8. Camp administration, transportation, and food storage

Relief programmes are doomed to failure if the administrative and operational aspects are poorly managed.

Camps must be properly administered. Auxiliary personnel should be recruited from the population assisted and receive fixed salaries or work on a clearly defined food-for-work basis. Key personnel should not be from the population assisted as they are likely to be subjected to heavy pressure.

Transportation needs careful planning and close supervision to reduce thefts, waste, etc. Local traditional transportation (e.g., animals) is often the cheapest and most reliable.

Foods are perishable. Storage at the local level should meet some minimum requirements. Of these, cleanliness of the store and up-to-date stock-cards are the most important.

In the past, relief efforts have been more seriously impaired by lack of proper management than by neglect or ignorance of nutritional principles or techniques.

Camp administration

The number of hired personnel should be restricted to a few essential posts:

— store keeper, food supervisor

— registry clerk (with helpers, depending on size of camp)

— camp supervisor (distributions, sanitation)
— guards (if security is not provided by the authorities) with fixed salaries and working hours.

The responsible personnel should live close to the camp in proper lodgings. They must be familiar with the habits of the people they are assisting and speak their language. The use of interpreters may lead to misunderstandings, especially between foreign volunteers and nationals, because they sometimes tend to put their own views into their interpretations. It is recommended that the key personnel not be recruited from the assisted group because they are likely to be subjected to strong pressure.

As far as possible, the other personnel needed (for distribution, cooking, etc.) should be recruited within the camp on a clearly defined food-for-work basis.

The office should have proper tables and chairs, registry book(s), and a map of the camp on the wall, with the different sectors marked. There should also be a chart, preferably a blackboard indicating the number of inhabitants for each sector, as a basis for programmes of all kinds. A clearly written list of the names of the staff is helpful for visitors.

There should be a sheltered porch for waiting visitors.

The office should be locked after working hours.

A camp committee helps to obtain cooperation with the administration. There should at least be a contact group, consisting of one or more people in each sector of the camp, to spread information about distributions, vaccinations, important visits, changes in programmes, etc.

Transportation

Foods are bulky. Their transportation is often the cause of bottlenecks in a relief operation.

- To provide a full dry ration for one week to 10 000 persons, 12 three-ton truckloads are necessary (i.e., some 36 000 kg).
- A 4-wheel vehicle can carry about 500 kg of food in addition to the team in charge of food distribution and surveillance. This is the daily requirement of 20 families (5 persons each) or one supplementary meal for 250 children.
- Medical officers and supervisors need adequate transportation on a full-time basis. No supervision is possible without transport.
- Under bad conditions at least one out of 10 vehicles will be immobilized at any time for maintenance or repair.
- Considerable delays due to bad weather, poor roads, and breakdowns are common.

Therefore:

- A *realistic* itinerary should be planned long in advance. It should be flexible—the unexpected is part of the daily routine during emergencies.
- Use local traditional transportation as much and as early as possible. It is cheap and reliable. A camel can cover an average of 15 km per day and carry 200 kg. A donkey can carry only half of that but can negotiate very difficult country. For short distances, bicycle delivery can be very valuable (load 50 kg) as maintenance is relatively simple.

FIG. 17 BILL OF LADING [a]

TO	NO
DATE	FROM
	VEHICLE NO

DESPATCHED			RECEIVED		
Commodity	Number of bags/ containers	Condition	Commodity	Number of bags/ containers	Condition

Warehouse	*Transporter*	*Consignee*
Despatched Date Time	I acknowledge that the supplies listed above have been received for transportation to the designated address	I certify that all the items listed, unless otherwise noted, have been received
Warehouseman's signature and stamp:	Carrier's signature:	Consignee's signature.

[a] From *Food emergency manual* Rome, World Food Programme (new edition in preparation)

Close supervision will reduce thefts during transportation. Each consignment should be accompanied by a "bill of lading" (Fig. 17) in at least two copies, of which one is returned to the head storekeeper with the signature of the receiver after careful checking when unloading. Damage to bags should be reported on this form. This simple procedure can save much food, provided appropriate sanctions are taken when indicated.

Each vehicle should have a log-book recording mileage and fuel; this should be checked regularly to prevent unauthorized trips and fuel thefts.

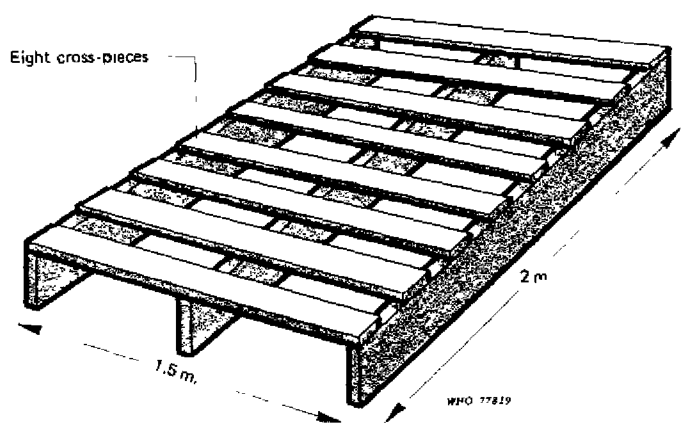
Food storage

Foods are perishable. Careful storage can minimize waste.

(*a*) *Storage at local level* should meet the following requirements.

- A "rule of thumb" is that one ton of processed foods in bags occupies a volume of approximately 2 m^3. The usable space of a store is at least 25% less than the total volume.
- The store should have a good roof and be dry and well ventilated. Whenever possible, use modern buildings for storage.
- Bags must not lie directly on the floor. Use pallets (Fig. 18), boards, heavy branches, or bricks, or put a layer of clean dry polyethylene bags underneath.
- Keep products at least 40 cm from the wall and 10 cm from the floor.
- Keep damaged bags apart from undamaged bags (possibly in a separate area). Keep a reserve of good empty bags.
- Keep each product separately.
- Pile the bags two by two crosswise to permit ventilation. In this way, they are steadier and easier to count.
- To avoid difficulty in handling and to keep packages from falling, do not stack them too high.

