SURVEILLANCE AND PREDICTION OF FOOD SHORTAGES AND MALNUTRITION

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Introduction : Food shortages and information lack

The idea of « nutritional surveillance » has gained considerable currency recently, to the extent that the term is coming to have a variety of meanings, and indeed is in danger of becoming another piece of jargon. The variety of interpretation reflects the range of different needs for information, and is a response to concern about current and future nutritional conditions under widely diverse conditions.

Rather than merely restate at the outset what could be done in terms of information collection, and the benefits that could derive from this, it may be useful to begin by examining the extent to which failure to take action to prevent malnutrition in fact results from lack of information. In the context of this meeting, we are concerned with « disastrous » malnutrition — and here too there may be some danger of « disaster » also becoming an over-used word. What are the realities behind these ideas ? What actually happens ?

Although malnutrition can be a consequence of any sudden — or suddenly apparent, which is different — sequence of events that cuts off food supplies, the type of acute situation that nutritional surveillance is most relevant to is the superimposition of severe food shortage on already chronic, endemic malnutrition This is not to say that only in situations of acute hunger is lack of information restrictive — on the contrary, chronic malnutrition is numerically responsible for more deaths than the more dramatic manifestations of « famine ». Nonetheless, the prediction of severe food shortage is a useful starting-point.

In any case, the type of information to predict disasters following, for example, eartquakes, is of a different type, and other long-term preventive measures would be needed. Except to note that « disasters » and « famine » must seen in the context of local conditions — is an extended hungry season a « famine » ? is an under-five mortality rate of 30 per cent an « ongoing disaster » — for these purposes a precise discussion of these terms is probably not useful

Acute food shortages that have recently caused widespread concern have in fact been of the acute/chronic type Case-studies are being presented, and there is no need to attempt to duplicate these In outline, however, it is possible to specify typical sequences of events : the picture is by now familiar. For example, drought can set in motion a vicious circle of events that builds up insidiously : one year's poor rainfall leads to low crop yields, and loss of livestock. The following year, seed may be scarce, there may be fewer draft animals, and less area is planted. With another year's inadequate rainfall, some emigration from the area occurs, there are further stock losses, surviving livestock are sold, but the price fetched falls greatly; at the same time market prices of grain rise. These events are superimposed on conditions in which seasonal hardship usually occurs : before harvest for agriculturalists, or at the end of the long dry season for pastoralists, often with the addition of seasonal intensification of infections or actual epidemics Drought is of course not the only precipitating factor, other hazards, environmental such as flooding, or man-made — war — produce similar results.

The background to these acute episodes may itself be a deteriorating food supply or economic situation : population pressure, declining soil fertility and land scarcity for agriculturalists, depleted pastures and overgrazing for pastoralists, unemployment and poverty for urban dwellers. Even when the underlying situation is not deteriorating, certain undefined fluctuations in malnutrition and mortality rates — that is, reaching « famine » proportions — which are no doubt a historically repetetive occurrence, are no longer considered acceptable, this itself is a result of increased availability of information.

The information that may be needed concerns both whether a population group is currently suffering from an acute food shortage, and whether such a shortage is likely to occur in the future, and on what time-scale. Information may thus be needed both to follow contemporary events and to predict future conditions. To the extent that shortages in practice may build up over several seasons, these may overlap.

Is more information really needed ?

But has information itself in reality been lacking, or has the problem been that such information as was available was not acted upon ?

To the affected farmer or nomad or urban poor family, the prospects and current situation may be all too apparent. Their situation, however, is not *effectively* known by those in a position to alleviate it — and undoubtedly in the past action has been delayed or simply not taken. Although some indication may in fact have been available and failure of response may in the past have reflected lack of will to respond, nonetheless information, even in these circumstances, could have clearly brought out the course of developing events and have stimulated relief or preventive measures Thus a reliable, objective, verifiable, system for predicting and monitoring nutritional conditions could have allowed more effective planning of measures to combat food shortages. At the present time, the will to prevent or relieve

acute food shortages does exist in many countries, so that knowing what to respond to and how to respond can be an important limiting factor.

Secondly, the risk to acute food shortage is not in fact always apparent, or certainly quantifiable. Even if areas and population groups at risk can be quite readily defined — and surely they can — when and if shortages will actually occur is vital information. Whether these are seen as fluctuations outside a normal range of variation, or whether they are part of a progressively deteriorating trend itself, the need to take account of these in development planning, at the right time, is clear. The set-backs in development — in extreme cases the abandoning of national development plans in the face of acute food shortage — are well known.

Thirdly, the underlying and immediate causes of food shortages, and of acute malnutrition, are themselves by no means well known, nor are they necessarily understood and taken account of by those making decisions. Hence the appropriate measures may not be taken at the right time.

