3. Assessment and surveillance of nutritional status

Suitable methods must be adopted for the rapid and objective measurement of the nutritional status:

- of individuals eligible for special food relief (individual screening);
- of communities, in order to detect changes with time and decide priorities in food distribution (nutritional surveillance).

Weight-for-height is the best indicator for the diagnosis of nutritional status, nutritional surveillance, and individual screening. Weight-for-age and arm circumference are less reliable for assessment and screening but can be used to measure changes with time. Oedema rates are a valuable indicator when kwashiorkor is the prevalent form of PEM in the area.

Results of surveys and surveillance must be interpreted with caution. They can be misleading unless the individuals measured are representative of the whole population and the technique is standardized and properly used.

Why measure malnutrition in emergencies?

During a nutritional emergency, the relief foods may be scarce and should be given to the people in greatest need. Since much of a population may be able to supply part or all of its own food, it is very useful to have an objective and quantifiable measure of nutritional status.

Measurement of nutritional status in emergencies relies mainly upon taking body measurements (anthropometry), particularly height, weight, and arm circumference. Valuable information may also be obtained from simpler methods, for example, monitoring clinic records or measuring the prevalence of oedema.

The commonest reasons for measuring malnutrition in a relief programme are:

Initial assessment. A rapid survey of the population should be done before initiating a relief programme, in order to identify the areas or groups that are most affected. Surveys of this type need to be carefully designed and conducted by an experienced team. They will not be considered further.[1]

Individual screening. Body measurements may be used to select the malnourished individuals eligible for food relief for themselves or their whole family.

Nutritional surveillance of the population. The repeated measuring of entire communities gives an idea of differences among the various population groups and changes in nutritional status with time. It may be used to decide priorities in the distribution of relief and will also provide some information about the effectiveness of the relief programme. In nutritional surveillance one is not interested in monitoring the progress of a child, but in knowing whether the overall nutritional condition of *village (or camp) A* is good or bad, is better or worse than that of village B and C (and so requires more supplies and personnel), and whether it is improving or deteriorating with time. Nutritional surveillance should not be confused with the "surveillance" or follow-up of an *individual* child in nutrition centres or health services.

Indicators of malnutrition

Clinical signs of PEM or specific deficiencies

Clinical signs in this context are signs that can be rapidly assessed by touching or examining the child concerned rather than by instruments or tests.

- *Oedema.* In extreme situations or where kwashiorkor is the prevalent type of malnutrition, simple surveys (or screening) for this sign may be sufficiently precise, without using body measurements (anthropometry). According to the local situation, oedema of the feet can be looked for in young children, lactating women, and possibly older people.

- *Clinical marasmus* (if a standard clinical definition is used).

- *Night blindness* (mothers should be questioned), *eye signs* of xerophthalmia (vitamin A deficiency).

- *Selected clinical signs* indicative of other vitamin or mineral (iron, etc.) deficiency of potential local importance, depending on the basic diet of the population.

In very severe famine with widespread advanced starvation, clinical signs are most useful as indicators and may be temporarily sufficient when resources are limited. The main problem lies in the fact that observations by different persons are not easily comparable and can hardly be standardized.

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[1] Interested readers are referred to *Guide to food and health relief operations in disasters.* New York, Protein-Calorie Advisory Group of the United Nations System, 1977.

Body measurements

Body measurements are used to detect malnutrition, but not food shortage, since malnutrition can also be caused by ignorance or faulty feeding habits in the presence of sufficient food. The results of body measurements can be misleading if considered in isolation.

Chronic undernutrition leads to a slowing in a child's rate of growth. A chronically malnourished child will be short for his age ("stunted") although he may be of otherwise normal proportions.

An *acute* episode of severe undernutrition results in a loss of muscle and fat which are used up to provide energy, and the individual becomes thinner without significant effect upon height ("wasting").

