

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)

These guidelines have been prepared by Dr Ann Ashworth (London School of Hygiene and Tropical Medicine), Dr Sultana Khanum (WHO SE Asia Office), Professor Alan Jackson (University of Southampton), and Claire Schofield (London School of Hygiene and Tropical Medicine, supported by the Canadian International Development Agency) in collaboration with WHO (Geneva), notably Dr Djamal Benbouzid, Dr Graeme Clugston and Dr Olivier Fontaine, and with Professor Michael Golden (University of Aberdeen). Thanks are due to Professor Sally Grantham-McGregor (Institute of Child Health) for the play activities, and Professor John Waterlow, Professor Joe Millward, Dr Harry Campbell, Ann Burgess and Patricia Whitesell for advice and encouragement.

CONTENTS

A. General principles for routine care	Page 2
B. Treatment of associated conditions	Page 9
C. Failure to respond to treatment	Page 10
D. Discharge before recovery is complete	Page 12
E. Emergency treatment	Page 13

Appendices

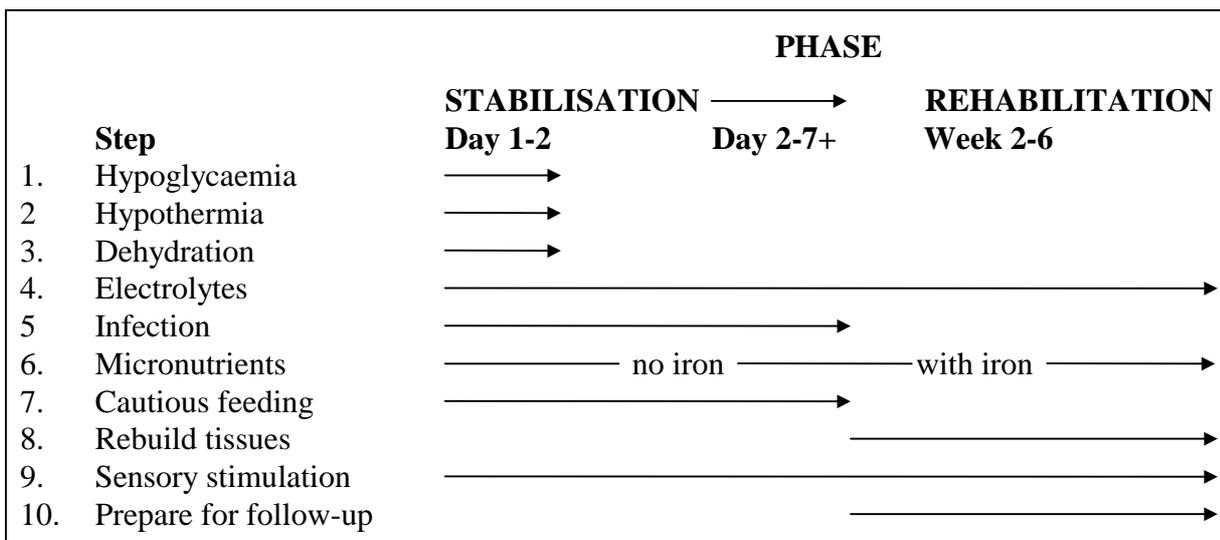
1. Recipes for ReSoMal oral rehydration solution & electrolyte/mineral solution
2. Recipes for F-75, F-100 and F-135 (starter and catch-up formulas)
3. F-75 feed volumes by feeding frequency and body weight
4. Structured play activities

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. Initiate refeeding
- 8. Facilitate 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 $< 35.0^{\circ}\text{C}$: rectal $< 35.5^{\circ}\text{C}$) is found. Frequent feeding is important in preventing both conditions.

If dextrostix is below 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 every 30 mins 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 below 3mmol/l repeat 50ml bolus of 10% glucose or sucrose solution, and continue feeding every 30 min until stable
- rectal temperature: if this falls $<35.5^{\circ}\text{C}$, 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 $<35.0^{\circ}\text{C}$, take the rectal temperature using a low reading thermometer.