FIG 18 PALLET



Use boards 5 × 10 cm (on edge) for runners and strips 2 5 × 5 cm (laid flat) for crosspieces

(b) A close watch must be kept on food.

- Limit access to the store to a few authorized persons.
- The key should stay with the storekeeper.
- Every item should have its own stock card (Fig. 19).
- The balance shown on the stock cards must be checked periodically by counting the actual number of items in stock.

- Food rotation is essential: the last food in should be the last to come out. Many items are marked with a date of manufacture. This date is often coded in the contract number on the bag. The local representative of the donor may help decode it.

FIG. 19 EXAMPLE OF STOCK CARD

CSM[a]
Bags (22 5 kg)

Date	Origin or destination	Received (in)	Distributed (out)	Balance (in stock)
10 May	From central store	32	—	32
12 May	To village A	—	10	22
13 May	From central store	27	—	49
" "	To mobile team	—	5	44
" "	To village B	—	7	37

[a] With locally bought food, the weight of bags might vary. The card then records kilograms rather than number of bags

(*c*) *Rats and vermin*

Spilled foods or refuse attract rodents, insects and birds. The best method of control is to keep the food store clean. Store broken bags in a separate area and enclose the contents in a polyethylene bag. Keeping cats in the store helps to control rats.

Chemical control

Fumigation with methyl bromide or phosphine is a very effective way of killing rodents and insects in the store and vermin inside the bags. Fumigants are not expensive but may be toxic to human beings. If the manufacturer's instructions are carefully followed (dosage time, protection, etc.) the technique is safe and the food not impaired.

Poison baits are not very effective, especially if there is plenty of spilled food available.

Insecticides: spraying the store regularly with DDT or other products is an effective measure (the outer paper layer of most imported bags has already been impregnated with insecticides). Do not spray unless all bags are closed and the food is protected from direct contact with the insecticide.

(d) Disposal of spoiled foods

Particularly in tropical climates, it is almost inevitable that certain food items like cereals and dried fish get infested with vermin. People are often used to this, and the nutritional value of the foods is not changed and their safety may not be affected. Wet bags should be dried in the sun before being piled up and stored. Infested bags should be taken out and weevils sieved out. Distribute infested cereals or blends as soon as possible. Weevils or worms will float on water when the grains are soaked. Note that hard lumps in milk bags are harmless as long as there is no rancid smell.

Annex 1

Review of basic facts about food and nutrition

Nutrient requirements of humans

Nutrients

All foods are made up of five basic types of nutrient: carbohydrates, fats, proteins, vitamins, and minerals, in addition to variable amounts of water.

Carbohydrates

Carbohydrates are mostly starches and sugars of vegetable origin, being, for example, a major component of cereals and tubers. They are primarily a source of energy.

Fats and oils

Fats and oils are also a source of energy, having more than twice the energy content of carbohydrates and proteins In most poor countries, most of the energy is derived from carbohydrate sources, especially cereals—fats accounting for a much smaller proportion.

Proteins

Proteins are body-building substances. Some proportion of protein is found in almost all human foods. Cereals, for example, contain about 8–12% protein. All proteins are composed of amino acids, of which some cannot be made by the body. These are called essential amino acids and must be obtained from food.

Proteins of animal origin contain all the essential amino acids in adequate amounts and are found in milk, meat, eggs, cheese, fish, and fowl.

Proteins of vegetable origin contain limited quantities of some of the essential amino acids. However, by combining different vegetable foods, e.g., cereals with legumes, or by adding some animal protein to vegetable sources, mixtures of higher quality can be obtained. It is possible for a human being to obtain an adequate quality of protein from mixed vegetable sources without eating protein from animal sources.

Vitamins

Vitamins are needed for the adequate functioning of the body. There are two main groups: first, *water-soluble vitamins*, e.g., the vitamin B complex—thiamine (B1), riboflavin (B2), and niacin—and vitamin C. Whole cereals, legumes, other vegetables, and animal foods are adequate sources of the B-complex vitamins. Vitamin C is found in raw fruits and vegetables. Vitamins A and D are examples of the other main group: *fat-soluble vitamins.* They are found in most animal products and significant amounts are stored in the body (liver, etc.). Vitamin A can also be formed in the body from pigments of yellow and green vegetables and fruits (carotenes) and vitamin D can be produced in the skin by exposure to sunlight.

Minerals

Iron is required for the formation of the red pigment in the blood (haemoglobin). Iron deficiency is a common cause of anaemia in many countries. Leafy vegetables, red meats, and fish are good sources of iron.

Sodium and potassium deficiency is only likely to be seen in individuals with profuse diarrhoea (see Chapter 8). Several other minerals are essential to the diet, but are not usually critical in emergency situations.

Water

Water is essential to sustain life. For practical purposes, water requirements may be considered to consist of the amount needed for replacement of the losses in faeces, urine, and transpiration. Young children are extremely vulnerable to dehydration (e.g., through profuse diarrhoea, vomiting, sweating).

The average minimum daily requirements of healthy children in warm climates are approximately as follows:

— at 1 month 400 ml
— at 4 months 600 ml
— at 12 months 800 ml
— at 3 years 1000 ml

Most infant foods, including milk, provide about 0.3 MJ (70 $kcal_{th}$)/100 ml and 95% of their volume is water. When the energy content of food approaches 0.42 MJ (100 $kcal_{th}$)/100 ml, the water content is only 90% of the volume of the food.

