London School of Hygiene & Tropical Medicine

Guidelines for the inpatient treatment of severely malnourished children

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GUIDELINES FOR THE INPATIENT TREATMENT OF SEVERELY MALNOURISHED CHILDREN

Every year some 12 million children die before they reach their 5th birthday. Seven out of every 10 of these deaths are due to diarrhoea, pneumonia, measles, malaria or malnutrition. The WHO/UNICEF strategy of Integrated Management of Childhood Illness (IMCI) aims at improving treatment and reducing mortality in these conditions.

The first activity of the IMCI strategy was to issue guidelines for integrated outpatient case-management, and now, preparation of guidelines for inpatient case-management is underway. The following guidelines for the routine treatment of severe malnutrition have been prepared in collaboration with WHO and form part of the nutrition component of this initiative.

These guidelines set out simple, specific instructions for the treatment of severely malnourished children. The aim is to provide practical help for those with responsibility for the medical and dietary management of such children. Without correct care, diarrhoea, poor appetite, slow recovery and high mortality are common. 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.

The guidelines are in five sections:-

1. Routine treatment: The '10 steps' (section A)
2. Treatment of associated conditions (section B)
3. What to do if a child fails to respond (section C)
4. What to do when children have to be discharged early (section D)
5. Emergency treatment of shock and severe anaemia (section E)

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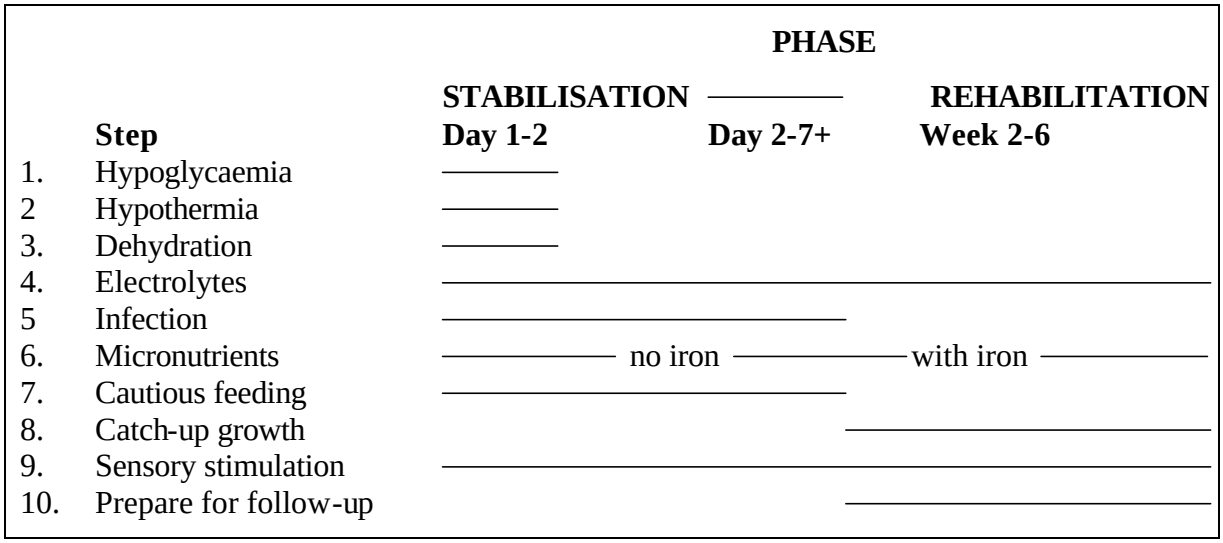
A. GENERAL PRINCIPLES FOR ROUTINE CARE

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 :-



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.