Finally, the effects of measures taken (and certainly of failure to take action) are usually not monitored. On-going information would not only allow their effects to be evaluated, it would allow them to be modified as needed during operation.

In short, disaster situations involving food shortage seem to have certain common characteristics. Notable amongst these are that preventive measures are not taken in time; the situation is confused and accurate information is scarce or non-existent, particularly away from relief centres; responses are not necessarily appropriate to conditions; and little examination of their effectiveness (still less cost-effectiveness) is carried out.

The requirements for information can therefore be summarized as :

(1) To provide a means of predicting acute food shortages, in such a way that preventive measures can be taken in time; in particular, to elucidate causes and hence optimize prevention.

(2) To inform those responsible for decision-making whether a shortage exists,its extent and severity, contributing to direction and disposal of resources for relief and rehabilitation.

(3) To monitor programmes, for modification and evaluation.

Type of information required; causal analysis

Having discussed in brief the reasons that information is needed, the next consideration is what form this information should take. For this, the factors that affect food supply, consumption and nutritional status must be examined (*) Although these clearly depend entirely on local circumstances,

(*) The approach outlined here is based on that proposed by the joint FAO/WHO/UNICEF Expert Committee on the Methodology of Nutritional Surveillance (Geneva, October 1975)

a useful first classification is to define the type of food supply system(s) the population group depends on.

Examples of food supply systems are settled subsistence, pastoral, and market, although other obviously exist. A list is given in table 1. In practice mixed systems are usually found, particularly in rural communities; moreover the emphasis may change both with season and with, for example, the trend to urbanization. An analysis of the relative importance of the different linked sources of food is needed, and examples are shown in figures 1-3, with emphasis on those factors likely to cause food shortages.

TABLE 1

Types of food supply system

Subsistence	Market
Food crops	Cash crops
Livestock	Commercial livestock
Fishing	Commercial fishing
Hunting/gathering	Non-agricultural self-employment
	Wage employment

These are the major categories mixed systems usually exist

For a mainly pastoral society, as in figure 1, family food availability depends on livestock yield, supplemented probably by grain bought in the market with cash obtained from selling livestock products or animals themselves. Livestock productivity depends on pasture condition, pasture carrying capacity, and so on.

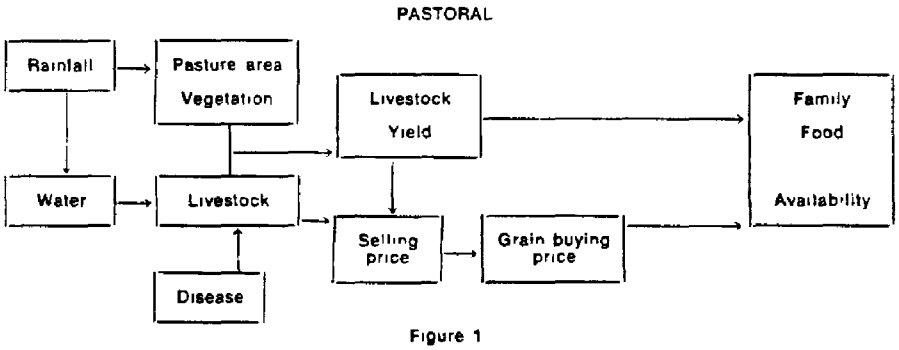

Figure 1

Pastoral food supply

Similar considerations can apply to an agricultural community (see figure 2). Here food is derived, for most of the year, from the stored yield from the previous harvest, again probably supplemented by bought food at certain times. Crop yields depend on weather, cultivated area, seed availability, and other such factors, and family food availability then depends on further factors, as indicated in the figure.

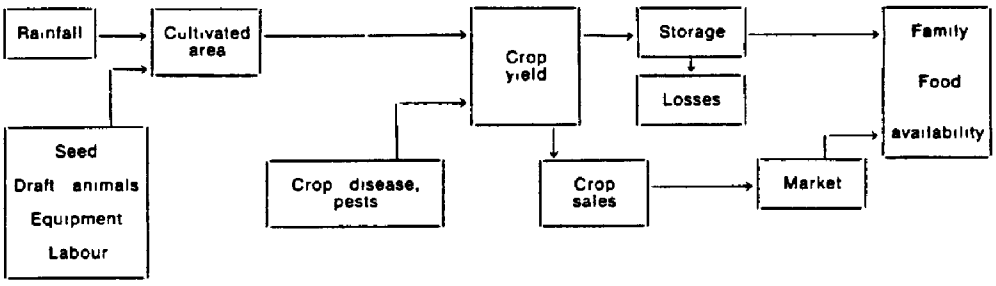

Figure 2

Agriculture food supply

A further example is market economy, as shown in figure 3. Here the critical factor may be money available to buy food, or, more precisely, the relation of food prices to income.

