, and pulse rate)

MONITORING RECORD

Respiratory rate	Pulse rate	Temperature	Date/time
		39.0	
		38.5	
		38.0	
		37.5	
		37.0	
		36.5	
		36.0	
		35.5	
		35.0	
		34.5	

Appendix 3

Recipes for ReSoMal & electrolyte / mineral solution

Recipe for ReSoMal oral rehydration solution

Ingredient	Amount
Water (boiled & cooled)	2 litres
WHO-ORS	One 1 litre-packet*
Sugar	50 g
Electrolyte/mineral solution (see below)	40 ml

ReSoMal contains approximately 45 mmol Na, 40 mmol K and 3 mmol Mg/litre.

Recipe for Electrolyte/mineral solution (used in the preparation of ReSoMal and milk feeds)

Weigh the following ingredients and make up to 2500 ml. Add 20 ml of electrolyte/mineral solution to 1000 ml of milk feed.

	quantity g	molar content of 20 ml
Potassium Chloride: KCl	224	24 mmol
Tripotassium Citrate: $C_6H_5K_3O_7 \cdot H_2O$	81	2 mmol
Magnesium Chloride: $MgCl_2 \cdot 6H_2O$	76	3 mmol
Zinc Acetate: $Zn(CH_3COO)_2 \cdot 2H_2O$	8.2	300 μ mol
Copper Sulphate: $CuSO_4 \cdot 5H_2O$	1.4	45 μ mol
Water: make up to	2500 ml	

Note: add selenium if available (sodium selenate 0.028 g, $NaSeO_4 \cdot 10H_2O$) and iodine (potassium iodide 0.012g, KI) per 2500 ml.

* 3.5g sodium chloride, 2.9g trisodium citrate dihydrate, 1.5g potassium chloride, 20g glucose.

Preparation: Dissolve the ingredients in cooled boiled water. Store the solution in sterilised bottles in the fridge to retard deterioration. Discard if it turns cloudy. Make fresh each month.

If the preparation of this electrolyte/mineral solution is not possible and if pre-mixed sachets (see step 4) are not available, give K, Mg and Zn separately.

Potassium:

- Make a 10% stock solution of potassium chloride (100 g KCl in 1 litre of water):
 - For oral rehydration solution, use 45 ml of stock KCl solution instead of 40 ml electrolyte/mineral solution
 - For milk feeds, add 22.5 ml of stock KCl solution instead of 20 ml of the electrolyte/mineral solution
- If KCl is not available, give Slow K ($\frac{1}{2}$ crushed tablet/kg/day)

Magnesium:

- Give 50% magnesium sulphate intramuscularly once (0.3 ml/kg up to a maximum of 2 ml)

Zinc:

- Make a 1.5% solution of zinc acetate (15 g zinc acetate in 1 litre of water). Give the 1.5% zinc acetate solution orally, 1 ml/kg/day

Appendix 4

Antibiotics reference table

Summary: Antibiotics for Severely Malnourished Children

IF:	GIVE:		
NO COMPLICATIONS	Cotrimoxazole oral (25 mg sulfamethoxazole + 5 mg trimethoprim / kg) every 12 hours for 5 days		
COMPLICATIONS (shock, hypoglycaemia, hypothermia, dermatosis with raw skin/fissures, respiratory or urinary tract infections, or lethargic/sickly appearance)	Gentamicin ¹ IV or IM (7.5 mg/kg), once daily for 7 days, plus: <table border="1" style="margin-left: 20px;"> <tr> <td>Ampicillin IV or IM (50 mg/kg), every 6 hours for 2 days</td> <td>Followed by: Amoxicillin² oral (15 mg/kg), every 8 hours for 5 days</td> </tr> </table>	Ampicillin IV or IM (50 mg/kg), every 6 hours for 2 days	Followed by: Amoxicillin ² oral (15 mg/kg), every 8 hours for 5 days
Ampicillin IV or IM (50 mg/kg), every 6 hours for 2 days	Followed by: Amoxicillin ² oral (15 mg/kg), every 8 hours for 5 days		
If child fails to improve within 48 hours, ADD:	Chloramphenicol IV or IM (25 mg/kg), every 8 hours for 5 days (give every 6 hours if meningitis is suspected.)		
If a specific infection requires an additional antibiotic,	Specific antibiotic as directed on pages 30 - 33 of the manual <i>Management of Severe Malnutrition</i>		