If dextrostix is <3mmol/l give:-

- 50ml bolus of 10% glucose or 10% sucrose solution (1 rounded teaspoon of sugar in 3.5 tablespoons water), orally or by nasogastric tube. Then feed starter F-75 (see step 7) every 30 min for 2 hours (giving one quarter of the 2-hourly feed each time)
- antibiotics (see step 5)
- 2-hourly feeds, day and night (see step 7)

Monitor:-

- if blood glucose was low, repeat dextrostix with finger/heel prick blood after 2h. Once treated, most children stabilise within 30min. If blood glucose falls to <3mmol/l repeat 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 2-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

If the axillary temperature is <35.0°C, take the rectal temperature using a low reading thermometer.

If the rectal temperature is <35.5°C (<95.9°F):-

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

Monitor:-

- take rectal temperature 2-hourly until it rises to >36.5°C (take half-hourly if heater is used)
- ensure the child is covered at all times, especially at night
- feel for warmth
- check for hypoglycaemia whenever hypothermia is found

Prevention:-

- feed 2-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 (eg bathing, prolonged medical examinations)

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 shock and then do so with care, infusing slowly to avoid flooding the circulation and overloading the heart. (See Section E:Emergency treatment).

The standard WHO oral rehydration salts solution contains too much sodium and too little potassium for severely malnourished children. Instead give special **Re**hydration **So**lution for **Mal**nutrition (ReSoMal). (For recipe see appendix 1).

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 5ml/kg every 30min for 2h, orally or by nasogastric tube, then
- 5-10ml/kg/h for next 4-10h: the exact amount to give should be determined by how much the child wants, and /or stool loss and whether vomiting. Replace the ReSoMal doses at 6h and 10h with an equal amount of F-75 if rehydration is continuing at these times
- begin feeding with starter F-75 (see step 7)

During treatment, rapid respirations and pulse rate should slow and the child begin to pass urine.

Monitor progress of rehydration:-

- observe half-hourly for 2h, then hourly for the next 6-12h recording:-
    - pulse rate
    - respiratory rate
    - urine frequency
    - stool/vomit frequency

Return of tears, moist mouth, eyes and fontanelle less sunken, and improved skin turgor, are also signs that rehydration is proceeding, but note that many severely malnourished children will not show these changes even when fully rehydrated.

Continuing rapid respiratory and pulse rates during rehydration suggest coexisting infection or overhydration. Signs of too much fluid (overhydration) are increasing respiratory and pulse rates, increasing oedema and puffy eyelids. If these signs occur, stop fluids immediately and reassess after 1h.

To prevent dehydration when a child has continuing watery diarrhoea :-

- continue feeding with starter F-75 (see step 7)
- replace approximate volume of stool losses with ReSoMal. As a guide give 50-100ml 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 which may take at least 2 weeks to correct. Oedema is partly due to these imbalances. (NB Do NOT treat oedema with a diuretic). Give:-

- extra potassium 2-4mmol/kg/d
- extra magnesium 0.3-0.6mmol/kg/d
- when rehydrating give low sodium rehydration fluid (eg 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 1 provides a recipe for a combined electrolyte/mineral solution. Adding 20ml of this solution to 1 litre of feed will supply the extra potassium and magnesium required.

STEP 5. TREAT/PREVENT INFECTION

In severe malnutrition the usual signs of infection, such as fever, are often absent.
Therefore **give routinely** on admission:-

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

Note: Some experts routinely give **in addition** to broad-spectrum antibiotics, metronidazole (7.5mg/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 antibiotic
a) if the child appears to have **no complications** give:

- Co-trimoxazole 5ml paediatric suspension orally twice daily for 5 days (2.5ml if weight <4kg). (5ml is equivalent to 40mg TMP+200mg SMX).