In an emergency what is important is the measurement of *acute* malnutrition, the effects of chronic malnutrition being of less concern. Because *both* stunting *and* wasting result in low weight-for-*age*, relating body measurements to age is not recommended. Two measurements are commonly used to assess acute malnutrition ("wasting"):

Weight-for-height. Here a child's weight is compared with the height of a "reference" (well-nourished) child of the same height. Results are expressed as "percentages of reference", e.g., 80% of standard weight-for-height or in relation to (above or below) a pre-selected cut-off point.[1]

Arm circumference (AC). Well-nourished children have a nearly constant arm circumference (about 16 cm) between 1 and 5 years. Undernourished children have a thinner upper arm and a smaller AC. Children can be classified as malnourished if their AC falls below an arbitrarily specified level. If ages are not known, AC can be related to height (arm-circumference-for-height).

Presence of diseases associated with PEM

These include measles, diarrhoea (defined for instance as three or more loose stools per day), whooping cough, etc.

Mortality data

PEM is associated with increased mortality among young children (e.g., from measles, etc.).

The data collected should be expressed as rates; for example, the rate per thousand of marasmus among infants (aged 0–1) in a refugee camp is:

$$\frac{\text{number of infants with marasmus in the camp}}{\text{total number of infants in the camp}} \times 1000$$

[1] Cut-off points at 2 or 3 standard deviations below the median reference values were recently recommended (See Annex 3).

Body measurements

N.B. A very great effort should be made to measure children accurately. Small errors (e.g., 2–3 cm in height) in the measurement of a younger child may lead to significant errors in the classification of the child's nutritional status.

Select only one indicator:

- Weight-for-height, the recommended body measurement in times of emergency, is a sensitive indicator of acute malnutrition. It is fairly independent of sex, race, and age (up to about 10 years of age). It requires a sufficient number of robust scales and adequate training of personnel. Neither condition is easy to meet in an acute emergency situation.
- If ages are not known, arm-circumference-for-height is the best alternative. Measuring arm circumference instead of weight results in only a marginal saving of time compared to that required for travelling and assembling people. Several techniques such as the QUAC stick (Annex 5) have been devised to simplify field work and are useful for the screening of large numbers of children.
- As a second alternative, measurement of arm circumference alone (without measurement of height) is acceptable in situations where resources are extremely limited. Considerable time is saved by not measuring height. The sensitivity of the measurement as an indicator is poor but is sufficient in situations where PEM is severe and widespread.

Techniques

(*a*) *Weight measurement*

- Check the scales daily with the *same* known weight (e.g., a piece of metal), having first set the scale at zero.
- Remove the child's shoes and at least *heavy* clothing (a standard routine should be followed). Infants can be weighed without clothing to give more accurate readings.
- If a beam balance with a tray is used, make sure that the child sits properly and is not holding his mother or the static part of the scales. Beam scales should lie on a stable and horizontal surface (e.g., a wide board or a table).
- Read weight to nearest 100 g.

Various types of scales can be used in field conditions. For example:

— UNICEF standard beam balance: accurate, robust, for fixed centres. Frequent transportation on rough roads is not recommended.
— Healthometer (Continental Scale Corporation, USA): a beam balance, accurate and robust, suitable for use by mobile teams.

— Portable Salter scale (CMS Weighing Equipment, Ltd, England): the child is suspended from the scale which is hung from a branch or a tripod. Special "pants" are used to weigh babies (Fig. 5). Robust, cheap, and easy to carry, these scales should be replaced after one year because of stretching of the spring and inaccurate readings. The model with readings up to 25 kg (× 100 g) is recommended.
— Bar scales with platforms have been used in fixed centres. Their use requires training and caution. They may be too bulky and heavy for use by mobile teams.
— The Homs beam balance scale which is sturdy, accurate, and relatively easy to carry in a small car. It can be used for all age groups.

FIG 5 SALTER SCALE

Bathroom scales are not recommended.