RECOMMENDED DAILY ENERGY AND PROTEIN INTAKES[a] FOR HEALTHY INDIVIDUALS

Group	Energy MJ ($kcal_{th}$)	Protein (g)[b]		Approximate proportion of the population in a developing country %
		mixed diet with some animal protein	cereals possibly with legumes	
0–1 year	3.4 (820)	14 (breast-feeding) plus, after six months, weaning foods		3.0
1–3 years	5.7 (1 360)	21	27	9.0
4–6 years	7.7 (1 830)	25	33	8.7
7–9 years	9.2 (2 190)	29	37	8.5
10–14 years: males	11.7 (2 800)	46	58	6.3
females	10.3 (2 450)	40	50	6.2
Male adult (moderately active)	12.6 (3 000)	49	62	29.2
Female adult (moderately active)	9.2 (2 200)	39	48	26.2
Pregnancy (latter half)	10.7 (2 550)	49	63	1.5
Lactation	11.5 (2 750)	60	77	1.4
Average	9.2 (2 195)	37	47	—

[a] Adapted from *Handbook on human nutritional requirements*. Geneva, World Health Organization, 1974 (Monograph Series, No. 61).

[b] Adjusted to take digestibility and quality of protein into account.

Energy and protein intakes

The accompanying table shows the recommended energy and protein intakes for individuals of different ages or physiological status. The last column indicates the approximate proportion of the different groups in a developing country.

An adequate energy intake is the first priority when food is scarce. Protein, carbohydrates, and fat supply energy at the following rate:

1 g carbohydrate provides approximately	0.017 MJ (4 $kcal_{th}$)
1 g fat provides approximately	0.038 MJ (9 $kcal_{th}$)
1 g protein provides approximately	0.017 MJ (4 $kcal_{th}$)

If an adequate energy supply is not provided, some protein will be burnt to provide energy and not used for body growth or repair, i.e., it will be used in the same way as carbohydrate or fat, which are much less expensive.

A part (20–40%) of the energy requirement should be supplied from fats and oils, which greatly enhance the palatability of the diet, diminish its bulk (important for younger children), and reduce transport requirements.

Energy requirements vary widely even in normal individuals. They are also increased by physical activity. For example, a 65-kg man requires daily:

6.3 MJ (1500 $kcal_{th}$) when resting in bed day and night
11.3 MJ (2700 $kcal_{th}$) if lightly active in the daytime (clerk, office worker)
12.6 MJ (3000 $kcal_{th}$) if moderately active 8 hours a day
14.6 MJ (3500 $kcal_{th}$) if doing heavy work 8 hours a day (labourer)

Much higher intakes are required for the treatment of malnutrition.

Vulnerable groups

The energy and protein requirements of women are increased by pregnancy (+1.5 MJ (350 $kcal_{th}$) and +10–15 g protein/day) and lactation (+2.3 MJ (550 $kcal_{th}$) and +15–20 g protein/day) over and above their normal requirements. The amount of proteins will vary with their quality. Larger amounts of vegetable proteins are required. Because of their rapid growth rate, young children require proportionally more energy and protein for each kg of body weight than adults do:

	MJ ($kcal_{th}$)/kg body weight
infant	0.5 (120)
5 years old	0.4 (90)
11 years old	0.3 (70)
male adult	0.2 (45)

Pregnant women and young children are particularly likely to become malnourished in times of food shortage. Young children are also more vulnerable to malnutrition for the following reasons:

- They require a greater number of feeds per day (3-4) than may be prepared for the family.
- They require more concentrated sources of energy and protein than may be supplied by available foods.

- Young children (between about 6 months and 5 years) are particularly subject to infections (measles, whooping cough, malaria, diarrhoea, etc.) which, by reducing appetite and increasing energy expenditure, may precipitate or worsen malnutrition.
- In some cultural contexts, adults are served first and younger children last.

Food given to sick children must not be reduced or restricted in quantity. On the contrary, they should receive additional food, whenever possible.

Foods and diets

Most diets in most countries contain adequate amounts of all the nutrients required for good health *if enough of the diet is taken to satisfy the individual's energy requirements.* This also applies to protein. Even a growing child, whose protein requirement is the highest (per unit of body weight) of any member of the population, if healthy, requires no more than 10% of his calories to be supplied from protein sources.

Commonly used foods (see Annex 2)

(*a*) *Cereal grains* (rice, corn, millet, sorghum, oats, and wheat)

These staple foods are the main source of energy (carbohydrates) and contain significant quantities of proteins (8–12%), vitamin B, and iron. Most vitamins (especially thiamine) are lost in the milling process. The whiter the flour, the greater the loss of vitamins, unless the flour is enriched or fortified with vitamins.

(*b*) *Legumes and oilseeds* (beans, peas, soya, groundnuts, etc.)

Legumes as a group contain about 20% of proteins (soy beans up to 40%), the B-complex vitamins, and iron. Legumes are particularly useful when eaten with cereals, as the proteins complement each other. They provide energy in a compact form but require careful storage because of their vulnerability to insects, rodents, and weevils. Digestibility can be increased by removing the skin after soaking overnight.

(*c*) *Tubers and roots* (yams, taro, cassava, sweet potato, potato, etc.)

Tubers and roots are the main sources of carbohydrates and are low in proteins (1–2%). Bulk and low protein content make them unsuitable as staple foods for infant feeding unless supplemented by foods richer in proteins.

(*d*) *Vegetables and fruits*

Vegetables and fruits are high in water and low in calories. They are often rich in provitamin A or carotenes, vitamins B and C, iron, and calcium, especially dark-green leafy vegetables (young cassava leaves, baobab leaves), which in addition have an appreciable protein content (2-4%).

(*e*) *Animal products* (meat, fish, milk and dairy products, eggs, etc.)

Of high protein quality, animal products are consumed in very small quantities in most developing countries in normal times and they may become even scarcer during emergencies. Small amounts add considerably to the quality and palatability of a diet. Local taboos might restrict their use in some groups (e.g., young children, pregnant women).

Milks are rich in protein, sugar, fat, calcium, and vitamins (except vitamin C, present only in human milk). All milks are poor in iron. Skim milk (non-fat milk) contains *no* fat-soluble vitamins A and D unless they have been added in the factory. It is important to check this on the label.

(*f*) *Oils and fats*

Oils and fats offer a compact source of calories. Fats derived from milk are sources of vitamin A and D, while vegetable fats contain no vitamin A and D, except for red palm oil which is extremely rich in carotenes.

(*g*) *Human milk*

This is the best and safest food for infants and young children (under 2 years). Breast-feeding should be promoted. Supplementary food must be given to the child at 4 months of age.