OR
b) if the child is **severely ill** (apathetic, lethargic) or **has complications** (hypoglycaemia; hypothermia; skin, respiratory tract or urinary tract infection) give:

- Ampicillin 50mg/kg IM/IV 6-hourly for 2 days, then oral amoxycillin 15mg/kg 8-hourly for 5 days, or if amoxycillin is not available, continue with ampicillin but give orally, 50mg/kg 6-hourly

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

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

- Chloramphenicol 25mg/kg IM/IV 6-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, including checking for sites of infection, potentially resistant organisms and 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 week 2) as giving iron can make infections worse.
Give:-

- Vit A orally on Day 1 (if aged >1 year give 200,000 iu; age 6-12m give 100,000iu; age 0-5m give 50,000iu) 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 1mg/d (give 5mg on Day 1)
- Zinc 2mg/kg/d
- Copper 0.3mg/kg/d
- Iron 3mg/kg/d but only when gaining weight

Appendix 1 provides a recipe for a combined electrolyte/mineral solution. Adding 20ml 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 from Nutriset, BP35, 76770 Malaunay, France (Fax +33 35 756161). This replaces 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 NG feeds (never parenteral preparations)
- 100kcal/kg/d
- 1-1.5g protein/kg/d
- 130ml/kg/d of fluid (100ml/kg/d if the child has severe oedema)
- if the child is breastfed, continue to breastfeed but give starter formula first

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

Milk-based formulas such as starter F-75 containing 75kcal/100ml and 0.9g protein/100ml will be satisfactory for most children (see appendix 2 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	11ml	130ml
3-5	3-hourly	16ml	130ml
6-7+	4-hourly	22ml	130ml

For children with a good appetite and no oedema, this schedule can be completed in 2-3 days (eg 24h at each level). Appendix 3 shows the volume/feed already calculated according to body weight. Appendix 4 gives the feed volumes for children with severe oedema.

If, after allowing for any vomiting, intake does not reach 80kcal/kg/d (105ml starter formula/kg) despite frequent feeds, coaxing and re-offering, give the remaining feed by NG tube (see appendix 3 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
- stool frequency and consistency
- 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 B4 (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 >10g gain/kg/d. The recommended milk-based F-100 contains 100kcal and 2.9g protein/100ml (see appendix 2 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 48h then,
- increase each successive feed by 10ml until some feed remains uneaten. The point when some remains unconsumed is likely to occur when intakes reach about 30ml/kg/feed (200ml/kg/d).

Monitor during the transition for signs of heart failure:-

- respiratory rate
- pulse rate

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

After the transition give:-

- frequent feeds (at least 4-hourly) of unlimited amounts of a catch-up formula
- 150-220kcal/kg/d
- 4-6g 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, so give F-100 first.)

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

- Weigh child each morning before being fed. Plot weight.
- Each week calculate and record weight gain as g/kg/d.

If weight gain is:

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

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 5 provides examples)
- physical activity as soon as well enough
- maternal involvement when possible (eg 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 6-monthly vitamin A is given

B. TREATMENT OF ASSOCIATED CONDITIONS

Treatment of conditions commonly associated with severe malnutrition:-

1. Vitamin A deficiency

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

- Vitamin A on days 1, 2 and 14 (if aged >1 year give 200,000iu; if aged 6-12 months give 100,000iu, if aged 0-5 months give 50,000iu). If first dose has been given in referring centre, treat on days 1 and 14 only.

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

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

(NB 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. Dermatosis

Signs:-

- hypo- or hyper-pigmentation
- 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:-

- bathe or soak affected areas for 10min/day in 1% potassium permanganate solution
- apply barrier cream (zinc and castor oil ointment, or petroleum jelly or tulle gras) to raw areas
- omit nappies so that the perineum can dry

3. Parasitic worms

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

4. Continuing diarrhoea

Diarrhoea is common in malnutrition but should subside during the first week with cautious refeeding. 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 (7.5mg/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 <300mOsmol/l. In these cases:

- use isotonic F-75 or low osmolar cereal-based F-75 (see Appendix 2 for recipe)
- introduce F-100 gradually