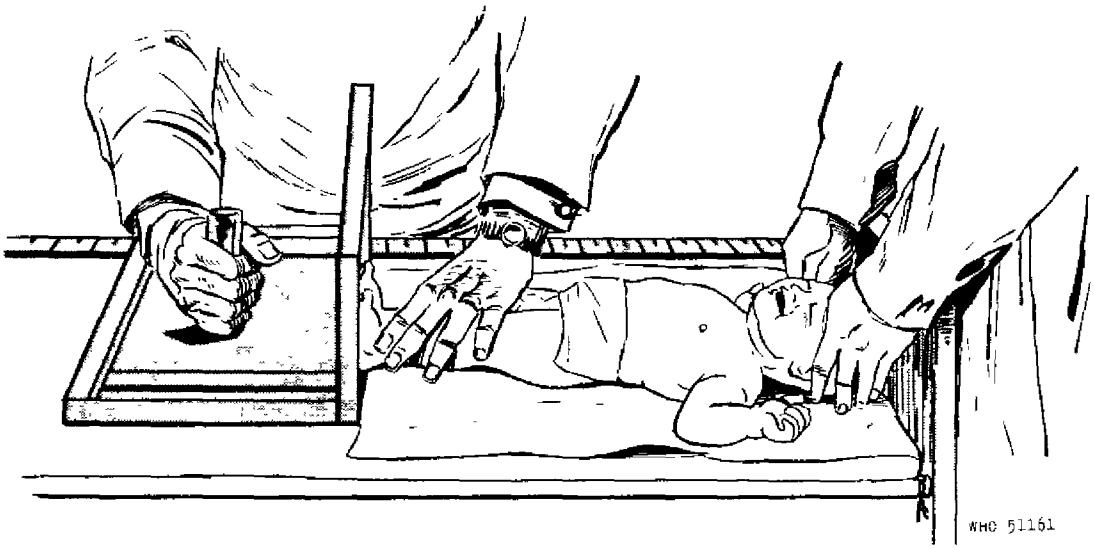
Most types of scales (especially beam scales) are sensitive to dust and mud.

(b) Height measurement

Use a baby-board (see Fig. 6) for children unable to stand up (under 2 years or less than 85 cm). Children should be quiet, relaxed (having a parent hold the child usually helps), and lying straight. Gentle pressure should be applied upon both knees with one hand and care taken to see that the slide is in contact with the whole surface of the soles of the child's feet, not just the toes. Measure to 1 cm (round off to the nearest cm: e.g., 90.0–90.4 cm = 90 cm, 90.5–90.9 cm = 91 cm).

When an upright measure is used the subject's heels should be together and touch the base of the upright, and the buttocks, the back of the heels, and the upper back should be in contact with the measuring stick (which can be locally made). Measurement is to the highest point of the head when the child is looking straight ahead. Shoes should be removed. On average, children are about 1 cm shorter when standing up than when lying down.

FIG. 6. USING A BABY-BOARD TO MEASURE A CHILD



(c) Arm-circumference measurement

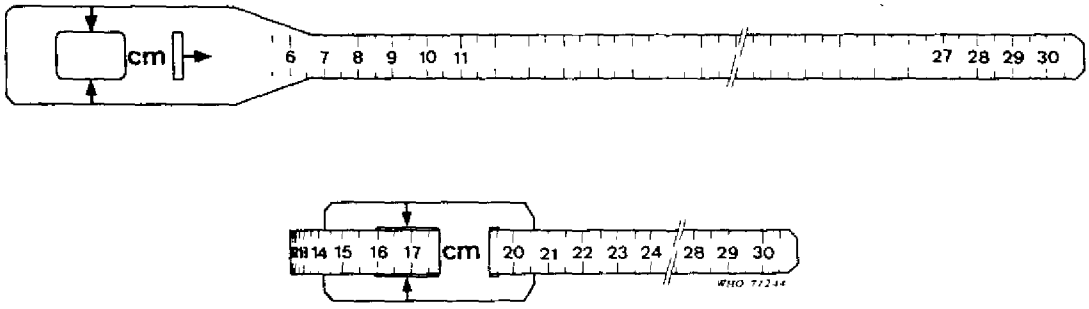
The circumference is measured on the left upper arm *half way* between the end of the shoulder (acromion) and the tip of the elbow (olecranon). To locate this point, the arm is flexed at a right angle. Then the arm is allowed to hang freely and a tape-measure (preferably of fibreglass) put firmly round it. Do not pull too tight (Fig. 7).