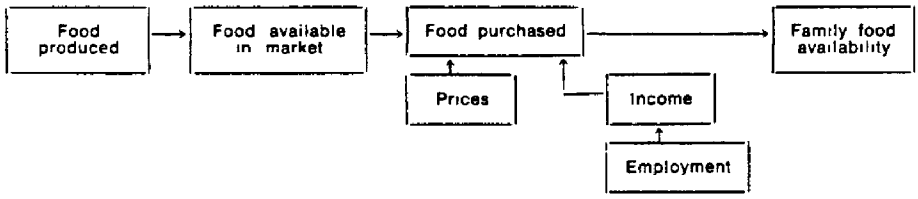

Figure 3

Market food supply.

The models so far have stopped at the point of food availability It should need no emphasis that this is not the sole determinant of nutritional status, and in fact the relations can be illustrated as in figure 4. Between food available to the family and an individual's dietary intake a number of factors operate : food choice, preparation, intra-family sharing, maternal care for children, and acceptance of food. However, at the level of actual intake the model becomes simpler, since the exogenous factors that determine nutritional status can be reduced to just two : dietary intake, and infection/ infestation (activity being regarded as endogenous).

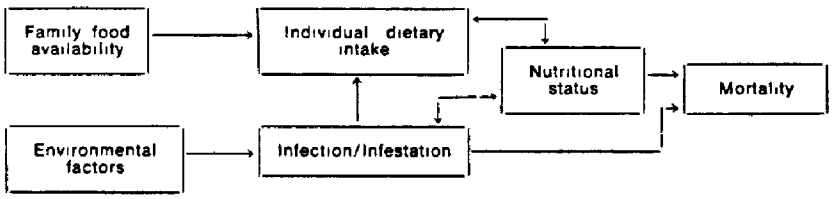

Figure 4

Immediate exogenous factors affecting nutritional status and mortality

This analysis is nor merely academic . it also clarifies the levels at which measures can be taken to improve nutritional status In an acute situation direct interventions to increase dietary intake, through feeding programmes for example, and to reduce disease, by public health measures, are the first priority On the other hand, preventive measures to avoid acute shortages, and action aimed at chronic malnutrition, will tend to concentrate on less direct factors, in other words on the range of approaches aimed at economic and social development.

It is clear from such a consideration that a wide range of subjects may need to be covered, under different circumstances, to allow prediction to be made of future food supplies and nutritional status. These subjects, in outline, will cover ecology, demography, resources, production, income, consumption, health and nutritional status.

Indicators

From a consideration of a causal sequence, it should be possible to select a few sensitive indicators which reflect the state of current and future nutritional conditions. There could be three types of indicators : first, those *predicting* future food supplies and nutritional status; second, those indicating *current* food supplies and hence likely change in nutritional status; and third, indicators of *nutritional status* itself.

At this stage the concept of an indicator needs to be further elaborated. Indicators are based on measurements, but they can be more than measurements themselves. Thus, for describing contemporary nutritional status, the weight-for-age of a child would be a basic measurement, and an indicator derived from this might be the number of children, in a defined group, of less than 70 per cent weight-for-age (i.e. moderately malnourished). Equally income and food prices might be the basic measurements : the ratio of income to the cost of adequate food might provide an important indicator. A given number of individuals or families in defined groups below a certain « cut-off » point — such as 10 per cent of children less than 70 per cent weight-for-age or 10 per cent of families with an income to food cost ratio of less than say 1.2 — might provide a « trigger-level » indicating the urgent need for action.

Referring back to the models discussed earlier, the principles of selection of predictive indicators become clear. Thus, for the pastoral food supply sequence show in figure 1 rainfall distribution, pasture conditions, water availability, livestock ownership per head, livestock selling prices and grain buying prices would provide examples of the type of information needed For the agricultural model, the information might be selected from rainfall distribution and water availability periods, seed and draft animal availability, cultivated area, crop yields, market selling and buying prices, food stocks and storage losses, and so on. For the market sector, the most useful information is likely to concern food prices, wages, and levels of employment.

A somewhat separate type of indicator applies to rural areas in particular, derived from monitoring responses of populations to impending or actual food shortage. For example, nomads in the Sahel had moved south much

earlier than usual before the effects of the drought had become widely known, and this movement itself was an obvious indication of deteriorating conditions. Thus monitoring population movement such as unseasonal use of grazing lands (winter/summer, wet/dry season), urban immigration, employment demand, to give a few examples, could provide rough indicators of change.

Assessment of nutritional status directly presents little theoretical problem : anthropometric methods are now well-developed, and will no doubt be covered elsewhere in the colloquium. Since considerable capacity to sample the population on a regular basis is needed for direct determination of nutritional status, less direct indicators from the health system would also be needed. A main problem here would be bias in the sample, since data on those attending MCH clinics, dispensaries, etc. would certainly not be representative ; nonetheless, valuable data could be obtained if interpreted with due caution.