5. Tuberculosis

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

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

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

C. FAILURE TO RESPOND TO TREATMENT

Failure to respond is indicated by:-

1. High Mortality

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

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

- within 24h: consider untreated or delayed treatment of hypoglycaemia, hypothermia, septicaemia, severe anaemia or incorrect rehydration fluid or volume
- within 72h: check whether refeeding with too high a volume/feed or wrong formulation
- 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: >10g/kg/d

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

- if this is for all cases (need major management overhaul)
- if 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 separating out
- if giving family foods with catch-up F-100, that they are suitably modified to provide >100kcal/100g (if not, re-modify). If resources for modification are limited, or children are not inpatients, compensate by replacing catch-up F-100 with catch-up F-135 containing 135kcal/100ml (see appendix 2 for recipe)

b) Specific nutrient deficiencies
Check:

- adequacy of multivitamin composition, shelf-life
- preparation of electrolyte/mineral solution and whether correctly prescribed and administered. If in goitrous region, check potassium iodide (KI) is added to the electrolyte/mineral solution (12mg/2500ml) 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 (20ml/day)

c) Untreated infection
If feeding is adequate and there is no malabsorption, some hidden infection can be suspected. Easily overlooked are: urinary tract infections, otitis media, TB and giardiasis.

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

Alter the antibiotic schedule (step 5) only if a specific infection is identified. (Blind antimicrobials are unlikely to be successful if step 5 has been followed.)

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 special love and attention. For the ruminator, firmness, but with affection and without intimidation, can assist.

D. DISCHARGE BEFORE RECOVERY IS COMPLETE

A child may be considered to have recovered and ready for discharge when s/he reaches 90% weight-for-length. For some children, earlier discharge may be considered if effective alternative supervision is available. Domiciliary care should only be considered 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 2-weeks of potassium/magnesium/mineral/vitamin supplement (or continuing supplementation at home is possible)

The mother/carer

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

Local health workers

- are trained to support home care
- are specifically trained to examine child clinically at home, when to refer back, to weigh child, give appropriate advice
- are motivated

For children being rehabilitated at home, it is essential to give frequent meals with a high energy and protein content. Aim at achieving at least 150kcal/kg/d and adequate protein (at least 4g/kg/d). This means feeding the child at least 5 times per day with foods that contain approximately 100kcal and 2-3g protein per 100g of food. A practical approach should be taken using simple modifications of 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 (eg milk, banana, bread, biscuits)
- assist and encourage the child to complete each meal
- give electrolyte and micronutrient supplements. Give 20ml (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/200ml fluid).
- breastfeed as often as child wants

E. EMERGENCY TREATMENT

1. Shock in severely malnourished children
Shock from dehydration and sepsis are likely to co-exist 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 guided by the child's response. Overhydration must be avoided.

To start treatment:-

- Give IV fluid at 15ml/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 respirations every 5-10 minutes
- give antibiotics (see step 5)

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

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

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

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

If the child gets worse during treatment (breathing increases by 5 breaths/min or pulse

increases by 25 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 4g/dl
- or if there is respiratory distress and Hb between 4 and 6g/dl

Give:-

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

It is particularly important that the volume of 10ml/kg is not exceeded in severely malnourished children. If the severely anaemic child has signs of cardiac failure, transfuse packed cells 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 rise, transfuse more slowly.

Following the transfusion, if the Hb remains less than 4g/dl or between 4-6g/dl in a child with continuing respiratory distress, DO NOT repeat the transfusion within 4 days.

(In mild or moderate anaemia, iron should be given for two months to replete iron stores **BUT this should not be started** until the child has begun to gain weight).

Appendix 1: 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	50g
Electrolyte/mineral solution (see below)	40ml

ReSoMal contains approximately 45mmol Na, 40mmol K and 3mmol Mg/litre.
*3.5g sodium chloride, 2.9g trisodium citrate dihydrate, 1.5g potassium chloride, 20g glucose.