FIG. 7 MEASURING ARM CIRCUMFERENCE

Tapes or strips can be made locally from thin cardboard or X-ray films which are marked off in centimetres.[1] Special plastic tapes (insertion tapes) have been manufactured (Fig. 8).

Bangles, worn as arm ornaments in some countries, can be used for a rough screening of severely malnourished children. A bangle of standard diameter is passed up the arm in one straight push. If it goes above the elbow, the arm cir-

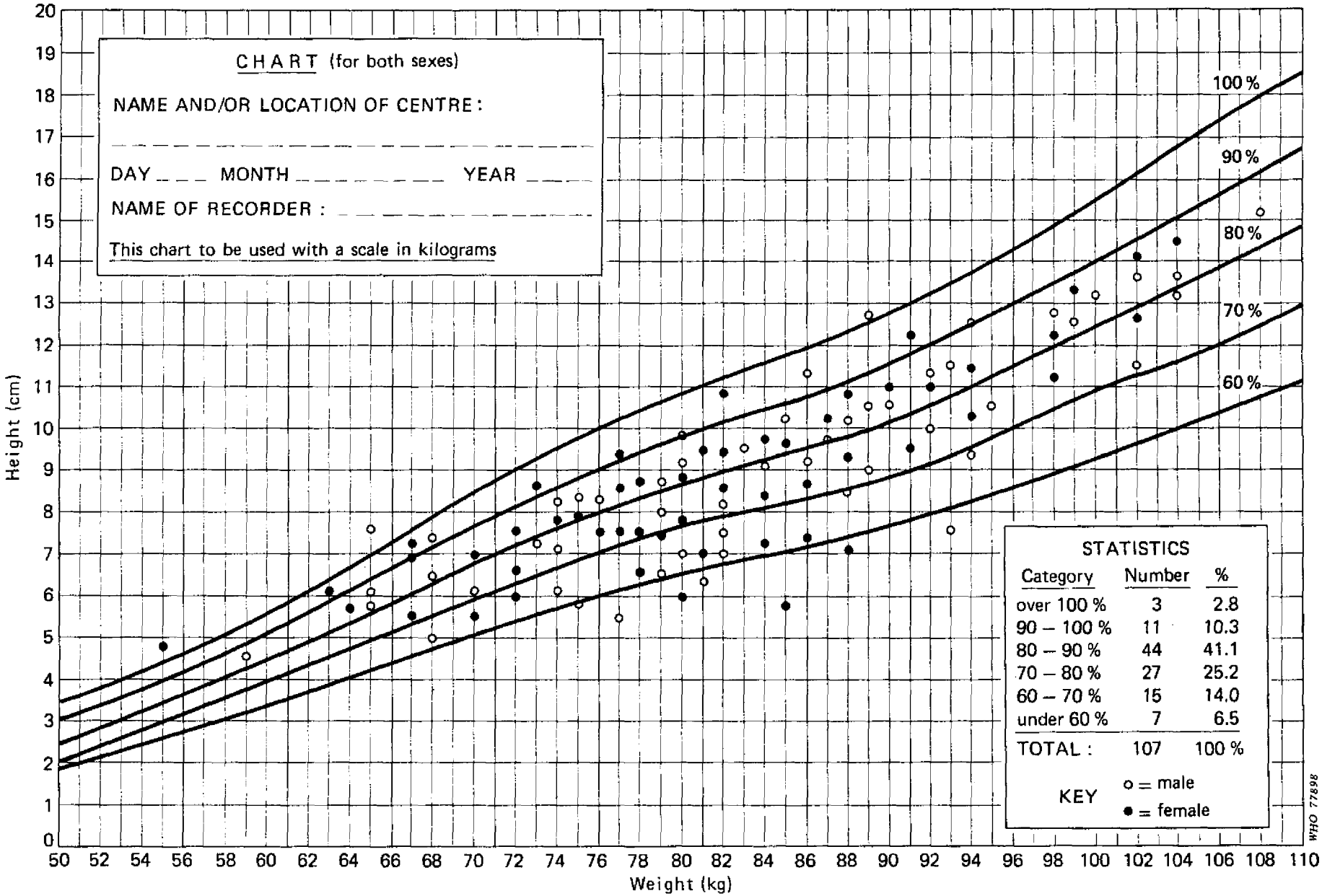
FIG 8 INSERTION TAPE



From. Zerfas, A. J *Am. J. clin. Nutr.*, **28**: 782–787 (1975)

[1] The cardboard tape or strips, X-ray films, or 8-mm cine films can be coloured according to the classification of the reading. (The X-ray film should first be scratched with a sharp point and then coloured with a spirit-based felt-tipped pen not quite up to the scratch line. Cut the film into 1-cm strips with scissors. About 40 strips can be made from one large X-ray film.)

FIG. 9. NUTRITIONAL STATUS CHART[a]



[a] Adapted from: CAPONE, C. A growth surveillance system for food and nutrition programs. In: *Integrating Title II program with locally operated nutrition, socio-economic and humanitarian activities.* Catholic Relief Services, 1977 (mimeographed).

The basic data are the same as those used by WHO for a forthcoming publication which gives specifications for a model growth chart. The measurements for children being screened are plotted on the graph. At the end of the day, the chart gives the nutritional status of the community concerned at the time of the screening. The category for each child is easily determined from the chart. Measurements falling on a curve are included in the statistics for the category beneath the curve—e.g., a child ranked at 80 % will be included in the category 70–80 %.

cumference is too small and the child is regarded as malnourished. A bangle 4.0 cm in diameter passes up arms that are up to about 13.2 cm in circumference (the measurable circumference depends on the flexibility of the bangle). This technique is very simple and cheap, but of little accuracy because the bangle assesses the *maximum* arm circumference and not the circumference *halfway* between shoulder and elbow. It may be useful, however, when resources do not permit any other measurement to be made.