If the rectal temperature is below 35.5°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 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 $>36.5^{\circ}\text{C}$ (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 night
- keep covered and away from draughts
- 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 **Rehydration Solution for Malnutrition (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
- initiate refeeding with starter F-75 (see step 7)

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

Monitor:-

assess progress of rehydration half-hourly for 2h, then hourly for the next 6-12h observing:-

- 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.

Prevention:-

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** to **ALL** admissions:-

- 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 amoxicillin 15mg/kg 8-hourly for 5 days, or if amoxicillin 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. Add 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 daily:-

- Multivitamin supplement
- Folic acid 1mg/d (give 5mg on Day 1)
- Zinc 2mg/kg/d
- Copper 0.2mg/kg/d
- once gaining weight, iron 3mg/kg/d
- 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

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. INITIATE REFEEDING

In the initial **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 initial 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 liquid (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.

If intake (after allowing for any vomiting) does not reach 80kcal/kg/d despite frequent feeds, coaxing and re-offering, give the remaining feed by NG tube. (Do not exceed 100 kcal/kg/d in this initial phase).

Monitor and note:-

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

During this initial 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. FACILITATE CATCH-UP GROWTH

In the rehabilitation phase a vigorous approach is required to achieve very high intakes and rapid weight gain of >10g gain/kg/d. 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 make a gradual transition from starter to catch-up formula:-

- replace starter F-75 with the same amount of catch-up formula F-100 for 48h. The recommended milk-based F-100 contains 100kcal and 2.9g protein/100ml (see appendix 2 for recipe). Modified porridges or modified family foods can be used provided they have comparable energy and protein concentrations.

- 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:-

- 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.)

Monitoring after the transition:-

Progress is assessed by 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

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 4 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. Dermatitis

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/diapers 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 <300mOsm/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 available

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:-

- is this for all cases (need major management overhaul)
- 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 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/day and adequate protein (at least 4g/kg/day). This will require 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.

- 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:-

- infuse IV fluid at 15ml/kg over 1 hour. Use half normal saline with 5% dextrose or Ringer's lactate with 5% dextrose, (if unavailable, give Ringer's lactate alone). Reassess after this.

If child is severely dehydrated there should be an improvement with IV treatment and respiratory and pulse rates will fall. In this case:-

- repeat IV 15ml/kg over 1 hour once more 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). Then initiate refeeding with starter F-75.

If child fails to improve after the first 15ml/kg/h, then assume that the child has septic shock. In this case:-

- give maintenance IV fluids (4ml/kg/hour) while waiting for blood. When blood is available, transfuse fresh whole blood at 10ml/kg *slowly* over 3h. Then initiate refeeding with starter F-75 (step 7)

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

(In mild or moderate anaemia, iron should be given for two months to replete iron stores **BUT this should not be started** until after the initial stabilisation phase has been completed).

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.

APPENDIX 1: RECIPE FOR ReSoMal ORAL REHYDRATION SOLUTION

Ingredient	Amount
Water	2 litres
WHO-ORS	one 1 litre-packet*
Sucrose	50g
Electrolyte/ mineral solution	40ml

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

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	<u>molar content of 20 ml</u>
Potassium Chloride:KCl	224	24mmol
Tripotassium Citrate: C ₆ H ₅ K ₃ O ₇ .H ₂ O	81	2mmol
Magnesium Chloride:MgCl ₂ 6.H ₂ O	76	3mmol
Zinc Acetate:Zn(CH ₃ COO) ₂ .2H ₂ O	8.2	300umol
Copper Sulphate:CuSO ₄ .5H ₂ O	1.4	45umol
Water: make up to	2500ml	

If available, also add selenium (sodium selenate 0.028g NaSeO₄ 10H₂O) and iodine (potassium iodide 0.012g KI per 2500ml)

Note: 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 are not available, give K, Mg and Zn separately:-

Make a 10% stock solution of potassium chloride (100g KCl in 1 litre of water) and a 1.5% solution of zinc acetate (15g zinc acetate in 1 litre of water).