Bottle-feeding with commercial cow's milk preparations must be discouraged in areas with low standards of hygiene and maternal education, because of the high risk of fatal diarrhoeal disease in young infants.

Annex 2

Protein and energy content of some foods used in tropical countries [a]

(100-g edible portions, raw [b])

	Energy [c] MJ ($kcal_{th}$)	Proteins (g)	Waste (%) [d]
Cereals			
rice			
lightly milled (brown)	1.5 (350)	7	0
overmilled (white or polished)	1 5 (350)	6	0
parboiled	1 5 (360)	7	0
maize, whole	1.5 (360)	9	0
millet and sorghum	1.5 (350)	10	0
wheat.			
bulgur wheat	1.5 (350)	11	0
whole wheat, soft	1 4 (340)	12	0
hard	1.4 (340)	11	0
wheat flour 80 % extraction rate	1 4 (330)	11	0
Vegetables and fruits			
cassava leaves, fresh	0.4 (90)	4	20 or more
sweet potato leaves, fresh	0 2 (50)	4	20 or more
dark-green leaves	0.2 (50)	2–5	20 or more
carrots, raw	0.2 (40)	1	10
tomato, fresh	0.1 (20)	1	2
citrus fruits (orange, lemon, lime, grapefruit, etc.)	0 2 (40)	0 5	25
mango, ripe	0.3 (60)	0.5	30–50
papaya, ripe	0.1 (30)	0 5	30
dates·			
raw	0 6 (140)	1	
dried	1 2 (290)	2	15
Fats and oils			
butter	2 8 (680)	—	0
ghee (butter oil)	3 6 (850)	—	0
palm oil	3.8 (900)	—	0
vegetable oils (others)	3.8 (900)	—	0

	Energy [c] MJ ($kcal_{th}$)	Proteins (g)	Waste (%) [d]
Legumes and oilseeds			
lentils	1.4 (340)	20	0
kidney beans	1.4 (330)	21	0
peas	1 4 (340)	25	0
chickpeas	1.5 (350)	20	0
black and red beans	1.5 (360)	25	0
nere (dried African locust bean)	1.7 (400)	32	—
groundnuts:			
whole, dried	2.3 (550)	23	30
press-cake	1.6 (380)	36	—
soya beans:			
dried seeds	1 7 (400)	33	0
partially defatted flour	1 1 (260)	46	0
Starchy roots and fruits, tubers			
cassava, fresh	0.6 (150)	1	15
flour	1.4 (340)	2	0
sweet potato, fresh, pale or orange	0.5 (110)	1	15
yam			
tuber, fresh	0.5 (110)	2	15
flour	1.3 (320)	4	0
cocoyam	0.4 (102)	2	0
bananas.			
green	0 3 (70)	1	33
ripe	0 5 (120)	1	33
plantain bananas	0 5 (130)	1	33
breadfruit, pulp, fresh	0.4 (90)	1	25

[a] Adapted from FAO food composition tables and from B S Platt: *Tables of representative values of foods commonly used in tropical countries.* London, HMSO, 1975 (Medical Research Council Special Report Series, No 302).
[b] The content of cooked food varies depending on the method of cooking and especially the water content of the dish
[c] Energy values in MJ have been rounded to one decimal figure when converting from $kcal_{th}$
[d] Waste values are given as percentages of the food as purchased The proportion may vary widely.

Annex 3

Weight-for-height

A. YOUNG CHILDREN (BOTH SEXES)

Height (cm)	Weight (kg)				
	Standard	90 % standard	80 % standard	70 % standard	60 % standard
50	3.4	3.1	2.7	2.4	2.0
51	3.5	3.2	2.8	2.4	2.1
52	3.7	3.3	3.0	2.6	2.2
53	3.9	3.5	3.1	2.7	2.3
54	4.1	3.7	3.3	2.9	2.5
55	4.3	3.9	3.4	3.0	2.6
56	4.6	4.1	3.7	3.2	2.8
57	4.8	4.3	3.8	3.4	2.9
58	5.1	4.6	4.1	3.6	3.1
59	5.3	4.8	4.2	3.7	3.2
60	5.6	5.0	4.5	3.9	3.4
61	5.9	5.3	4.7	4.1	3.5
62	6.2	5.6	5.0	4.3	3.7
63	6.5	5.8	5.2	4.6	3.9
64	6.7	6.0	5.4	4.7	4.0
65	7.0	6.3	5.6	4.9	4.2
66	7.3	6.6	5.8	5.1	4.4
67	7.6	6.8	6.1	5.3	4.6
68	7.9	7.1	6.3	5.5	4.7
69	8.2	7.4	6.6	5.7	4.9
70	8.5	7.6	6.8	6.0	5.1
71	8.7	7.8	7.0	6.1	5.2
72	9.0	8.1	7.2	6.3	5.4
73	9.2	8.3	7.4	6.4	5.5
74	9.5	8.6	7.6	6.6	5.7
75	9.7	8.7	7.8	6.8	5.8
76	9.9	8.9	7.9	6.9	5.9
77	10.1	9.1	8.1	7.1	6.1
78	10.4	9.4	8.3	7.3	6.2
79	10.6	9.5	8.5	7.4	6.4
80	10.8	9.7	8.6	7.6	6.5
81	11.0	9.9	8.8	7.7	6.6
82	11.2	10.1	9.0	7.8	6.7
83	11.4	10.3	9.1	8.0	6.8
84	11.5	10.4	9.2	8.0	6.9
85	11.7	10.5	9.4	8.2	7.0
86	11.9	10.7	9.5	8.3	7.1
87	12.1	10.9	9.7	8.5	7.3
88	12.3	11.1	9.8	8.6	7.4
89	12.6	11.3	10.1	8.8	7.6
90	12.8	11.5	10.2	9.0	7.7
91	13.0	11.7	10.4	9.1	7.8
92	13.2	11.9	10.6	9.2	7.9
93	13.5	12.2	10.8	9.4	8.1
94	13.7	12.3	11.0	9.6	8.2
95	14.2	12.8	11.4	9.9	8.5
96	14.5	13.0	11.6	10.2	8.7
97	14.8	13.3	11.8	10.4	8.9
98	15.0	13.5	12.0	10.5	9.0
99	15.3	13.8	12.2	10.7	9.2
100	15.5	14.0	12.4	10.8	9.3
101	15.8	14.2	12.6	11.1	9.5
102	16.1	14.4	12.9	11.3	9.7
103	16.4	14.8	13.1	11.5	9.8
104	16.7	15.0	13.4	11.7	10.0
105	16.9	15.2	13.5	11.8	10.1
106	17.2	15.4	13.8	12.0	10.3
107	17.5	15.8	14.0	12.2	10.5
108	17.8	16.0	14.2	12.5	10.7
109	18.2	16.4	14.6	12.7	10.9