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

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

	quantity g	molar content of 20 ml
Potassium Chloride:KCl	**224**	24mmol
Tripotassium Citrate: $C_6H_5K_3O_7.H_2O$	**81**	2mmol
Magnesium Chloride:$MgCl_2.6H_2O$	**76**	3mmol
Zinc Acetate:$Zn(CH_3COO)_2.2H_20$	**8.2**	300umol
Copper Sulphate:$CuSO_4.5H_2O$	**1.4**	45umol
Water: make up to	**2500ml**	

Note: If available, also add selenium (sodium selenate 0.028g, $NaSeO_4$ $10H_20$) and iodine (potassium iodide 0.012g, KI) per 2500ml.

To make: Dissolve the ingredients in cooled boiled water. Store the solution in sterilised bottles in the fridge to retard deterioration. Discard if 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 (100g KCl in 1 litre of water) :
  For oral rehydration solution, use 45ml of stock KCl solution instead of 40ml electrolyte/mineral solution.
  For milk feeds, add 22.5ml of stock KCl solution instead of 20ml of the electrolyte/mineral solution
- If KCl is not available, give Slow K (½ crushed tablet/kg/day)

Zinc

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

Magnesium

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

Appendix 2: Recipes for starter and catch-up formulas

	F-75 (starter)	**F-100 (**catch-up)	**F-135** (catch-up)
Dried skimmed milk (g)*****	25	80	90
Sugar (g)	100	50	65
Vegetable oil (g)	30 (or 35ml)	60 (or 70ml)	85 (or 95ml)
Electrolyte/mineral solution (ml)	20	20	27
Water: make up to 1000ml or add	860ml	810ml	765ml
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/1)	413	419	508

To make up:-

- Using an electric blender mix the milk powder, sugar and oil with some of the warm boiled water, add electrolyte/mineral solution, the remaining water and blend at high speed
- If no 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.
- Store made-up formula in refrigerator.

*Alternative recipes using full cream dried milk or liquid cows milk

F 75 starter formulas

- full cream dried milk 35g, 100g sugar, 20g (or ml) oil, 20ml electrolyte/mineral solution, and make up to 1000ml or add 860ml water
- full cream cow's milk (fresh or long life) 300ml, 100g sugar, 20g (or ml) oil, 20ml electrolyte/mineral solution and make up to 1000 ml or add 570ml water

F-100 catch-up formulas

- full cream dried milk 110g, 50g sugar, 30g (or ml) oil, 20ml electrolyte/mineral solution, and make up to 1000ml or add 810ml water
- full cream cow's milk (fresh or long life) 880ml, 75g sugar, 20g (or ml) oil, 20ml electrolyte/mineral solution and make up to 1000ml or add 30ml water

F-135 catch-up formulas

This is for use in special circumstances (see section C2a, inadequate feeding)

- full cream dried milk 130g, 70g sugar, 40g (or 45ml) oil, 20ml electrolyte/mineral solution, make up to 1000ml or add 765ml water
- full cream cow's milk (fresh or long life) 880ml, 50g sugar, 60g (or 65ml) oil, 20ml electrolyte/mineral solution (this makes 1000ml)

Isotonic and cereal based F-75

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

Appendix 3: F-75 feed volumes by feeding frequency, and body weight and for naso-gastric feeding.

(Columns 2, 3 and 4 are approximately 11ml/kg/feed, 16ml/kg/feed and 22ml/kg/feed respectively.)

