

Management of severe malnutrition:

a manual for physicians and
other senior health workers



World Health Organization
Geneva

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Preface

Malnutrition remains one of the most common causes of morbidity and mortality among children throughout the world. Approximately 9% of children below 5 years of age suffer from wasting (weight-for-height below -2 standard deviations (<-2 SD) of the National Center for Health Statistics (NCHS)/WHO reference values) and are at risk of death or severe impairment of growth and psychological development.

This manual is based on *The treatment and management of severe protein-energy malnutrition*, which was published by WHO in 1981. Since then, many advances have been made in the treatment of severe malnutrition. An improved oral rehydration salts (ORS) solution has been developed for the treatment of dehydration. Advances in knowledge of the physiological roles of micronutrients have led to improved dietary management during the initial phase of treatment. It has been shown that physical and psychological stimulation, as well as care and affection, are necessary during the rehabilitation phase in order to prevent retardation of growth and psychological development.

This manual provides guidelines for the treatment of severely malnourished children (below 5 years of age) in hospitals and health centres. The treatment of severely malnourished adolescents and adults is also briefly considered. The manual is intended for health personnel working at central and district level, including physicians, nurses, midwives and auxiliaries.

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1. Introduction

This manual provides practical guidelines for the management of patients with severe malnutrition.¹ It seeks to promote the best available therapy so as to reduce the risk of death, shorten the length of time spent in hospital, and facilitate rehabilitation and full recovery. Emphasis is given here to the management of severely malnourished children; the management of severely malnourished adults and adolescents is also considered briefly.

Severe malnutrition is both a medical and a social disorder. That is, the medical problems of the child result, in part, from the social problems of the home in which the child lives. Malnutrition is the end result of chronic nutritional and, frequently, emotional deprivation by carers who, because of poor understanding, poverty or family problems, are unable to provide the child with the nutrition and care he or she requires. Successful management of the severely malnourished child requires that both medical and social problems be recognized and corrected. If the illness is viewed as being only a medical disorder, the child is likely to relapse when he or she returns home, and other children in the family will remain at risk of developing the same problem.

Table 1. Time-frame for the management of a child with severe malnutrition

Activity	Initial treatment:		Rehabilitation:	Follow-up:
	days 1-2	days 3-7	weeks 2-6	weeks 7-26
Treat or prevent: hypoglycaemia	----->			
hypothermia	----->			
dehydration	----->			
Correct electrolyte imbalance	----->			
Treat infection	----->			
Correct micronutrient deficiencies	←-----	without iron	with iron----->	
Begin feeding	----->			
Increase feeding to recover lost weight ("catch-up growth")			----->	
Stimulate emotional and sensorial development	----->			
Prepare for discharge			----->	

¹ "Malnutrition" and "malnourished" are used as synonyms of "undernutrition" and "undernourished", respectively.

Management of the child with severe malnutrition is divided into three phases. These are:

- *Initial treatment*: life-threatening problems are identified and treated in a hospital or a residential care facility, specific deficiencies are corrected, metabolic abnormalities are reversed and feeding is begun.
- *Rehabilitation*: intensive feeding is given to recover most of the lost weight, emotional and physical stimulation are increased, the mother or carer is trained to continue care at home, and preparations are made for discharge of the child.
- *Follow-up*: after discharge, the child and the child's family are followed to prevent relapse and assure the continued physical, mental and emotional development of the child.

A typical time-frame for the management of a child with severe malnutrition is shown in Table 1.

Successful management of the severely malnourished child does not require sophisticated facilities and equipment or highly qualified personnel. It does, however, require that each child be treated with proper care and affection, and that each phase of treatment be carried out properly by appropriately trained and dedicated health workers. When this is done, the risk of death can be substantially reduced¹ and the opportunity for full recovery greatly improved.

¹ For the purposes of this manual, a case-fatality rate of >20% is considered unacceptable, 11–20% is poor, 5–10% is moderate, 1–4% is good and <1% is excellent.

2. Treatment facilities

Residential care is essential for initial treatment and for the beginning of rehabilitation of a child with severe malnutrition. The child should be admitted to hospital, preferably to a special nutrition unit, which is an area in a general hospital that is dedicated to the initial management and rehabilitation of severe malnutrition. When the child has completed the initial phase of treatment, has no complications, and is eating satisfactorily and gaining weight (usually 2–3 weeks after admission), he or she can usually be managed at a non-residential nutrition rehabilitation centre. A nutrition rehabilitation centre is a day hospital, primary health centre or similar facility that provides daytime care by staff trained in the rehabilitation of malnourished children. The child sleeps at home, is brought to the centre each morning, and returns home each evening. Close cooperation between the hospital and centre is necessary to ensure continuity of care for the child and facilitate returning the child quickly to hospital, should a serious problem develop. In urban areas, nutrition rehabilitation centres should preferably be established close to hospital facilities. In areas where there are no specialized centres, the hospital must continue to provide care until the child is ready for discharge. Important features of residential and non-residential treatment facilities are compared in Table 2.