Data sources and information flow

Having defined, at least in outline, the type of information likely to be needed, the first practical question to arise is how this information is to be collected. In fact, to differing extents in different countries, a basis for the required information is likely to be available. The problems may be that the data flow is slow and perhaps unreliable, and that the data itself is not interpreted to give an integrated picture. Thus the initial step in obtaining the necessary data must be through strengthening of existing systems; further information, even if of a qualitative nature, could be obtained through these, for example from extension workers, health workers, and the like.

The existing sources of information that could be utilized would be government statistical and meteorological agencies, agricultural services, and the health system. The data available from these must however be available in a sufficiently disaggregated form to specifically monitor and predict the conditions of population groups at risk, and therefore some modification in the forms of reporting may well be required.

Additional data sources are likely to be needed however to specifically monitor and predict the nutritional conditions of vulnerable groups. The form that these could take, as with so many other consideration, depends on local conditions — administrative structure, communications, resources available and particularly the information required itself. It must be recognized that there would be quantum change in resource requirement between obtaining, on the one hand, « unsampled » data, such as prices or rainfall, and on the other hand « sampled » data such as family food stocks, food consumption, or indeed nutritional status.

« Surveillance » should not be « repeated survey » : that is, the essence of the concept is of a continuous process of data collection, transmittal to a central point for processing and interpretation, and information output. Each step in the process should keep pace with the others, so that there would be no undue gaps in information, and equally no accumulation of unprocessed data. These considerations first apply to data collection.

The type of additional data source, for « unsampled » data, that could be envisaged would be « reporting stations » located in villages. These could report on such subjects as rainfall, progress of crop calendars, population and livestock movements, crop damage, produce selling prices, food buying prices, employment, wage rates, and the like, they could give qualitative warning of serious changes in food supply and nutritional status. The « reporting station » could perhaps be a local teacher, extension or community development worker, or dispenser, alternatively, someone could be employed specifically for the purpose. In either case the requirements would be for maintaining communications and data flow, providing equipment and stationary, and giving training and support from a central point

For mobile populations, some information could be obtained from reporting stations, but regular data availability might have to be established in a similar way as for « sampled » data (see below).

Sampling capacity would mean the ability to visit selected households, in order to carry out interviews and make measurements In principle, for a settled population, this could be also based on a static reporting station; alternatively, it could involve the use of mobile teams — as would certainly be needed for sampling mobile populations. In either case, recruitment, training and employment of personnel specifically for the purpose, and provision of transport, would be required.

The type and quality of data obtainable by sampling would be much more extensive than without : livestock ownership, crop yields, food stocks, storage losses, family incomes, food availability, some indication of consumption, health and nutritional status, and other information could all be obtained. Nonetheless, the value of the extra information obtained in terms of modifying action would need to be carefully assessed in view of the additional costs.

The balance of types of data sources employed could only be worked out for each local situation, on the basis of existing sources and channels of information, information requirements, and resources available.

The further requirements for the surveillance system are for data flow, quality control, and for data processing and interpretation.

Translating information into action

The type of information required, and how to obtain it, has been considered in principle. However, the key to the usefulness and success of a surveillance system is how this information can be used to modify the situation of the population monitored. In other words. how the information can be made effectively available to decision-makers, so that surveillance can be translated into action.

The information output from a surveillance system must be presented in a form that is directly useful to planners. The output that, for example, showed that 10 per cent of a defined population group had a high probability of only having available 60 per cent of its energy requirement in 3 months time, that the present 2 per cent of under-fives of less than 70 per cent weight-for-height would change to 15 per cent, and so on, would indeed sum up the situation, but of itself would change nothing. The pro-

blem would be how to use this information to produce adequate and timely action, and this is an administrative and political problem.

The conclusion is that a central unit, that would be needed to administer the surveillance system and to interpret data, must be effectively located within the political structure. Moreover, it must be established with links to the decision-making process, and be vested with sufficient authority to be taken seriously. Plans to establish surveillance need to start from this point as much as from the data collection end. Then the output can be tailored to the type of information that would be useful to planners, and a dialogue beween those making decisions and those providing the information on which these could be based could really be effective.

Conclusions

This paper has aimed to outline the principles behind the idea of surveillance. The theory is based on current knowledge, but what could be a new result is the synthesis of information into an overall picture of people's nutritional conditions, with a predictive element to allow prevention of acute malnutrition. The ideas largely remain to be translated into reality. For this to happen, what is required is an agreed coordinated approach, the acceptance of the real need for such information, and the use of this information to bring about change.