¹ If the child is not passing urine, gentamicin may accumulate in the body and cause deafness. Do not give the second dose until the child is passing urine.

² If amoxicillin is not available, give ampicillin, 50 mg/kg orally every 6 hours for 5 days.

Doses for specific formulations and body weight ranges

ANTIBIOTIC	ROUTE/DOSE/ FREQUENCY/ DURATION	FORMULATION	DOSE ACCORDING TO CHILD'S WEIGHT		
			3 up to 6kg	6 up to 8kg	8 up to 10kg
Amoxicillin	Oral: 15 mg/kg every 8 hours for 5 days	Tablet, 250 mg	1/4 tablet	1/2 tablet	1/2 tablet
		Syrup, 125 mg/5ml	2.5 ml	5 ml	5 ml
		Syrup, 250 mg/5ml	1.5 ml	2 ml	2.5 ml
Ampicillin	Oral: 50 mg/kg every 6 hours for 5 days	Tablet, 250 mg	1 tablet	1 1/2 tablet	2 tablets
		IV/IM: 50 mg/kg every 6 hours for 2 days	Vial of 500 mg mixed with 2.1 ml sterile water to give 500 mg/2.5 ml	1 ml	1.75 ml
Cotrimoxazole + trimethoprim, SMX + TMP	Oral: 25mg SMX + 5mgTMP/kg every 12 hours for 5 days	Tablet, 100 mg SMX + 20mg TMP	1 tablet	1 1/2 tablet	2 tablets
		Syrup, 200 mg SMX + 40 mg TMP per 5 ml	2.5 ml	4 ml	5 ml
Metronidazole	Oral: 7.5 mg/kg every 8 hours for 7 days	Suspension, 200 mg/5ml	1 ml	1.25 ml	1.5 ml
Nalidixic Acid	Oral: 15 mg/kg every 6 hours for 5 days	Tablet, 250 mg	1/4 tablet	1/2 tablet	1/2 tablet
Benzylpenicillin	IV or IM: 50 000 units/kg every 6 hours for 5 days	IV: Vial of 600 mg mixed with 9.6 ml sterile water to give 1 000 000 units/ 10 ml	2 ml	3.5 ml	4.5 ml
		IM: Vial of 600 mg mixed with 1.6 ml sterile water to give 1 000 000 units/ 2 ml	0.4 ml	0.7 ml	0.9 ml

Doses for selected antibiotics, for specific formulations and body weights

ANTIBIOTIC	ROUTE DOSE/ FREQUENCY/ DURATION	FORMULATION	DOSE ACCORDING TO CHILD'S WEIGHT (use closest weight)									
			3 kg	4 kg	5 kg	6 kg	7 kg	8 kg	9 kg	10 kg	11 kg	12 kg
Chloramphenicol	IV or IM: 25 mg/kg every 8 hours (or every 6 hours if suspect of meningitis) for 5 days	IV: vial of 1 g mixed with 9.2 ml sterile water to give 1 g/10 ml	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
		IM: vial of 1 g mixed with 3.2 ml sterile water to give 1 g/4 ml	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2
Gentamicin	IV or IM: 7.5 mg/kg once daily for 7 days	IV/IM: vial containing 20 mg (2 ml at 10 mg/ml), undiluted	2.25	3	3.75	4.5	5.25	6	6.75	7.5	8.25	9
		IV/IM: vial containing 80 mg (2 ml at 40 mg/ml), mixed with 6 ml sterile water to give 80 mg/8ml	2.25	3	3.75	4.5	5.25	6	6.75	7.5	8.25	9
		IV/IM: vial containing 80 mg (2 ml at 40 mg/ml), undiluted	0.5	0.75	0.9	1.1	1.3	1.5	1.7	1.9	2	2.25