Table 2. Comparison of residential and non-residential facilities for treating severely malnourished children

Feature	Residential care (hospital)	Non-residential care (nutrition rehabilitation centre)
Daily transport required	No	Yes
Number and level of training of staff	Large number, formally trained	Fewer staff, informally trained
Diagnostic, consultant and support services	Usually available	Patient must be taken to hospital
Emergency care	Available at all times	Patient may need to be taken to hospital
Care available 24 h per day	Yes	No
Patient can be fed throughout the night	Yes	No
Inappropriate remedies can be given at home	No	Yes
Child separated from mother	Sometimes	No
Rate of staff turnover	High	Low
Risk of cross-infection	High	Moderate
Intimidating for parents and children	Often	Sometimes
Financial cost	High	Moderate
Cost in terms of parental time required	Moderate	High

3.

Evaluation of the malnourished child

When first seen, the child must be examined, a history taken and a decision made on the treatment to be given. Treatment should be started as soon as these tasks have been completed; details of the history and examination should be recorded later. Very sick children respond badly to frequent handling; they should not be taken for X-rays initially and should remain in bed while clinical specimens are taken.

3.1 Assessment of nutritional status and criteria for admission

The assessment of nutritional status according to weight-for-height (or length),¹ height (or length)-for-age¹ and oedema is summarized in Table 3. Also shown are the criteria for classifying severe malnutrition as "oedematous", "severely wasted" or "severely stunted". Reference values for weight-for-height or length are given in Appendix 1.

Children whose weight-for-height is below -3 SD or less than 70% of the median NCHS/WHO reference values (termed "severely wasted"), or who have symmetrical oedema involving at least the feet (termed "oedematous malnutrition") are severely malnourished. They should be admitted to hospital where they can be observed, treated and fed day and night.

Table 3. Classification of malnutrition^a

	Classification	
	Moderate malnutrition	Severe malnutrition (type) ^b
Symmetrical oedema	No	Yes (oedematous malnutrition) ^c
Weight-for-height	-3 ≤ SD-score < -2 ^d (70-79%) ^e	SD-score < -3 (<70%) (severe wasting) ^f
Height-for-age	-3 ≤ SD-score < -2 (85-89%)	SD-score < -3 (<85%) (severe stunting)

^a For further information about anthropometric indicators, see reference 1.

^b The diagnoses are not mutually exclusive.

^c This includes kwashiorkor and marasmic kwashiorkor in older classifications. However, to avoid confusion with the clinical syndrome of kwashiorkor, which includes other features, the term "oedematous malnutrition" is preferred.

^d Below the median NCHS/WHO reference; the SD-score is defined as the deviation of the value for an individual from the median value of the reference population, divided by the standard deviation of the reference population.

$$\text{SD-score} = \frac{(\text{observed value}) - (\text{median reference value})}{\text{standard deviation of reference population}}$$

^e Percentage of the median NCHS/WHO reference (see footnote in Appendix 1).

^f This corresponds to marasmus (without oedema) in the Wellcome clinical classification (2, 3), and to grade III malnutrition in the Gomez system (4). However, to avoid confusion, the term "severe wasting" is preferred.

¹ In this manual length and height, as well as weight-for-length and weight-for-height, are used interchangeably. Children who are below 24 months, less than 85 cm tall, or too ill to stand should have their *length* measured while they are lying down. Children who are 24 months or more and 85 cm or more tall, and who are able to stand should have their *height* measured.

Stunted children are usually considered to have a milder, chronic form of malnutrition. Their condition can rapidly worsen, however, with the onset of complications such as diarrhoea, respiratory infections or measles. Stunted children may be satisfactorily managed in the community, rather than in hospital. Management of children with severe stunting should follow guidelines for “preparation for discharge” (see section 5.5).

3.2 History and physical examination

A checklist for taking the child's medical history and conducting the physical examination is given in the box below. It helps to use a printed proforma so that the information is collected and recorded in a standard manner. A sample recording form is given in Appendix 2, which may be adapted to local conditions.