B ADULTS[a]

Height (cm)	Males (weight in kg)				Female (weight in kg)			
	Standard weight	80 % standard	70 % standard	60 % standard	Standard weight	80 % standard	70 % standard	60 % standard
140					44.9	36.0	31.5	27.0
141					45.4	36.4	31.8	27.3
142					45.9	36.8	32.2	27.6
143					46.4	37.2	32.5	27.9
144					47.0	37.6	32.9	28.2
145	51.9	41.6	36.4	31.2	47.5	38.0	33.3	28.5
146	52.4	42.0	36.7	31.5	48.0	38.4	33.6	28.8
147	52.9	42.4	37.1	31.8	48.6	38.9	34.0	29.2
148	53.5	42.8	37.5	32.1	49.2	39.4	34.5	29.6
149	54.0	43.2	37.8	32.4	49.8	39.9	34.9	29.9
150	54.5	43.6	38.2	32.7	50.4	40.4	35.3	30.3
151	55.0	44.0	38.5	33.0	51.0	40.8	35.7	30.6
152	55.6	44.5	39.0	33.4	51.5	41.2	36.1	30.9
153	56.1	44.9	39.3	33.7	52.0	41.6	36.4	31.2
154	56.6	45.3	39.7	34.0	52.5	42.0	36.8	31.5
155	57.2	45.8	40.1	34.4	53.1	42.5	37.2	31.9
156	57.9	46.4	40.6	34.8	53.7	43.0	37.6	32.2
157	58.6	46.9	41.1	35.2	54.3	43.5	38.0	32.6
158	59.3	47.5	41.5	35.6	54.9	44.0	38.5	33.0
159	59.9	48.0	42.0	36.0	55.5	44.4	38.9	33.3
160	60.5	48.4	42.4	36.3	56.2	45.0	39.4	33.8
161	61.1	48.9	42.8	36.7	56.9	45.6	39.9	34.2
162	61.7	49.4	43.2	37.0	57.6	46.1	40.4	34.6
163	62.3	49.9	43.6	37.4	58.3	46.7	40.8	35.0
164	62.9	50.4	44.1	37.8	58.9	47.2	41.3	35.4
165	63.5	50.8	44.5	38.1	59.5	47.6	41.7	35.7
166	64.0	51.2	44.8	38.4	60.1	48.1	42.1	36.1
167	64.6	51.7	45.3	38.8	60.7	48.6	42.5	36.4
168	65.2	52.2	45.7	39.2	61.4	49.2	43.0	36.9
169	65.9	52.8	46.2	39.6	62.1	49.7	43.5	37.3
170	66.6	53.3	46.6	40.0				
171	67.3	53.9	47.1	40.4				
172	68.0	54.4	47.6	40.8				
173	68.7	55.0	48.1	41.2				
174	69.4	55.6	48.6	41.7				
175	70.1	56.1	49.1	42.1				
176	70.8	56.7	49.6	42.5				
177	71.6	57.3	50.2	43.0				
178	72.4	58.0	50.7	43.5				
179	73.3	58.7	51.3	44.0				

[a] Based on JELLIFFE, D.B *The assessment of the nutritional status of the community* Geneva, World Health Organization, 1966 (Monograph Series No 33), pp 238–241.

C. ALTERNATIVE THRESHOLDS OF MALNUTRITION USING THE REFERENCE VALUE (MEDIAN) LESS TWO AND THREE STANDARD DEVIATIONS (CHILDREN, BOTH SEXES)[a]

Height (cm)	Reference weight (kg)	Standard deviation SD	Threshold of malnutrition	
			Less 2 SD	Less 3 SD
50	3.4	0.38	2.6	2.3
51	3.5	0.41	2.7	2.3
52	3.7	0.44	2.8	2.4
53	3.9	0.47	2.9	2.5
54	4.1	0.50	3.1	2.6
55	4.3	0.52	3.3	2.7
56	4.6	0.54	3.5	3.0
57	4.8	0.57	3.7	3.1
58	5.1	0.59	3.9	3.3
59	5.3	0.61	4.1	3.5
60	5.6	0.63	4.3	3.7
61	5.9	0.65	4.6	4.0
62	6.2	0.66	4.8	4.2
63	6.5	0.68	5.1	4.5
64	6.7	0.70	5.4	4.6
65	7.0	0.71	5.6	4.9
66	7.3	0.72	5.9	5.1
67	7.6	0.74	6.1	5.4
68	7.9	0.75	6.4	5.6
69	8.2	0.76	6.7	5.9
70	8.5	0.77	6.9	6.2
71	8.7	0.79	7.2	6.3
72	9.0	0.80	7.4	6.6
73	9.2	0.81	7.6	6.8
74	9.5	0.82	7.8	7.0
75	9.7	0.83	8.1	7.2
76	9.9	0.84	8.3	7.4
77	10.1	0.84	8.5	7.6
78	10.4	0.85	8.6	7.8
79	10.6	0.86	8.8	8.0
80	10.8	0.87	9.0	8.2
81	11.0	0.88	9.2	8.4
82	11.2	0.89	9.4	8.5
83	11.4	0.90	9.6	8.7
84	11.5	0.91	9.7	8.8
85	11.7	0.92	9.9	8.9
86	11.9	0.92	10.1	9.1
87	12.1	0.93	10.3	9.3
88	12.3	0.94	10.5	9.5
89	12.6	0.95	10.7	9.7
90	12.8	0.96	10.8	9.9
91	13.0	0.97	11.1	10.1
92	13.2	0.98	11.3	10.3
93	13.5	1.00	11.5	10.5
94	13.7	1.01	11.7	10.7
95	14.2	1.24	11.8	10.7[b]
96	14.5	1.27	12.0	10.7
97	14.8	1.29	12.2	10.9
98	15.0	1.32	12.4	11.0
99	15.3	1.34	12.6	11.3
100	15.5	1.37	12.8	11.4
101	15.8	1.39	13.0	11.6
102	16.1	1.42	13.3	11.8
103	16.4	1.44	13.5	12.1
104	16.7	1.46	13.7	12.3
105	16.9	1.49	14.0	12.4
106	17.2	1.51	14.2	12.7
107	17.5	1.54	14.5	12.9
108	17.8	1.56	14.7	13.1
109	18.2	1.58	15.0	13.5