Doses for iron syrup for a common formulation

Weight of child	Dose of iron syrup: ferrous fumarate 100 mg/5 ml (20 mg elemental iron per ml)
3 - 6 kg	0.5 ml
6 - 10 kg	0.75 ml
10 - 15 kg	1 ml

Appendix 5

Recipes for starter and catch-up formulas

	F-75	F-100	F-135
	(starter)	(catch-up)	(catch-up)
Dried skimmed milk (g)*	25	80	90
Sugar (g)	100	50	65
Vegetable oil (g)	30 (or 35 ml)	60 (or 70 ml)	85 (or 95 ml)
Electrolyte/mineral solution (ml)	20	20	20
Water: make up to	1000 ml	1000 ml	1000 ml
Contents per 100 ml			
Energy (kcal)	75	100	135
Protein (g)	0.9	2.9	3.3
Lactose (g)	1.3	4.2	4.8
Potassium (mmol)	4.0	6.3	7.7
Sodium (mmol)	0.6	1.9	2.2
Magnesium (mmol)	0.43	0.73	0.8
Zinc (mg)	2.0	2.3	3.0
Copper (mg)	0.25	0.25	0.34
% energy from protein	5	12	10
% energy from fat	36	53	57
Osmolarity (mOsmol/l)	413	419	508

Preparation:

- using an electric blender: place some of the warm boiled water in the blender, add the milk powder, sugar, oil and electrolyte/mineral solution. Make up to 1000 ml, and blend at high speed
- if no electric blender is available, mix the milk, sugar, oil and electrolyte/mineral solution to a paste, and then slowly add the rest of the warm boiled water and whisk vigorously with a manual whisk
- store made-up formula in refrigerator - when possible.

* Alternative recipes using full-cream dried milk or liquid cow's milk are given on p.39.

F-75 starter formulas

- full-cream dried milk 35 g, 100 g sugar, 20 g (or ml) oil, 20 ml electrolyte/mineral solution, and make up to 1000 ml
- full-cream cow's milk (fresh or long life) 300 ml, 100 g sugar, 20 g (or ml) oil, 20 ml electrolyte/mineral solution and make up to 1000 ml

F-100 catch-up formulas

- full-cream dried milk 110 g, 50 g sugar, 30 g (or ml) oil, 20 ml electrolyte/mineral solution, and make up to 1000 ml
- full-cream cow's milk (fresh or long life) 880 ml, 75 g sugar, 20 g (or ml) oil, 20 ml electrolyte/mineral solution and make up to 1000 ml

F-135 catch-up formulas

This is for use in special circumstances (see Section D2, poor weight gain) for children aged > 6 months

- full-cream dried milk 130 g, 70 g sugar, 40 g (or 45 ml) oil, 20 ml electrolyte/mineral solution, make up to 1000 ml
- full-cream cow's milk (fresh or long life) 880 ml, 50 g sugar, 60 g (or 65 ml) oil, 20 ml electrolyte/mineral solution (this makes 1000 ml)

Isotonic and cereal based F-75

- cereal-based, low-osmolar F-75 (334 mOsmol/l). Replace 30 g of the sugar with 35 g cereal flour in F-75 recipes above. Cook for 4 min. This may be helpful for children with osmotic diarrhoea
- isotonic versions of F-75 (280 mOsmol/l) are available commercially from Nutriset. In these, maltodextrins replace some of the sugar, and all the extra nutrients (K, Mg and micro-nutrients) are incorporated

Appendix 6

Volume of F-75 to give for children of different weights

(see Appendix 7 for children with severe (+++ oedema)