Calculating and tabulating the percentage of the reference value

The reference or "standard" values are shown in Annex 3 (weight-for-height) and Annex 4 (arm-circumference-height). To calculate the nutritional status of a child, compare the child's weight (or arm circumference) with the values given opposite his height in the relevant table.

This gives the percentage "rank" to which the child belongs, e.g., 70–80%. For most purposes it is not necessary to know the exact "percentage of reference" for each individual. Results are most conveniently recorded as shown in Fig. 9. They can readily be converted into percentages in accordance with the table in the lower right-hand corner of the figure.

Fig. 9 gives a "nutritional profile" indicating the distribution of nutritional status within the population measured. Without "normal" baseline figures it is not possible to say (unless the situation is extremely good or bad) whether or not a given set of findings is unusual for that population. Results can only be interpreted in this way, if much more information is available, e.g., crop statistics, mortality rates, etc.

The use of local standards of reference is not recommended unless these are based on well-nourished samples *in the same population* prior to the emergency. *Local standards do not permit international comparisons of value to relief organizations.*

The classification of malnutrition

Body measurements give reasonably accurate estimates of body wasting. Children below 70% of the reference standard (weight-for-height) can be said with some certainty to be severely malnourished, while those between 70% and 80% are moderately malnourished.

Table 3 shows two classifications using different cut-off points. In practice, the number and level of the cut-off points will have to be decided arbitrarily, taking two factors into account:

(1) The purpose of the measurement. If the object is to distinguish children with severe and moderate PEM from normal children for different types of feeding, two cut-off points will be needed If a survey is contemplated, divisions by 10% of the reference standard might be used.