Checklist of points for taking the child's medical history and conducting the physical examination

Medical history:

- Usual diet before current episode of illness
- Breastfeeding history
- Food and fluids taken in past few days
- Recent sinking of eyes
- Duration and frequency of vomiting or diarrhoea, appearance of vomit or diarrhoeal stools
- Time when urine was last passed
- Contact with people with measles or tuberculosis
- Any deaths of siblings
- Birth weight
- Milestones reached (sitting up, standing, etc.)
- Immunizations

Physical examination:

- Weight and length or height
- Oedema
- Enlargement or tenderness of liver, jaundice
- Abdominal distension, bowel sounds, “abdominal splash” (a splashing sound in the abdomen)
- Severe pallor
- Signs of circulatory collapse: cold hands and feet, weak radial pulse, diminished consciousness
- Temperature: hypothermia or fever
- Thirst
- Eyes: corneal lesions indicative of vitamin A deficiency
- Ears, mouth, throat: evidence of infection
- Skin: evidence of infection or purpura
- Respiratory rate and type of respiration: signs of pneumonia or heart failure
- Appearance of faeces

3.3 Laboratory tests

Where facilities permit, the tests given in Table 4 may help to diagnose specific problems. They are not needed, however, to guide or monitor treatment. The interpretation of test results is frequently altered by malnutrition. For this reason, laboratory tests may misguide inexperienced workers. The most important guide to treatment is frequent careful assessment of the child.

Table 4. Laboratory tests

Test	Result and significance
Tests that may be useful	
Blood glucose	Glucose concentration <54 mg/dl (3 mmol/l) is indicative of hypoglycaemia
Examination of blood smear by microscopy	Presence of malaria parasites is indicative of infection
Haemoglobin or packed-cell volume	Haemoglobin <40 g/l or packed-cell volume <12% is indicative of very severe anaemia
Examination and culture of urine specimen	Presence of bacteria on microscopy (or >10 leukocytes per high-power field) is indicative of infection
Examination of faeces by microscopy	Presence of blood is indicative of dysentery Presence of <i>Giardia</i> cysts or trophozoites is indicative of infection
Chest X-ray	Pneumonia causes less shadowing of the lungs in malnourished children than in well-nourished children Vascular engorgement is indicative of heart failure Bones may show rickets or fractures of the ribs
Skin test for tuberculosis	Often negative in children with tuberculosis or those previously vaccinated with BCG vaccine
Tests that are of little or no value	
Serum proteins	Not useful in management, but may guide prognosis
Test for human immunodeficiency virus (HIV)	Should not be done routinely; if done, should be accompanied by counselling of the child's parents and result should be confidential
Electrolytes	Rarely helpful and may lead to inappropriate therapy

4.

Initial treatment

4.1 Principles of management

Children with severe malnutrition are often seriously ill when they first present for treatment. Wasting, anorexia and infections are common. Wherever possible, severely malnourished children should be referred to hospital. Successful initial management requires frequent, careful clinical evaluation and anticipation of common problems so they can be prevented, or recognized and treated at an early stage. The physiology of malnourished children is seriously abnormal; how this affects their management is summarized in Appendix 3.

Recently admitted children should be kept in a special area where they can be *constantly monitored*. Because they are very susceptible to infection, they should, if possible, be isolated from other patients. The child should not be kept near a window or in a draught, and windows should be closed at night. The child should be properly covered with clothes, including a hat, and blankets. Washing should be kept to a minimum and, if necessary, done during the day. When the child is washed he or she must be dried immediately and properly. The room temperature should be kept at 25–30 °C (77–86 °F). This will seem uncomfortably warm for active, fully clothed staff, but is necessary for small, immobile children who easily become hypothermic.

Intravenous infusions should be avoided except when essential, as for severe dehydration or septic shock. Intramuscular injections should be given with care in the buttock, using the smallest possible gauge needle and volume of fluid.

Initial treatment begins with admission to hospital and lasts until the child's condition is stable and his or her appetite has returned, which is usually after 2–7 days. If the initial phase takes longer than 10 days, the child is failing to respond and additional measures are required (see section 7). The principal tasks during initial treatment are:

- to treat or prevent hypoglycaemia and hypothermia;
- to treat or prevent dehydration and restore electrolyte balance;
- to treat incipient or developed septic shock, if present;
- to start to feed the child;
- to treat infection;
- to identify and treat any other problems, including vitamin deficiency, severe anaemia and heart failure.

These tasks are described in detail below.