Weight of child (kg)	Volume of F-75 per feed (ml) ^a			Daily total (130 ml/kg)	80% of daily total ^a (minimum)
	Every 2 hours ^b (12 feeds)	Every 3 hours ^c (8 feeds)	Every 4 hours (6 feeds)		
2.0	20	30	45	260	210
2.2	25	35	50	286	230
2.4	25	40	55	312	250
2.6	30	45	55	338	265
2.8	30	45	60	364	290
3.0	35	50	65	390	310
3.2	35	55	70	416	335
3.4	35	55	75	442	355
3.6	40	60	80	468	375
3.8	40	60	85	494	395
4.0	45	65	90	520	415
4.2	45	70	90	546	435
4.4	50	70	95	572	460
4.6	50	75	100	598	480
4.8	55	80	105	624	500
5.0	55	80	110	650	520
5.2	55	85	115	676	540
5.4	60	90	120	702	560
5.6	60	90	125	728	580
5.8	65	95	130	754	605
6.0	65	100	130	780	625
6.2	70	100	135	806	645
6.4	70	105	140	832	665
6.6	75	110	145	858	685
6.8	75	110	150	884	705
7.0	75	115	155	910	730
7.2	80	120	160	936	750
7.4	80	120	160	962	770
7.6	85	125	165	988	790
7.8	85	130	170	1014	810
8.0	90	130	175	1040	830
8.2	90	135	180	1066	855
8.4	90	140	185	1092	875
8.6	95	140	190	1118	895
8.8	95	145	195	1144	915
9.0	100	145	200	1170	935
9.2	100	150	200	1196	960
9.4	105	155	205	1222	980
9.6	105	155	210	1248	1000
9.8	110	160	215	1274	1020
10.0	110	160	220	1300	1040

^a Volumes in these columns are rounded to the nearest 5 ml.

^b Feed 2-hourly for at least the first day. Then, when little or no vomiting, modest diarrhoea (<5 watery stools per day), and finishing most feeds, change to 3-hourly feeds.

^c After a day on 3-hourly feeds: If no vomiting, less diarrhoea, and finishing most feeds, change to 4-hourly feeds.

Appendix 7

Volume of F-75 for children with severe (+++) oedema

Weight with +++ oedema (kg)	Volume of F-75 per feed (ml) ^a			Daily total (100 ml/kg)	80% of daily total ^a (minimum)
	Every 2 hours ^b (12 feeds)	Every 3 hours ^c (8 feeds)	Every 4 hours (6 feeds)		
3.0	25	40	50	300	240
3.2	25	40	55	320	255
3.4	30	45	60	340	270
3.6	30	45	60	360	290
3.8	30	50	65	380	305
4.0	35	50	65	400	320
4.2	35	55	70	420	335
4.4	35	55	75	440	350
4.6	40	60	75	460	370
4.8	40	60	80	480	385
5.0	40	65	85	500	400
5.2	45	65	85	520	415
5.4	45	70	90	540	430
5.6	45	70	95	560	450
5.8	50	75	95	580	465
6.0	50	75	100	600	480
6.2	50	80	105	620	495
6.4	55	80	105	640	510
6.6	55	85	110	660	530
6.8	55	85	115	680	545
7.0	60	90	115	700	560
7.2	60	90	120	720	575
7.4	60	95	125	740	590
7.6	65	95	125	760	610
7.8	65	100	130	780	625
8.0	65	100	135	800	640
8.2	70	105	135	820	655
8.4	70	105	140	840	670
8.6	70	110	145	860	690
8.8	75	110	145	880	705
9.0	75	115	150	900	720
9.2	75	115	155	920	735
9.4	80	120	155	940	750
9.6	80	120	160	960	770
9.8	80	125	165	980	785
10.0	85	125	165	1000	800
10.2	85	130	170	1020	815
10.4	85	130	175	1040	830
10.6	90	135	175	1060	850
10.8	90	135	180	1080	865
11.0	90	140	185	1100	880
11.2	95	140	185	1120	895
11.4	95	145	190	1140	910
11.6	95	145	195	1160	930
11.8	100	150	195	1180	945
12.0	100	150	200	1200	960

^a Volumes in these columns are rounded to the nearest 5 ml.