Not until surveillance has in practice made a contribution to the improvement of the actual nutritional conditions of people suffering from or at risk to food shortage and malnutrition will these ideas have been of any use. Surveillance could make an important contribution to eradicating hunger and malnutrition, by identifying the situation of those at risk, warning of possible deterioration, and providing the basis for initiating, modifying and evaluating action programmes. Future events will show whether this really happens.

Summary — It is proposed that access to up-to-date information concerning current and future food supplies and nutritional status would contribute to prevention and alleviation of acute food shortages

Such information could be made available by establishing nutritional surveillance systems to monitor the situation of vulnerable groups in countries prone to food shortage The approach proposed by the Joint FAO/WHO/UNICEF Expert Committee Meeting on the Methodology of Nutritional Surveillance (Geneva, October 1975) is outlined in the paper

This involves an initial assessment of the food supply and nutritional situation, selection of indicators both for early-warning and for monitoring change, establishment of data sources and a system for information flow and interpretation, and a mechanism for translating the information into effective action.

DISCUSSION

M. F. Lechat : One thing I should like to ask Dr Mason with respect to surveillance systems, FAO is issuing a monthly, I guess it is monthly, document on food shortage in the various countries of the world. It is a confidential document, which is normal due to political implications involved. It is based on a number of sources of information, meteorological, from agriculture, etc. May I ask you How efficient was it in the last three years to prevent localized famine situations ?

J. B. Mason : Perhaps I did not make myself sufficiently clear : surveillance is concerned with information needed within a country to identify and monitor specifically vulnerable groups The Early Warning System is a comprehensive cover, which does not produce information disaggregated below the national level. So these two do not overlap — they are complementary. Surveillance is designed to be useful at a much finer level, therefore, than the Early Warning System. As to the reliability of the Early Warning System, I have no information to hand Although the information is often of a qualitative nature, I think it is found to be useful — for example for the World Food Programme, for pre-planning, movements of food stocks, etc

F. Merkle : I fully agree with the value of an early warning system, and the condition of surveillance, of the flow of information and the feed-back reporting system. But in practice how can it be realized ? Such an organisation again needs staff and money and that's the main problem in most of the poor countries in the world. So the only way to establish such an early warning system seems to me to get support from the field, from outside and we should find a way to connect such skilled services to work together with teams who are normally working in the field, for instance the malaria eradication team, the smallpox vaccinators or BCG vaccinators.

J. B. Mason : We are in complete agreement : the existing structures should obviously be the main source of information for a surveillance system. We are not advocating a sophisticated and expensive approach, but simply trying to use the information that is anyway available, interpreted particularly to give a predictive element. In my view, the concept should not be of repeated survey, but to obtain existing information as a regular flow, which although perhaps less accurate and more qualitative than survey data, will compensate for these inadequacies by being regularly available over time

NUTRITIONAL INDICATORS IN TIMES OF EMERGENCY

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Indicators are necessary to assess and to monitor the nutritional status of populations in emergency situations. They are usually based on measurements but at the same time they are more than the measurements themselves. They include the definition of critical range limits and of the proportion of the population which falls within these. Indicators must be sensitive to critical changes in the nutritional state of the population; they must reflect any change that is large enough to warrant intervention. They must also be specific, not being affected by non-nutritional factors. They should be easy to measure, requiring little equipment and little processing of the data. Continuous availability of the data is also an advantage since it will permit the early detection of change. The cost of collection should be as low as possible in order not to constitute a major constraint on the collection of data The best indicators of population nutrition in times of disasters appear to be those related to health and dietary intake.

In the field of health, one can distinguish four groups of indicators, i.e. those related to clinical signs, biochemical parameters, anthropometrical measurements and vital statistics It should be noted, however, that low values for anthropometrical measurements or biochemical parameters are frequently observed in the absence of any clinical signs of malnutrition.

Amongst the indicators which fulfill the conditions outlined above, we shall mention the following ones :

1. *Clinical signs.* Most clinical signs are late to appear and indicate a long standing deficiency. The presence of bilateral oedema is an almost unmistakable sign of moderate to severe protein-energy malnutrition in children; the causes of erroneous diagnosis are few. In pregnant women, the chances of errors are greater but do not affect significantly the results if oedema is detected in a large number of women. It is a sign of advanced protein-energy malnutrition and as such will not be observed in a significant percentage of the vulnerable population (preschool age children, pregnant and lactating women) unless the nutritional situation is gravely affected or if a fairly large sample of population has been examined. Attempts have been made to standardize the detection of oedema, although this has never been fully achieved. The presence of oedema is characteristic of the kwashiorkor or marasmic kwashiorkor

forms of protein-calorie malnutrition but fails to identify the marasmic forms : there is therefore a tendency to underestimate the importance of the problem. It is nevertheless a useful indicator especially in emergency situations when no other one is available; it has been used with success during the drought in the Sahel.