(2) The availability of food. In this case, the cut-off points may be decided (on the basis of a pilot survey) in such a way that the children are classified into groups according to the food available to feed them.

Different techniques give different rates of malnutrition. For instance, if a cut-off point of 80% arm-circumference-for-height is used, this will often give a higher "rate" for malnutrition than will 80% weight-for-height. (In many countries where chronic malnutrition is common, 90%, 80%, 70% weight-for-height are very roughly equivalent to 80%, 70%, 60% weight-for-age respectively.)

TABLE 3. EXAMPLES OF CLASSIFICATION

	Arm circumference (AC) [a] (cm)	AC-for-height (% of reference standard)	Weight-for-height [b] (% of reference standard)
A. Three categories			
Well nourished and mild PEM	13 5 or more	85 % or more	80 % or more
Moderate PEM	12 5–13 5	70–85 %	70–80 %
Severe PEM	under 12 5	under 70 %	under 70 %
B Two categories			
Well nourished and mild PEM	13 or more	75 % or more	80 % or more
Clearly malnourished	less than 13	under 75 %	less than 80 %

[a] Arm circumference might be used alone for children under 5, although this is not recommended. A child would be classified as malnourished if the AC was less than a minimum acceptable value (cut-off point)
[b] Cut-off points 2 or 3 standard deviations below the reference median have recently been recommended (see Annex 3).

Organization of individual screening

Objectives

First decide what criteria (e.g., weight-for-height, arm-circumference-for-height, QUAC stick measurements, oedema) are to be used for the screening. When body measurements are used and the choice is between four courses of action (e.g., no assistance, weekly ration, daily ration, and intensive supervised feeding), four categories of classification should be established.

There is, for instance, very little point in selecting a large number of malnourished children unless facilities are available and organized for them. Obtain a rough estimate of the proportion of malnourished children in a large population by quickly measuring 200 children (see Annex 6).

Decide which population is to be screened. This will depend upon the local situation, but remember that people attending relief centres are not necessarily the worst off. Malnourished individuals may remain at home, because they are unable to walk, live in relatively inaccessible areas, or, in the case of marasmic children, are not regarded by their parents as being in need of help.

Procedure

Inform the community through local leaders at least 24 hours in advance to allow them to arrange for all eligible people to attend. Choose a time that is convenient for the community.

When large numbers of people are to be screened, make sure that they are well organized and, if at all possible, sitting down out of the sun. Convert existing buildings, wherever possible, into temporary screening locations.

Select the severely malnourished first, by clinical examination. If people are well organized, this can be done very quickly by walking along rows. Do not keep severely ill people waiting for long periods of time.

Use a system of individual identification, i.e., date-stamp the feeding card or mark the individual's finger nail with a 10% silver nitrate solution.

Use clearly defined criteria for selection, e.g., pregnant and lactating women, the very old, and/or all children shorter than some designated height—105 cm is the approximate average height of a 5-year-old.

Make sure each individual understands what is being done. Food may be distributed immediately as the direct result of a screening. In this case, the individual should be shown to the appropriate distribution point.

Screening may be done on each occasion that food is distributed or intermittently, in which case each individual (or family) is given a card that entitles him to food at several subsequent distributions.

If whole communities are being screened, *record* the results. These can be useful for making comparisons with future measurements. *Record* the results of other observations, e.g., oedema (Fig. 10).

Staff and equipment

A team of six workers given one day's training can screen from 500 to 2000 persons a day. Efficiency decreases in sparsely populated areas. It is quicker to use the QUAC stick (AC-for-height) than weight-for-height.

The equipment needs for each measuring team are:

2 tape-measures (ideally of fibreglass or locally made), if AC is to be measured

1 scale with an adequate support (table or tripod) and 1 spare

1 measuring stick and a baby-board to measure height (or length)

a known weight to check the accuracy of the scales (e.g., a piece of metal or solid rock)

ration cards, special ration entitlements, etc.