^b Feed 2-hourly for at least the first day. Then, when little or no vomiting, modest diarrhoea (<5 watery stools per day), and finishing most feeds, change to 3-hourly feeds.

^c After a day on 3-hourly feeds: If no vomiting, less diarrhoea, and finishing most feeds, change to 4-hourly feeds.

Appendix 8

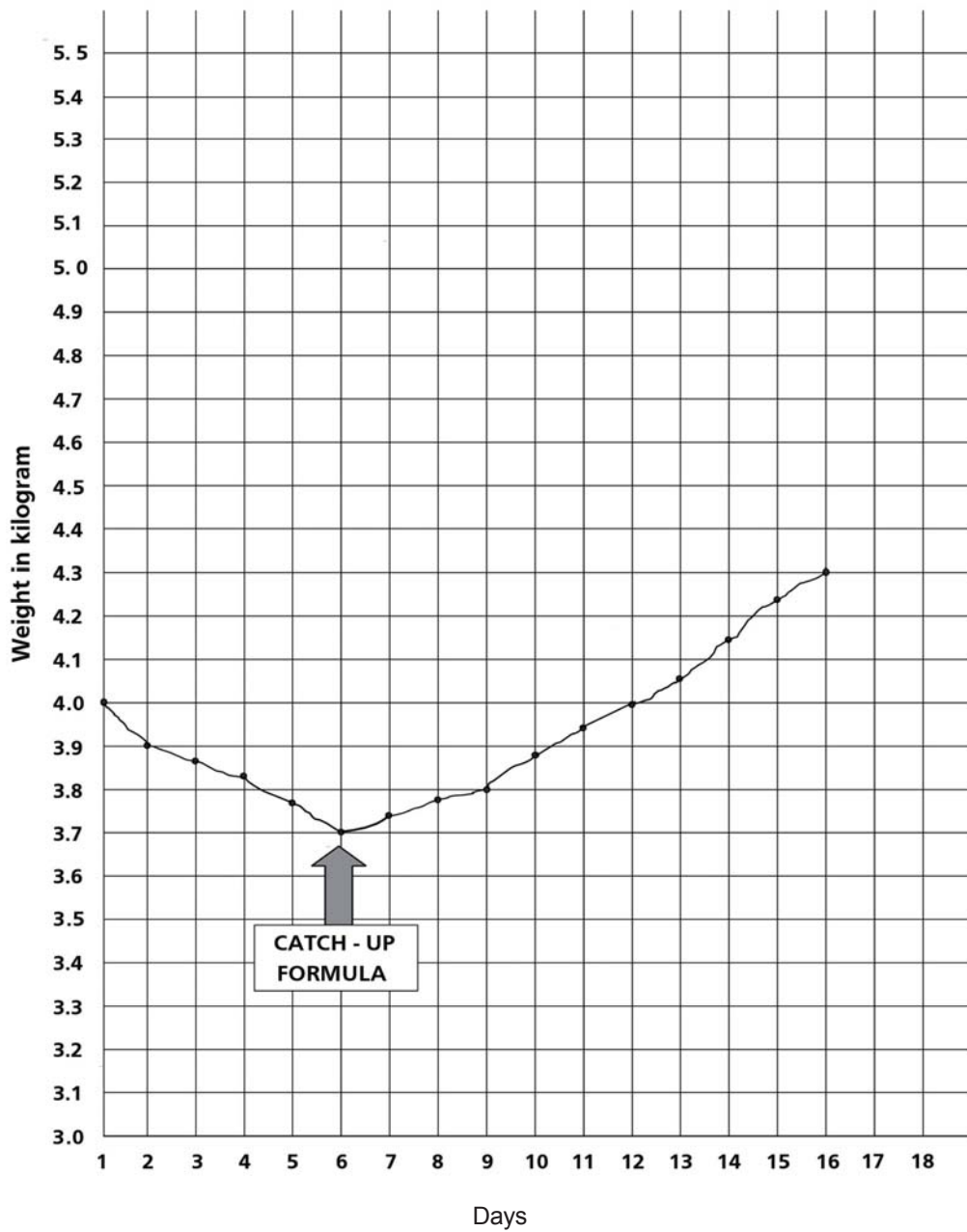
Range of volumes for free feeding with F-100