2. *Biochemical parameters.* The determination of haemoglobin is particularly useful in preschool age children and in women in the reproductive period. Indices for the diagnosis of anaemia have been reported by WHO (1972). Levels of vitamin A in the plasma are also useful to measure when hypovitaminosis A is suspected It should be noted, however, that the applicability of biochemical tests in emergency situations is low owing to the circumstances.

3. *Anthropometric measurements.* These include the following : birthweight, weight for age, height for age, weight for height and arm circumference for height or by year.

3.1 *Birthweight*

An association between the weights of children at birth and the nutritional status of the mothers has been well documented in various parts of the world (Rosa *et al.*, 1970). A decrease of birthweight has been observed during times of famine, such as in the Netherlands in 1945. In countries where malnutrition is highly prevalent, a large proportion of children are born with weights under 2.5 kg. There is also recent evidence that supplementary feeding during pregnancy, providing as little as 100 kcal per day, will increase the birthweight of the offsprings (Lechtig *et al.*, 1972). Birth weight is influenced by a number of other factors such as socio-economic status of the family, parity, stature of parents and grandparents and infectious episodes during pregnancy. It is nevertheless a good indicator of the nutritional status of the community and as such will give a rough estimate of the prevalence of malnutrition in preschool age children. The indicator should be the proportion of birthweights equal or below 2.5 kg.

3.2 *Weight for age*

This is the simplest and most common measurement for the assessment of growth. A scale is required which must be checked and adjusted with known weights; ideally, this should be done every day before any measurements are made. For the assessment of the nutritional status, the actual weight should be compared with a reference weight, i.e. the weight of a « normal child » of the same age. There have been diverging opinions as to which reference growth figures should be used, i.e. national or international ones. There is much to say in favour of an international reference growth curve since in most cases the influence of environmental and especially of nutritional factors is greater than that of genetic factors in determining the growth of children. There are few national or local growth curves available and the time and money required to determine

those are often out of proportion with the benefits, this is especially true in cases of emergency.

It is on the basis of this comparison that the classification of Gomez for malnutrition has been established Three degrees of malnutrition have been defined, i.e 1st degree for children with a weight between 75 and 90 per cent of the reference child of the same age, 2nd degree for children between 60 and 75 per cent and 3rd degree for children below 60 per cent of the reference weight. In this class are also included all children with oedema. This type of classification has been widely used; it has the merit of simplicity and gives information as to the actual nutritional status The age of children must be known with a fair degree of precision. The method tends to overestimate the number of malnourished children by not taking into consideration the height Children classified as malnourished because they are underweighed may be shorter than normal for their age with the result that their weight for height is normal.

The problem of overestimation is of little concern when one compares prevalence figures calculated by this method for different age classes. Such an analysis may help to identify the problem areas for future action programmes. In Central America for example (table 1) the second half of the first year appears to be the most critical period in Salvador while in Guatemala malnutrition is highly prevalent from 6 months up to 4 years.

TABLE 1

Prevalence of third degree malnutrition (less than 60 per cent of weight for age)

Age	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panama
First half	0 0	0 0	1 7	0 0	1 4	0 0
Second half	1 3	12 5	5 9	3 3	2 9	1 6
Second year	0 8	2 8	5 7	1 9	2 4	0 9
Third and fourth year	0 7	0 9	4 2	1 7	0 0	0 5

3 3 *Height for age*

This indicator does not necessarily reflect the present nutritional status but estimates past and/or chronic malnutrition. It is seldom present in infant malnutrition and when observed is more likely to be the result of a small size at birth Malnutrition must be prolonged over a long time before height is affected significantly and even then the deficit in terms of percentage by comparison to a reference child is much smaller than for weight. This indicator is therefore of little value in times of emergency

3 4 *Weight for height*

The shortcomings of measuring height or weight for age can be overcome by relating weight to height, i e. by comparing the weight to that of a reference child of the same height rather than of the same age. The comparison can be expressed in terms of percentage. It has been suggested that 80 per cent of the reference weight may be an acceptable cut-off

point between adequate nutrition and malnutrition By this method, the children who are stunted but are otherwise well nourished are no more identified as being malnourished and as a result, the number of malnourished children identified in a given population is usually smaller than when measuring weight for age and using a Gomez-type classification. This method is almost age-independent, bypassing thus one of the main difficulty of weight or height for age (Waterlow *et al.*, 1974).