CHILD'S WEIGHT kg	2-hourly (ml/feed)	3-hourly (ml/feed)	4-hourly (ml/feed)	Switch to NG feeding if intakes (ml) fall below:-
2.0	**20**	**30**	**45**	**210**
2.2	25	35	50	230
2.4	25	40	55	250
2.6	30	45	55	270
2.8	30	45	60	290
3.0	**35**	**50**	**65**	**320**
3.2	35	55	70	340
3.4	35	55	75	360
3.6	40	60	80	380
3.8	40	60	85	400
4.0	**45**	**65**	**90**	**420**
4.2	45	70	90	440
4.4	50	70	95	460
4.6	50	75	100	490
4.8	55	80	105	510
5.0	**55**	**80**	**110**	**530**
5.2	55	85	115	550
5.4	60	90	120	570
5.6	60	90	125	590
5.8	65	95	130	610
6.0	**65**	**100**	**130**	**640**
6.2	70	100	135	660
6.4	70	105	140	680
6.6	75	110	145	700
6.8	75	110	150	720
7.0	**75**	**115**	**155**	**740**
7.2	80	120	160	760
7.4	80	120	160	780
7.6	85	125	165	810
7.8	85	130	170	830
8.0	**90**	**130**	**175**	**850**
8.2	90	135	180	870
8.4	90	140	185	890
8.6	95	140	190	910
8.8	95	145	195	930
9.0	**100**	**145**	**200**	**950**
9.2	100	150	200	980
9.4	105	155	205	1000
9.6	105	155	210	1030
9.8	110	160	215	1040
10.0	**110**	**160**	**220**	**1060**

Appendix 4: F-75 feed volumes for children with severe oedema

(**Amounts of F75 to provide 100kcal/kg/d)** (severe oedema (+++): generalised; including feet, lower and upper legs, arms, hands and face)

oedematous weight (kg)	2-hourly (ml/feed)	3-hourly (ml/feed)	4-hourly (ml/feed)
3.0	25	40	50
3.2	25	40	55
3.4	30	45	60
3.6	30	45	60
3.8	30	50	65
4.0	35	50	65
4.2	35	55	70
4.4	35	55	75
4.6	40	60	75
4.8	40	60	80
5.0	40	65	85
5.2	45	65	85
5.4	45	70	90
5.6	45	70	95
5.8	50	75	95
6.0	50	75	100
6.2	50	80	105
6.4	55	80	105
6.6	55	85	110
6.8	55	85	115
7.0	60	90	115
7.2	60	90	120
7.4	60	95	125
7.6	65	95	125
7.8	65	100	130
8.0	65	100	135
8.2	70	105	135
8.4	70	105	140
8.6	70	110	145
8.8	75	110	145
9.0	75	115	150
9.2	75	115	155
9.4	80	120	155
9.6	80	120	160
9.8	80	125	165
10.0	85	125	165
10.2	85	130	170
10.4	85	130	175
10.6	90	135	175
10.8	90	135	180
11.0	90	140	185
11.2	95	140	185
11.4	95	145	190
11.6	95	145	195
11.8	100	150	195
12.0	100	150	200

Appendix 5: Structured play activities

Play therapy is intended to develop language skills and motor activities aided by the use of 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 eg '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:
Every day encourage the child to perform the next motor milestone eg:

- bounce the child up and down and hold under the arms so that the feet support child's weight
- prop child up, roll toys out of reach, encourage child to crawl after them.
- hold hand and help 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 ring within reach and tempt child to grab it
- suspend ring over crib and encourage 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 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 child to take out blocks by turning container upside down.
- teach child to hold a block in each hand and bang them together.
- let child put blocks in and out of container saying *'in'*.
- 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 (eg

pieces of cloth).

- turn the container upside down and teach the child to put blocks *on top* of the container.

- teach 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 two then more, teach child to push them along making train or car noises. In older children teach *stop and go, fast and slow* and *next to*. After this teach to sort by colours, 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 bottle upside down and to take object out saying 'can you get it?' Then teach child to put the object in and out. Later try with several objects

Stacking Bottle Tops

- Let child play with 2 bottle tops then teach 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 *high and low*.

Books

- Sit child on lap. Get child to turn pages, pat pictures and vocalise. Later let child point to the picture you name. Talk about pictures, obtain pictures of similar 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 child.

- Teach 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.

If you have any comments or queries please contact

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