[a] Waterlow et al *Bull World Health Organ.*, **55**: 489–498 (1977). Full tabulation available from Nutrition, World Health Organization, 1211 Geneva 27, Switzerland.
[b] Adjusted value

Annex 4

Arm-circumference-for-height, young children (both sexes)

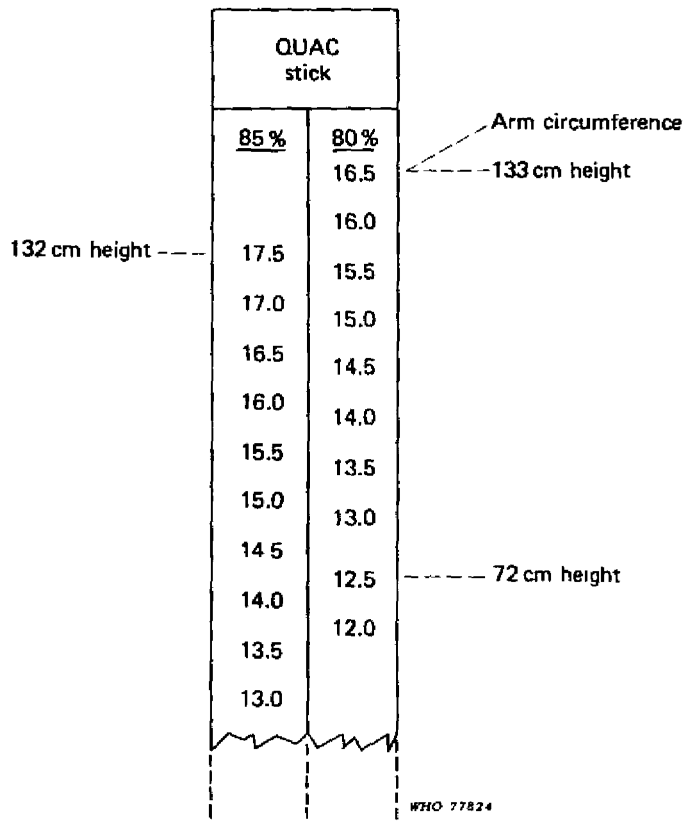
Height (cm)	Standard arm circumference (cm)	90 % standard	85 % standard	80 % standard	75 % standard	70 % standard	60 % standard
54	11.1	10.0	9.4	8.9	8.3	7.8	6.7
56	11.6	10.4	9.9	9.3	8.7	8.1	7.0
58	12.2	11.0	10.4	9.8	9.1	8.5	7.3
60	13.0	11.7	11.0	10.4	9.7	9.1	7.8
62	13.9	12.5	11.8	11.1	10.4	9.7	8.3
64	14.2	12.8	12.1	11.4	10.6	9.9	8.5
66	14.4	13.0	12.2	11.5	10.8	10.1	8.6
68	14.8	13.3	12.6	11.8	11.1	10.4	8.9
70	15.4	13.9	13.1	12.3	11.5	10.8	9.2
72	15.6	14.0	13.3	12.5	11.7	10.9	9.4
74	15.7	14.1	13.3	12.6	11.8	11.0	9.4
76	15.8	14.2	13.4	12.6	11.8	11.1	9.5
78	15.9	14.3	13.5	12.7	11.9	11.1	9.5
80	15.9	14.3	13.5	12.7	11.9	11.1	9.5
82	15.9	14.3	13.5	12.7	11.9	11.1	9.5
84	16.0	14.4	13.6	12.8	12.0	11.2	9.6
86	16.1	14.5	13.7	12.9	12.1	11.3	9.7
88	16.2	14.6	13.8	12.9	12.1	11.3	9.7
90	16.2	14.6	13.8	13.0	12.1	11.3	9.7
92	16.3	14.7	13.9	13.0	12.2	11.4	9.8
94	16.4	14.8	13.9	13.1	12.3	11.5	9.8
96	16.5	14.9	14.0	13.2	12.4	11.5	9.9
98	16.6	14.9	14.1	13.3	12.4	11.6	10.0
100	16.7	15.0	14.2	13.4	12.5	11.7	10.0
102	16.8	15.1	14.3	13.4	12.6	11.8	10.1
104	16.9	15.2	14.4	13.5	12.7	11.8	10.1
106	17.1	15.4	14.5	13.7	12.8	12.0	10.3
108	17.3	15.6	14.7	13.8	13.0	12.1	10.4
110	17.4	15.7	14.8	13.9	13.1	12.2	10.4
112	17.6	15.8	15.0	14.0	13.2	12.3	10.6
114	17.8	16.0	15.1	14.2	13.3	12.5	10.7

The QUAC stick[a]

Preparation of the QUAC stick (to measure arm-circumference-for-height)

1. Secure a straight pole about 140 cm long and 4 cm wide.
2. Smooth one surface to take marking by pen.
3. Select from the table overleaf two scales out of the three (85 %, 80 %, 75 %) and the corresponding height values listed.
4. Tape a centimetre rule to the stick so that it will not move during marking. Measuring from the bottom, make on the left a mark at each of the heights indicated on the higher scale selected (e.g., 85%) and on the right, another mark at each of the heights listed for the second scale selected (e.g., 80% or 75%).
5. Remove the taped centimetre rule.
6. Extend the height marks to either edge of the stick with clearly drawn lines (1.5 cm long) using different colours for each scale (left and right).
7. Using the table again, mark at the line for each height the arm-circumference figure corresponding to that height.