4.2 Hypoglycaemia

All severely malnourished children are at risk of developing hypoglycaemia (blood glucose <54 mg/dl or <3 mmol/l), which is an important cause of death during the first 2 days of treatment. Hypoglycaemia may be caused by a serious systemic infection or can occur when a malnourished child has not been fed for 4–6 hours, as often happens during travel to hospital. To prevent hypoglycaemia the child should be fed at least every 2 or 3 hours day and night (see section 4.5).

Signs of hypoglycaemia include low body temperature ($<36.5^{\circ}\text{C}$), lethargy, limpness and loss of consciousness. Sweating and pallor do not usually occur in malnourished children with hypoglycaemia. Often, the only sign before death is drowsiness.

If hypoglycaemia is suspected, treatment should be given *immediately without laboratory confirmation*; it can do no harm, even if the diagnosis is incorrect. If the patient is conscious or can be roused and is able to drink, give 50 ml of 10% glucose or sucrose, or give F-75 diet by mouth (see section 4.5), whichever is available most quickly. If only 50% glucose solution is available, dilute one part to four parts of sterile water. Stay with the child until he or she is fully alert.

If the child is losing consciousness, cannot be aroused or has convulsions, give 5 ml/kg of body weight of sterile 10% glucose intravenously (IV), followed by 50 ml of 10% glucose or sucrose by nasogastric (NG) tube. If IV glucose cannot be given immediately, give the NG dose first. When the child regains consciousness, immediately begin giving F-75 diet or glucose in water (60 g/l). Continue frequent oral or NG feeding with F-75 diet to prevent a recurrence.

All malnourished children with suspected hypoglycaemia should also be treated with broad-spectrum antimicrobials for serious systemic infection (see section 4.6).

4.3 Hypothermia

Infants under 12 months, and those with marasmus, large areas of damaged skin or serious infections are highly susceptible to hypothermia. If the rectal temperature is below 35.5°C (95.9°F) or the underarm temperature is below 35.0°C (95.0°F), the child should be warmed. Either use the “kangaroo technique” by placing the child on the mother’s bare chest or abdomen (skin-to-skin) and covering both of them, or clothe the child well (including the head), cover with a warmed blanket and place an incandescent lamp over, but not touching, the child’s body. Fluorescent lamps are of no use and hot-water bottles are dangerous.

The rectal temperature must be measured every 30 minutes during rewarming with a lamp, as the child may rapidly become hyperthermic. The underarm temperature is not a reliable guide to body temperature during rewarming.

All hypothermic children must also be treated for hypoglycaemia (see section 4.2) and for serious systemic infection (see section 4.6).

4.4 Dehydration and septic shock

Dehydration and septic shock are difficult to differentiate in a child with severe malnutrition. Signs of hypovolaemia are seen in both conditions, and progressively worsen if treatment is not given. Dehydration progresses from “some” to “severe”, reflecting 5–10% and $>10\%$ weight loss, respectively, whereas septic shock progresses from “incipient” to “developed”, as blood flow to the vital organs decreases. Moreover, in many cases of septic shock there is a history of diarrhoea and some degree of dehydration, giving a mixed clinical picture.

Diagnosis

Many of the signs that are normally used to assess dehydration are unreliable in a child with severe malnutrition, making it difficult or impossible to detect dehydration reliably or determine its severity. Moreover, many signs of dehydration are also seen in septic shock. This has two results:

- dehydration tends to be overdiagnosed and its severity overestimated; and
- it is often necessary to treat the child for both dehydration and septic shock.

- (a) Signs of dehydration and/or septic shock that are reliable in a child with severe malnutrition include:

History of diarrhoea. A child with dehydration should have a history of watery diarrhoea. Small mucoid stools are commonly seen in severe malnutrition, but do not cause dehydration. A child with signs of dehydration, but without watery diarrhoea, should be treated as having septic shock.

Thirst. Drinking eagerly is a reliable sign of "some" dehydration. In infants this may be expressed as restlessness. Thirst is *not* a symptom of septic shock.

Hypothermia. When present, this is a sign of serious infection, including septic shock. It is *not* a sign of dehydration.

Sunken eyes. These are a helpful sign of dehydration, but only when the mother says the sunken appearance is recent.

Weak or absent radial pulse. This is a sign of shock, from either severe dehydration or sepsis. As hypovolaemia develops, the pulse rate increases and the pulse becomes weaker. If the pulse in the carotid, femoral or brachial artery is weak, the child is at risk of dying and must be treated urgently.

Cold hands and feet. This is a sign of both severe dehydration and septic shock. It should be assessed with the back of the hand.