For the oral rehydration solution, use 45ml of the stock KCl solution instead of 40ml electrolyte/mineral solution.

For milk feeds, add 22.5ml of the stock KCl solution instead of 20ml of the electrolyte/mineral solution to 1000ml of feed.

Give the 1.5% zinc acetate solution by mouth 1ml/kg/day

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

APPENDIX 2: RECIPES FOR F-75, F-100 AND F-135

RECIPES FOR	F-75 ^{a,b,c}	F-100 ^d	F-135 ^e
	(starter)	(catch-up)	(catch-up)
Dried skimmed milk (g)	25	80	90
Sugar (g)	100	50	65
Vegetable oil (g)	30	60	85
Electrolyte/mineral solution (ml)	20	20	27
Water: make up to	1000ml	1000ml	1000ml
Contents per 100 ml	F-75	F-100	F-135
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	5.7
osmolarity (mOsmol/l)	413	419	508

To make up:-

- Using an electric blender mix the dried skimmed milk, sugar and oil with warm boiled water, add electrolyte/mineral solution-make up to 1000ml and blend at high speed
- If no mixer is available, mix the milk, sugar, oil and electrolyte/mineral solution to a paste, and then slowly add the warm boiled water-make up to 1000ml

^a Comparable starter formulas can be made from 35g whole dried milk, 100g sugar, 20g oil, 20ml electrolyte/mineral solution and water to 1000ml, or with 300ml fresh cow's milk, 100g sugar, 20ml oil, 20ml electrolyte mineral/solution and water to 1000ml.

^b 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 micronutrients) are incorporated.

^c A low osmolar cereal-based F-75 (334mOsmol/l) can be made by replacing 30g sugar by 35g cereal flour. Cook for 4 minutes. This may be helpful for children with osmotic diarrhoea.

^d Comparable catch-up formulas can be made from 110g whole dried milk, 50g sugar, 30g oil, 20ml electrolyte/mineral solution and water to 1000ml or 880ml fresh cow's milk, 75g sugar, 20ml oil, 20ml electrolyte/mineral solution and water to 1000ml.

^e For use in special circumstances (see section C2a, inadequate feeding)

APPENDIX 3: F-75 FEED VOLUMES BY FEEDING FREQUENCY AND BODY WEIGHT (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)
2.0	20	30	45
2.2	25	35	50
2.4	25	40	55
2.6	30	45	55
2.8	30	45	60
3.0	35	50	65
3.2	35	55	70
3.4	35	55	75
3.6	40	60	80
3.8	40	60	85
4.0	45	65	90
4.2	45	70	90
4.4	50	70	95
4.6	50	75	100
4.8	55	80	105
5.0	55	80	110
5.2	55	85	115
5.4	60	90	120
5.6	60	90	125
5.8	65	95	130
6.0	65	100	130
6.2	70	100	135
6.4	70	105	140
6.6	75	110	145
6.8	75	110	150
7.0	75	115	155
7.2	80	120	160
7.4	80	120	160
7.6	85	125	165
7.8	85	130	170
8.0	90	130	175
8.2	90	135	180
8.4	90	140	185
8.6	95	140	190
8.8	95	145	195
9.0	100	145	200
9.2	100	150	200
9.4	105	155	205
9.6	105	155	210
9.8	110	160	215
10.0	110	160	220

APPENDIX 4. 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.

Illustrations of the toys can be sent by post on request.

If you have any comments or queries please contact

Ann Ashworth Hill, Reader in Community Nutrition or Claire Schofield, Lecturer in Human Nutrition in the Public Health Nutrition Unit at the London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK.

E-mail addresses

A.Hill@lshtm.ac.uk

C.Schofield@lshtm.ac.uk

Last updated: 7 October, 1998.