DIAGRAM OF QUAC STICK SHOWING 85% AND 80% ARM CIRCUMFERENCES FOR VARIOUS HEIGHTS



[a] Based on: Arnhold, R. *J. trop. Pediatr.*, **15:** 243 (1969); and Davis, L. E., *Am. J. Clin. Nutr.*, **24:** 358 (1971).

Use of the stick

After measuring the arm circumference, place the stick behind the child (standing up) and look for his arm-circumference value on the left-hand side. If the child's actual height is below the corresponding mark on the stick he is *not* malnourished according to the selected standard or scale (85% for instance). Conversely, if he is taller than the level on the stick at which his measured arm circumference is found, he is malnourished (under 85%, for instance). In this case, compare with the scale on the right-hand side.

BASIC DATA FOR THE MANUFACTURE OF THE QUAC STICK
(ARM-CIRCUMFERENCE-FOR-HEIGHT)

Height (cm)	AC 85 % (cm)	Height (cm)	AC 80 % (cm)	Height (cm)	AC 75 % (cm)
132	17.50	133	16.50	132 ½	15.50
129	17.00	129	16.00	129	15.00
126	16.50	125	15.50	125	14.50
122	16.00	121	15.00	122 ½	14.25
117 ½	15.50	118 ½	14.75	120	14.00
112	15.00	116	14.50	117 ½	13.75
109	14.75	114	14.25	116	13.50
106	14.50	112	14.00	113	13.25
101	14.25	107	13.75	108	13.00
96	14.00	104	13.50	105	12.75
88	13.75	98	13.25	100	12.50
80	13.50	92	13.00	92	12.25
72	13.25	82	12.75	84	12.00
		72	12.50	72	11.75

Annex 6

Random surveys and sampling techniques

In large population groups, measurements can be performed only on a sample. To draw any valid conclusion, the sample must be *representative* of the whole population. For instance, nutritional data obtained from health services are not representative of *all* the population. Nor are those collected in the most accessible villages or in camps that are reported to be in a bad state. Some randomization is essential.

The steps to take are as follows:

Definition of the objective of the survey. To estimate the nutritional status in camp A; to compare the nutritional status in villages A, B, C, and D; etc.

Definition of the population to be surveyed: Children; ethnic group; sedentaries and/or nomads; etc.

Obtaining the sample

● Obtain census data and a list of all settlements in the area (from ministries of statistics and planning or malaria control services). If these are unavailable, the population can be estimated by counting the dwellings and estimating the average number of people in each dwelling.

● Divide the population into groups that are similar with respect to the information to be collected. It is confusing if information from pastoral nomads cannot be separated from that obtained from sedentary subsistence farmers or urban settlers.

● Draw a random sample. Villages, camps, or other populations can be selected from the area at random for each defined group. At the village or camp level, households or families will be selected. Use random numbers as in Table A. [1]

— Number villages, camps, etc., consecutively in the list or on the map.

— Choose a first random number "at random" (e.g., shut your eyes and use a pin) then take every following number in the table to identify a sample point until the required number of sample points have been selected.

— Never change because a village selected is too remote or is close to a bigger or "more affected" place you feel should be surveyed in preference to the randomly selected "unimportant" village.

— Repeat the random process to select households and children at the level of the village.

● Determine the sample size: this depends on your objectives and need for accuracy. Seek professional advice.

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[1] Please note that these numbers are given only as examples and those responsible for the sampling should use the more extensive table of random numbers in the publication by Fisher & Yates referred to in the note to Table A or similar tables in other statistical text-books.

For instance, if the observed percentage of malnourished children from a sample of 100 children is 10%, the most one can say with a 95% chance of being right (probability level) is that the true (and unknown) proportion of malnourished children in the *total* child population is somewhere between 5% and 18% (confidence interval). Table B shows the respective confidence intervals at the 95% probability level for various sample sizes and observed percentages of malnutrition.

A. RANDOM NUMBERS [a]

76	58	30	83	64	87	29	25	58	84	86	50	60	00	25
47	56	91	29	34	05	87	31	06	95	12	45	57	09	09
10	80	21	38	84	90	56	35	03	09	43	12	74	49	14
00	95	01	31	76	17	16	29	56	63	38	78	94	49	81
07	28	37	07	61	11	16	36	27	03	78	86	72	04	95
20	26	36	31	62	68	69	86	95	44	84	95	48	46	45
31	56	34	19	09	79	57	92	36	59	14	93	87	81	40
98	40	07	17	81	22	45	44	84	11	24	62	20	42	31
24	33	45	77	58	80	45	67	93	82	75	70	16	08	24
01	31	60	10	39	53	58	47	70	93	85	81	56	39	38
50	78	13	69	36	37	68	53	37	31	71	26	35	03	71
90	78	50	05	62	77	79	13	57	44	59	60	10	39	66
46	72	60	18	77	55	66	12	62	11	08	99	55	64	57
47	21	61	88	32	27	80	30	21	60	10	92	35	36	12
12	73	73	99	12	49	99	57	94	82	96	88	57	17	91
23	54	20	86	85	23	86	66	99	07	36	37	34	92	09
65	76	36	95	90	18	48	27	45	68	27	23	65	30	72
37	55	85	78	78	01	48	41	19	10	35	19	54	07	73
87	12	49	03	60	41	15	20	76	27	50	47	02	29	16
83	05	83	38	96	73	70	66	81	90	30	56	10	48	59

[a] Taken from Table XXXIII of: Fisher, R. A & Yates, F *Statistical tables for biological, agricultural and medical research*, 6th ed., Longman Group Ltd, London, 1974 (previously published by Oliver & Boyd, Edinburgh) by permission of the authors and publishers.