Waterlow (1974) has proposed to combine the information on weight for height with the growth performance of the child as provided by the parameter height/age. A two by three tabulation can be prepared in which children are grouped vertically by percentage weight for height and horizontally by percent height for age. The cut-off points may vary according to the objectives pursued; convenient limits are usually 80 per cent for weight for height and 90 per cent for height for age; the inclusion of an upper limit such as for instance 120 per cent for weight for height allows also for the assessment of the prevalence of obesity in the same population. An example of such a two by three classification is given in table 2. The interpretation of this classification is given in table 3.

TABLE 2

Two-by-three classification (in percent) of child populations aged 1-2 years from three countries as stunted, not stunted, wasted, not wasted and obese

Country	% height for age	% weight for height		
		< 80	80 - 119	> 120
Togo	⩽ 90	8 1	14 7	0 0
	> 90	19.9	57 4	0 0
Philippines	⩽ 90	3 7	31 7	0.3
	> 90	7 5	56 7	0 4
Yugoslavia	⩽ 90	0 0	0 0	0 0
	> 90	1 4	97 3	1 4

TABLE 3

Interpretation of Waterlow's classification

% height for age	% weight for height		
	< 80	90 - 119	> 120
⩽ 90	Chronic malnutrition I	Stunting but no actual signs of malnutrition II	Stunting and obesity III
> 90	Acute malnutrition IV	Normal V	Obese VI

3.5 *Arm circumference*

Measurement of the arm circumference has been widely used as an index of malnutrition, either alone (Burgess *et al.*, 1969) or in combination with height in the Quac stick test (Arnhold, 1969).

There is little increase in the arm circumference between one and four years and this measurement is therefore relatively but not totally independent from age during that period (see table 4). There is an increase of about 1 cm in three years, or 2 per cent per year. By comparison, height increases by 8-9 per cent per year and weight by 10-12 per cent per year during the same period.

TABLE 4

Mid-upper arm circumference, based on data from Polish children

Age	Arm circumference
12 months	15 8 cm
24 months	16 2 cm
36 months	16 5 cm
48 months	16 7 cm

Shakir (1975) has recommended the mid-upper arm circumference because it reflects the body mass changes of malnutrition and also because it is relatively constant between 1 and 5 years in well-nourished children. Considering 16.5 cm as a reference figure during that period, one may draw a cut-off point at 75 per cent, i.e. 12.5 cm as the limit under which the child is in a critical stage and requires immediate attention. Mild-moderate malnutrition will be represented by those having an arm circumference of 12.5-14.0 cm (76-85 per cent of the reference). Anything above that figure and below 16.5 cm may be considered normal. However, the narrow distribution of measurements in a child's population makes it a rather insensitive index. This added to the fact that the measurement usually lacks accuracy, appears to diminish considerably its significance.

The Quac stick (Arnhold, 1969) has been used in emergency situations, for its simplicity and the fact that it does not require elaborate or heavy equipment to carry around. It consists simply of a height measuring stick which is marked off in arm circumference measurements instead of height measurements The values for 85 per cent and 80 per cent of the expected arm circumference for a specific height are marked directly at the corresponding height levels. If the child's actual height is below the level corresponding to his arm circumference, the arm measurement is greater than 85 per cent of the arm circumference of an average child of his height. Therefore, he is not malnourished. Conversely if he is taller than the level corresponding to the arm circumference marked on the stick, he is malnourished. If the arm circumference is lower than 75 per cent of the expected one, the risk of death is greatly increased (Sommer *et al.*, 1975). According to reports from Bangladesh the Quac stick can be used efficiently under field conditions for prevalence surveys but its value for screening purposes is doubtful. The method is simple and there is no need to know the age of the child; it requires, however, two measurements, the validity of which in field conditions is questionable. This is especially true of the arm circumference measurement. Recently however, a simplified method for measuring arm circumference has been described (Zerfas, 1975).

4. *Vital statistics*. Death rate at ages 1 to 4 years. Malnutrition is an important cause of mortality during that period. Death rates in this age group have therefore sometimes been used as a measure of the nutritional status of the population, although the importance of environmental sanitation should not be underestimated.

The importance of death rates during the second year of life has also been stressed (Gordon *et al.*, 1967). The largest proportion of deaths at ages 1 to 4 years occurs in the second year This is also the time when malnutrition assumes distinct importance The second year death rate has therefore been proposed as a practical index of community malnutrition.

As far as *dietary information* is concerned, the proportion of babies under one year of age who are breast fed, the dietary patterns and the total energy intake of the population are also indicators of the nutritional status which can provide useful information.

In conclusion, there are a number of indicators of the nutritional status of population which can be used. They include clinical signs, biochemical parameters, anthropometric data, vital statistics and dietary information In practice, in times of emergency, some of them are likely to be used more frequently than others because of the simplicity of their collection. They include the recording of oedema in children and lactating mothers and the anthropometrical data outlined above.