Weight of Child (kg)	Range of volumes per 4-hourly feed of F-100 (6 feeds daily)		Range of daily volumes of F-100	
	Minimum (ml)	Maximum (ml) ^a	Minimum (150 ml/kg/day)	Maximum (220 ml/kg/day)
2.0	50	75	300	440
2.2	55	80	330	484
2.4	60	90	360	528
2.6	65	95	390	572
2.8	70	105	420	616
3.0	75	110	450	660
3.2	80	115	480	704
3.4	85	125	510	748
3.6	90	130	540	792
3.8	95	140	570	836
4.0	100	145	600	880
4.2	105	155	630	924
4.4	110	160	660	968
4.6	115	170	690	1012
4.8	120	175	720	1056
5.0	125	185	750	1100
5.2	130	190	780	1144
5.4	135	200	810	1188
5.6	140	205	840	1232
5.8	145	215	870	1276
6.0	150	220	900	1320
6.2	155	230	930	1364
6.4	160	235	960	1408
6.6	165	240	990	1452
6.8	170	250	1020	1496
7.0	175	255	1050	1540
7.2	180	265	1080	1588
7.4	185	270	1110	1628
7.6	190	280	1140	1672
7.8	195	285	1170	1716
8.0	200	295	1200	1760
8.2	205	300	1230	1804
8.4	210	310	1260	1848
8.6	215	315	1290	1892
8.8	220	325	1320	1936
9.0	225	330	1350	1980
9.2	230	335	1380	2024
9.4	235	345	1410	2068
9.6	240	350	1440	2112
9.8	245	360	1470	2156
10.0	250	365	1500	2200

^a Volumes per feed are rounded to the nearest 5 ml.

Appendix 9 Weight record chart

Name: Sipho age 14 months, sex: male, wt on admission: 4 kg, ht: 65 cm, oedema **



Appendix 10

Structured play activities

Play therapy is intended to develop language skills and motor activities aided by simple toys. It should take place in a loving, relaxed and stimulating environment.

Language skills

At each play session:

- teach local songs and finger and toe games
- get child to laugh and vocalise, repeat what (s)he says
- describe all activities
- teach action words with activities e.g. 'bang bang' as (s)he beats a drum, 'bye bye' as (s)he waves etc.
- teach concepts at every opportunity, examples are in italics in the text below

Motor activities

Encourage the child to perform the next motor milestone e.g.:

- bounce the child up and down and hold him/her under the arms so that the feet support the child's weight
- prop the child up, roll toys out of reach, encourage the child to crawl after them
- hold hand and help the child to walk
- when starting to walk alone, give a '*push-along*' and later a '*pull-along*' toy

Activities with toys

Simple toys can easily be made from readily available materials. These toys can be used for a variety of different motor activities:

'Ring on a string'

- Swing the ring within reach and tempt the child to grab it
- suspend ring over the crib and encourage the child to knock it and make it swing
- let child explore the ring, then place it a little distance from child with the string stretched towards him/her and within reach. Teach the child to retrieve the ring by pulling on the string horizontally
- sit child on lap, then holding the string, lower the ring towards the ground. Teach child to get the ring by pulling up on the string vertically. Also teach child to dangle the ring.