B CONFIDENCE INTERVALS AT 95% PROBABILITY LEVEL CORRESPONDING TO VARIOUS SAMPLE SIZES AND SAMPLE PERCENTAGES

Sample size	Percentage observed in sample					
	5%	10%	20%	30%	40%	50%
30	1–18	2–26	8–39	15–49	23–59	31–69
40	1–17	3–24	9–36	17–47	25–57	34–66
50	1–15	3–22	10–34	18–45	26–55	36–65
60	1–14	4–20	11–32	19–43	28–54	37–63
80	1–12	4–19	12–31	20–41	29–52	39–61
100	2–11	5–18	13–29	21–40	30–50	40–60
200	2–9	6–15	15–26	24–37	33–47	43–57
300	3–8	7–14	16–25	25–36	35–46	44–56
400	3–8	7–13	16–24	26–35	35–45	45–55
500	3–7	8–13	17–24	26–34	36–45	46–55
1000	4–7	8–12	18–23	27–33	37–43	47–53
2000	4–6	9–11	18–22	28–32	38–42	48–52

A rough idea should be formed before the survey of the likely or expected proportion of malnourished children. This can be done by a very rapid and non-randomized survey of one or two villages thought to be representative of the area, using the same anthropometric technique and cut-off point to define malnutrition.

The sample size is determined by the degree of precision desired. If, for instance, the observed percentage of malnutrition is about 20%, a total sample size of 100 will make it possible to locate the *true* rate of malnutrition somewhere between 13% and 29%. If considerable accuracy is required, for instance 18–22%, a sample size of 2000 is necessary. Confidence intervals for simple random sampling are given in Table B.

The number of sites selected at random will vary with the total sample size and the observed percentage of malnutrition. As a general rule, it is essential that the total population sampled be distributed in a sufficient number of sites or clusters (at least 10) to assure the representativeness of the findings. At least 25 children should be examined in each site.

Very important. If you want to compare the results of the various clusters (sites, villages, camp), the sample size at each cluster (and not the total sample size) will determine the accuracy of the result. When cluster sampling is used, the confidence intervals for the same sample size may tend to be wider than those given in Table B. However, an increase in sample size to secure the same confidence interval with cluster sampling may not necessarily be more expensive.

● Do not draw far-reaching conclusions from small differences between two or more rates. These can be due to chance. Statistical tests are necessary. It is particularly important to reduce nonsampling errors (including bias). Seek professionnal advice.

Annex 7

Simple field test for vitamin A in dried skim milk

A simple field test has been developed to check the presence of vitamin A in dried skim milk (DSM) About 35 ml of trichloroacetic reagent are prepared by dissolving 50 g of crystalline reagent grade trichloroacetic acid in 5 ml of distilled water, preferably heated to about 60°C.[a] The resulting reagent is highly corrosive and irritating; it should never be pipetted by mouth and any drop that comes accidentally into contact with the skin, mouth, or eyes should be rinsed immediately and copiously with water. The reagent is light-sensitive and should be stored in the dark, preferably in a brown bottle, itself kept in some opaque container, box, or cupboard. The use of a freshly prepared solution appears advantageous. This seldom involves any difficulty as crystalline trichloroacetic acid is one of the most commonly used reagents in clinical and biochemical laboratories.

The test is carried out in two steps and requires one saucer and two glass or china cups (1) Place a teaspoonful of DSM in the saucer and add a few drops of reagent; if the wet powder turns blue, vitamin A is present, but if there is no colour change, the test could be negative or false and should be checked. (2) To check, place 15 g of DSM in each cup, add 15 ml of water to the first, and stir, preferably with a glass or plastic rod or spoon, until a white slurry is produced. Then add 15 ml of reagent to the second cup and stir in the same way. If vitamin A is present, the colour will become pale blue or green in about one minute, quite distinct from the white slurry in the first cup. If vitamin A is absent, the slurries in both cups will look alike. To clean the utensils, they should be rinsed promptly,[b] thoroughly, and repeatedly with water. To render the reagent harmless before disposal, it should be diluted a hundredfold or more.

This qualitative test is designed for use under field conditions; it is not meant as a substitute for quantitative determinations.

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[a] The laboratory that prepares the reagent may wish to supply convenient measuring spoons to handle 15 g of DSM and 15 ml of liquid· tolerances of ± 10% are of no consequence for the test, but account should be taken of the 30–40% density variations existing between batches of DSM

[b] Delayed cleaning-up may be laborious.

WORLD HEALTH ORGANIZATION

THE MANAGEMENT OF NUTRITIONAL EMERGENCIES IN LARGE POPULATIONS

by

C. DE VILLE DE GOYET, J. SEAMAN & U. GEIJER

CORRIGENDA

Page 16, footnote 1

Delete:

[1] UNICEF tablets specified as containing 0.2 g dried iron sulfate (equivalent to 368 mg of elemental iron) and 250 μg of folate are recommended for routine use—UNIPAC catalogue number 15 500 10 (bottles of 1000 tablets).

Insert:

[1] UNICEF tablets containing 300 mg of ferrous sulfate ($FeSo_4.7H_2O$), or about 60 mg of elemental iron, and 250 μg of folate are recommended for routine use—UNIPAC catalogue number 15 500 10 (bottles of 1000 tablets).

Page 20, Table 2, right-hand column, second entry (Xerophthalmia)

Delete: intramuscular injection of 55 000 μg water-miscible retinol palmitate (100 000 IU of vitamin A) followed the next day by oral administration of 110 000 μg (200 000 IU of vitamin A) ; adequate protein intake is essential

Insert: intramuscular injection of 55 000 μg water-miscible retinol palmitate (100 000 IU of vitamin A) followed the next day by oral administration of 68 000 μg of retinol acetate or 110 000 μg of retinol palmitate (200 000 IU of vitamin A) ; adequate protein intake is essential