Urine flow. Urine flow diminishes as dehydration or septic shock worsens. In severe dehydration or fully developed septic shock, no urine is formed.

- (b) Signs of dehydration that are *not reliable* include:

Mental state. A severely malnourished child is usually apathetic when left alone and irritable when handled. As dehydration worsens, the child progressively loses consciousness. Hypoglycaemia, hypothermia and septic shock also cause reduced consciousness.

Mouth, tongue and tears. The salivary and lacrimal glands are atrophied in severe malnutrition, so the child usually has a dry mouth and absent tears. Breathing through the mouth also makes the mouth dry.

Skin elasticity. The loss of supporting tissues and absence of subcutaneous fat make the skin thin and loose. It flattens very slowly when pinched, or may not flatten at all. Oedema, if present, may mask diminished elasticity of the skin.

The clinical features of dehydration and septic shock are compared in Table 5.

- (c) Additional signs of septic shock:

Incipient septic shock. The child is usually limp, apathetic and profoundly anorexic, but is neither thirsty nor restless.

Developed septic shock. The superficial veins, such as the external jugular and scalp veins, are dilated rather than constricted. The veins in the lungs may also become engorged, making the lungs stiffer than normal. For this reason the child may groan, grunt, have a shallow cough and appear to have difficulty breathing. As shock worsens, kidney, liver, intestinal or cardiac failure may occur. There may be vomiting of blood mixed with stomach contents ("coffee-ground vomit"), blood in the stool, and abdominal distension with "abdominal splash"; intestinal fluid may be visible on X-ray. When a child reaches this stage, survival is unlikely.

Treatment of dehydration

Whenever possible, a dehydrated child with severe malnutrition should be rehydrated

Table 5. Comparison of clinical signs of dehydration and septic shock in the severely malnourished child

Clinical sign	Some dehydration	Severe dehydration	Incipient septic shock	Developed septic shock
Watery diarrhoea	Yes	Yes	Yes or no ^a	Yes or no ^a
Thirst	Drinks eagerly ^b	Drinks poorly	No ^a	No ^a
Hypothermia	No	No	Yes ^a or no	Yes ^a or no
Sunken eyes	Yes ^{b,c}	Yes ^{b,c}	No ^a	No ^a
Weak or absent radial pulse	No ^b	Yes	Yes	Yes
Cold hands and feet	No ^b	Yes	Yes	Yes
Urine flow	Yes	No	Yes	No
Mental state	Restless, irritable ^b	Lethargic, comatose	Apathetic ^a	Lethargic
Hypoglycaemia	Sometimes	Sometimes	Sometimes	Sometimes

^a Signs that may be useful in diagnosing septic shock.^b Signs that may be useful in diagnosing dehydration.^c If confirmed as recent by the mother.

orally. IV infusion easily causes overhydration and heart failure and should be used *only* when there are definite signs of shock.

Oral rehydration salts (ORS) solution for severely malnourished children

Because severely malnourished children are deficient in potassium and have abnormally high levels of sodium, the oral rehydration salts (ORS) solution should contain less sodium and more potassium than the standard WHO-recommended solution. Magnesium, zinc and copper should also be given to correct deficiencies of these minerals. The composition of the recommended ORS solution for severely malnourished children (ReSoMal) is given in Table 6.

ReSoMal is available commercially. However, ReSoMal can also be made by diluting one packet of the standard WHO-recommended ORS in 2 litres of water, instead of 1 litre, and adding 50 g of sucrose (25 g/l) and 40 ml (20 ml/l) of mineral mix solution¹ (see Appendix 4).

Amount of ReSoMal to give

Between 70 and 100 ml of ReSoMal per kg of body weight is usually enough to restore normal hydration. Give this amount over 12 hours, starting with 5 ml/kg every 30 minutes for the first 2 hours orally or by NG tube, and then 5–10 ml/kg per hour. This rate is slower than for children who are not severely malnourished. Reassess the child *at least* every hour. The exact amount to give should be determined by how much the child will drink, the amount of ongoing losses in the stool, and whether the child is vomiting and has any signs of overhydration, especially signs of heart failure. ReSoMal should be stopped if:

- the respiratory and pulse rates increase;
- the jugular veins become engorged; or
- there is increasing oedema (e.g. puffy eyelids).

Rehydration is completed when the child is no longer thirsty, urine is passed and any other signs of dehydration have disappeared. Fluids given to maintain hydration should

¹ Contains the mineral salts needed to prepare ReSoMal from the standard WHO-recommended ORS solution. The same salts are also added to the child's food (see section 4.5 and Appendix 4).