'Rattle and drum'

- Let the child explore rattle. Show child how to shake it saying 'shake shake'
- encourage child to shake the rattle by saying 'shake' but without demonstrating
- teach child to beat drum with shaker saying 'bang bang'
- roll drum out of reach and let child crawl after it, saying 'fetch it'
- get child to say 'bang bang' as (s)he beats drum

'In and Out' toy with blocks

- Let the child explore blocks and container. Put blocks into container and shake it, then teach child to take them out, one at a time, saying 'out' and 'give me'
- teach the child to take out blocks by turning container upside down
- teach the child to hold a block in each hand and bang them together
- let the child put blocks in and out of container saying 'in' and 'out'
- cover blocks with container saying 'where are they, they are *under* the cover'. Let the child find them. Then hide them under two and then three covers (e.g. pieces of cloth)
- turn the container upside down and teach the child to put blocks *on top* of the container
- teach the child to stack blocks: first stack two then gradually increase the number. Knock them down saying, 'up up' then 'down'. Make a game of it
- line up blocks horizontally: first line up two then more; teach the child to push them along making train or car noises. Teach older children words such as *stop* and *go*, *fast* and *slow* and *next to*. After this teach to sort blocks by colour, first two then more, and teach *high* and *low* building. Make up games

Posting bottle

- Put an object in the bottle, shake it and teach the child to turn the bottle upside down and to take the object out saying 'can you get it?' Then teach the child to put the object in and take it out. Later try with several objects

Stacking bottle tops

- Let the child play with two bottle tops then teach the child to stack them saying 'I'm going to put one *on top of* the other'. Later, increase the number of tops. Older children can sort tops by colour and learn concepts such as *high* and *low*

Books

- Sit the child on your lap. Get the child to turn the pages, pat pictures and vocalise. Later, let the child point to the picture you name. Talk about pictures, obtain pictures of simple familiar objects, people and animals. Let older children name pictures and talk about them

Doll

- Teach the word '*baby*'. Let the child love and cuddle the doll. Sing songs whilst rocking the child
- teach the child to identify his/her own body parts and those of the doll when you name them. Later (s)he will name them
- put the doll in a box as a bed and give sheets, teach the words '*bed* and *sleep*' and describe the games you play

Appendix 11 Discharge card

DISCHARGE CARD
For Child Recovering from Severe Malnutrition
Hospital Name _____

Child's name: _____ M F Date of birth: _____
Address: _____

Date:	Weight (kg)	Ht./length (cm)	% weight-for-height
Admission			
Discharge			



Instructions for Feeding at Home

What to feed? (include recipe if needed) _____

How much and how often? _____

Medications and Supplements


Give _____ drops _____ (multivitamin preparation) with food once daily.


Give 1 tablet folic acid once daily for _____ days.


Give _____ iron twice daily for 1 month.


Other: _____


Danger Signs – Bring Child for Immediate Care if:


Not able to drink or breastfeed
Stops feeding 

Diarrhoea more than 1 day or blood in stool 

Swelling in feet, hands, legs, or arms 

Fever (feels hot) 

Convulsion (fits) 

Fast or difficult breathing 

Come for Scheduled Follow-Up Visits

Next Planned Follow-Up:		Record of Visits:	
Date	Place	Date	Weight % wt./for ht

Vitamin A – Bring Child for a Dose Every Six Months

Next Dose Vitamin A:		Record of Doses Received:	
Date	Place	Date	Dose

Immunizations Given

Tick or record date given:

BCG DPT 1 OPV 0

OPV 2 DPT 2 OPV 2 Measles

DPT 3 OPV 3

Next Immunization

Date	Dose(s) needed

For the WHO South-East Asia Region, this publication can be obtained from:

World Health Organization
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World Health House
Indraprastha Estate
New Delhi - 110 002, India
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Email : bookorders@who.int

For further information please contact:

Dr Sultana Khanum
Department of Nutrition for Health and Development
World Health Organization
20 Avenue Appia
1211 Geneva 27, Switzerland
Telephone : +41-22-791 2624
Fax : +41-22-791 4156
Website : www.who.int