2 rubber date-stamps, one official stamp to validate the ration card (important for preventing abuses), a table, and a chair

tally forms for recording oedema or other signs (Fig. 10) and the number of children falling into different nutritional categories. Lactating or pregnant women should not be classified with females of 10-54 years but in a special category. The tabulation is completed at the end of the day and the percentage of oedema per age group and sex is entered on a special form.

FIG 10. OEDEMA TALLY FORM

Group	Height (cm)	Male		Female	
		No oedema	Oedema	No oedema	Oedema
Unable to walk (0 –1 years)	under 75	IIII	I	III	I
Preschool children (1–4 years)	75 - 105	𝍸[a]	IIII	𝍸 II	IIII
School children (5–9 years)	105 - 136	IIII	II	III	II
Active population[b] (10–54 years)	over 136	𝍸 I		𝍸	
55 years or more		𝍸 III	I	𝍸 𝍸 I	
Lactating women				𝍸	II
Pregnant women				III	I
TOTAL		27	8	37	10

WHO 77817

[a] 𝍸 = 5.
[b] Excluding lactating or pregnant women.

Organization of nutritional surveillance[1]

Under most circumstances the nutritional status of preschool children can be taken to reflect the nutritional status of the whole community. However, adults also suffer from food shortages and in cultures where the feeding of children has precedence over that of the parents, it may be the adults who are most affected by starvation.

Weight-for-height is a suitable measurement for adults between 15 and 50 years old. However, the range of values which can be regarded as normal is much wider for this age group than for young children (see Annex 3).

To measure changes in the nutritional status of a large population accurately over a period of time requires exacting sampling standards and techniques (see Annex 6).

However, some useful information can be obtained by relatively simple methods.

[1] The surveillance of communicable diseases is dealt with in Chapter 7.

(*a*) *Where vulnerable groups are periodically screened for food distribution, using body measurement or other indicators*

Data collected during screenings can be recorded and comparisons made between measurements. Results of anthropometric measurements should be arranged by 10% groupings (see Fig. 9), and converted to percentages. This gives "nutritional profiles" of the community on two or more occasions. These can be compared directly to see if the proportion of the malnourished is changing, and in what way.

If part of the population is being screened *and* having food distributed to it, this group is obviously not representative of the population at large. The required information can only be obtained by sample surveys (see Annex 6).

Comparisons between two measurements taken from the same community should be interpreted with caution. The fact that the death rate for malnourished children is generally very high may lead to a false impression of improvement. For example:

	First measurement			*Second measurement*	
Number over 80 % of reference standard	36		1 death . .	35	
Number under 80 % of reference standard	12	(25 %)	6 deaths . .	6	(15 %)

Here, there seems to have been an improvement whereas in fact the situation may have deteriorated.

N.B. A real improvement might be caused by climatic or economic factors *in spite* of an inefficient food relief programme.

Even small differences in the procedure used during a screening may cause a different group of people to attend. If the first screening is held early in the morning the group measured will be different from that measured at a second screening held at midday, when people are at work. The differences introduced by such variations can be very large and lead to false conclusions.

Indicators other than body measurements can be used for screening, either singly or in combination. Since organization and travelling take up so much working time, several indicators should be estimated on the same occasion, e.g., oedema, specific signs of vitamin deficiency.

(*b*) *Where vulnerable groups are not regularly screened*

Data collected weekly at fixed health facilities and maternal and child health centres can give some idea of changes, e.g., number and complaints of individuals attending for health care or nutritional relief. Data of this kind should be used with caution because they do not give a picture of the whole population but only of those who

— feel that they need *medical* attention, whatever the reason

— can physically attend the health facilities (e.g., live within walking distance, etc.).

Local auxiliaries can be temporarily recruited and trained to carry out the surveillance of simple symptoms and signs of malnutrition at the camp or village level.

The training can, for instance, be organized as follows:

1 day: major signs of PEM (wasting, oedema)
investigation of night blindness
diagnosis of major eye lesions due to vitamin A deficiency
clinical signs of other vitamin deficiencies

1 day: drill in measuring weight (or arm circumference) and height reporting system

1 day: field test

Visiting schedules for auxiliaries must be carefully prepared by a census of the dwellings (houses, tents) involved. Conclusions based on a poorly organized and supervised surveillance system are not valid.

On completing a regular cycle of visits, the auxiliary will report the total number of families and children visited as well as the number of persons presenting the selected signs, by age and sex. Rates should be calculated centrally.

Other indicators for the evaluation of relief programmes

The following indicators can be useful in evaluating a relief programme:

- Age distribution of children attending relief centres compared with the age distribution from census data.

- Monthly attendance rate of children registered. This is obtained by dividing the monthly average number of those attending by the total number of children registered.

- Malnutrition rates in people attending relief centres compared with similar rates obtained by an occasional survey of random samples and house-to-house visits in the same area. This indicator is essential in confirming that the programme is really reaching the target groups.

The following data can be obtained from analysis of a random sample of registration cards or growth charts:

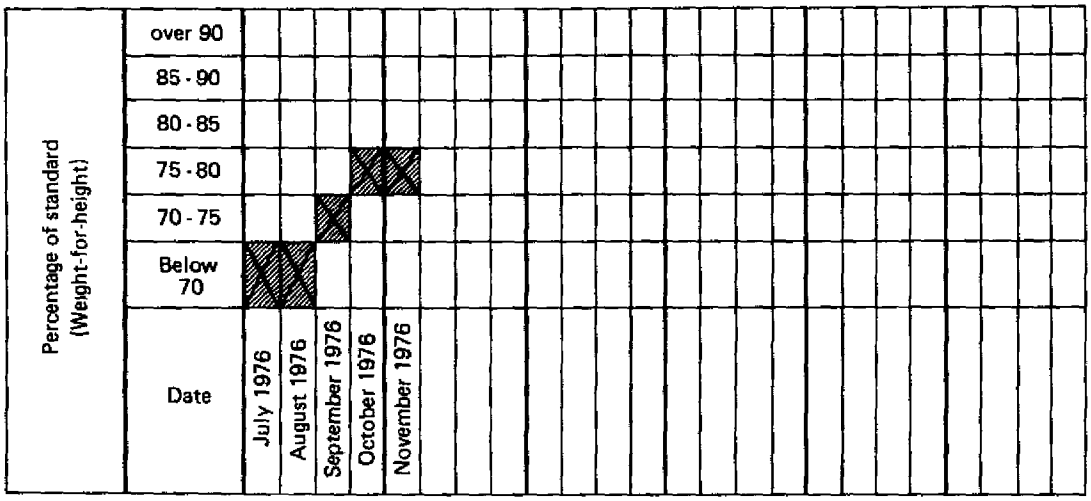
- Percentage of children losing weight over 1 month. Weight gain over a long period of time is no proof of a successful programme. Undernourished children may gain some weight and still fall into a lower nutritional category.
- Percentage of children shifting to another nutritional category in a given period of time (e.g., from 70–80% weight-for-height up to 80–90% or down to 60–70%). This information can easily be taken from the simplified growth chart (Fig. 11).
- Weight gain processed as weight gain ÷ last weight, the results being expressed as g/kg.

The daily weight gain in "normal" reference children between 1 and 5 years old is about 1 g/kg. In malnourished children, the gain must be higher to indicate recovery.

FIG 11 SIMPLIFIED GROWTH CHART [a]

NAME..... FATHER'S NAME.....

VILLAGE ..... DATE FIRST SEEN.....Estimated age: .....



[a] Adapted from: CAPONE, C A growth surveillance system for food and nutrition programs In *Integrating Title II program with locally operated nutrition, socio-economic and humanitarian activities* Catholic Relief Services, 1977 (mimeographed).

This chart is to be used in conjunction with the nutritional status chart (Fig 9) Kept by the mother, it can be printed on the reverse side of a ration card. The information is recorded weekly or monthly