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DISCUSSION

J. J. Amy : I am not a nutritionist and I have come here to learn something, so I would like to ask you whether the skinfold cannot be used as a simple method for assessing the nutritional state of either adult or child in such a situation.

E. M. DeMaeyer : The arm circumference measurement is difficult to take with accuracy. This is even more true of the measurement of the skinfold The latter requires a caliper which is quite expensive, you have then to calibrate your skinfold caliber and under field conditions this is sometimes very difficult. Finally the measurement is extremely difficult to take accurately and requires a careful standardization of the surveillors against each other and against themselves at different times of the day or the week. From all what we have seen so far, it is the most difficult measurement to take with accuracy. We believe therefore that it is not practical under field conditions

J. A. Kusin : I agree completely with you that the skinfold under field conditions is completely out of the question, but I was wondering whether your arm-circumference standard, taken from Polish children is applicable for adequate assessment of muscle mass in developing countries where you know that the skinfold is very small. Isn't it better to make a reference of muscle circumference by deducting from the arm-circumference the skinfold of Polish children which will be appreciable within normal measurements. I ask this because the cut off point of 12.5 which you mentioned does not seem to measure the same degree of muscle deficit when you have a child of 1, 2, 3 or 4 years old, for which age range you say the arm circumference is constant.

E. M. DeMaeyer : If I have taken the example of Polish children, it is because until recently it was the only information available in the literature. Since then WHO has collected measurements on a large sample of individuals in fifteen different countries. You are very right that there are differences in the arm circumference, but we believe that we shall be able within a few months to provide references of arm circumference for different population groups We have now anthropometric measurements from Latin America, Africa, the Far East, Southeast Asia and the Middle East. So I believe we shall be in a position to provide information on arm circumference for different races.

W. Adam : Speaking about weight for age, you say that the age of the children must be known with a fair degree of precision but aren't there many populations where these people don't know even their own age ?

E. M. DeMaeyer : I think this was true twenty years ago, and it is still correct when you talk about adult populations, but we should also realize that in most countries there is an increasing degree of sophistication and that recordings of birthday are improving every day If you talk of adults of course that remains a problem, but we should realize that every country in the world, even the most backwards are becoming more sophisticated every day and there is a better recording of birthdays almost everywhere in the world It is therefore no more the problem that we used to know twenty years ago.

J. Rivers : I admire you for your optimism about the estimation of age. During the 18 months I spent in Ethiopia a considerable number of children go younger according to their parents and I don't think that one can actually be quite so certain that their age doesn't fluctuate

The other point is this problem of the skinfold thickness Two observations, one for it and one against it. It's quite attractive as a measurement in theory because first, it measures directly calory reserves; secondly it doesn't require a second measurement, you don't need age, you don't need measurements of weight and height and skinfold thickness doesn't fluctuate greatly in Jelliffe's standards at least with age in growing children. Technically against, you can't actually measure it yet, but the technology of conquering that should be overcome by a species which can land on the moon There is one point against it, which you haven't discussed, which is that some populations show very abnormal patterns of fat deposition. In Ethiopian children you get a selective fat deposition originally in the triceps and then later shifting towards the biceps and there is a sex difference in this which complicates definitely the measurement of skinfold, but also presumably the measurement or arm circumference in these populations

E. M. DeMaeyer : Thank you for this useful information.

E. W. Kinney : I would like to substantiate if I may what Dr DeMaeyer was saying about the index of measurement. None of these indices are completely accurate. I think they all can be considered to be glass houses but of them, on a practical level, it does appear that the age/weight measurement is perhaps the most practical. This is based on the fact that my own organization has presently in the hands of mothers with children under five several million age/weight charts in more than 25 countries. While I realize that efficiency is involved, I do think it's the most available index that we can consider and applied to children of five years and younger, you'd be surprised how many mothers do know approximately how old each child under five years is.

E. M. DeMaeyer : I would agree with you that in practical terms the weight age measurement, although it may lead to some errors, is still the quickest assessment that you can conduct in the field.

G. Thiers : About the difficulties to know the childrens exact age, I agree with Mr Rivers. In Tunisia, where I worked for about five years and which is already a more sophisticated country than Ethiopia, it is indeed very difficult, especially in the rural areas, to know the exact age of the children. People often wait a long time before declaring birth to the local authorities, since they know that there is a lot of chance that their child will die before the age of one year. So you can meet children whose official age is three months but their real age may be one year.

PRINCIPES METHODOLOGIQUES DE L'INTERVENTION EN CAS DE FAMINE

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1. Introduction

La situation alimentaire et nutritionnelle présente un caractère alarmant dans de nombreux pays d'Afrique et d'Asie (conférence mondiale de l'alimentation, 5-16 novembre 1974). Les épisodes aigus de pénurie alimentaire tendent en effet à se multiplier Les appels à l'assistance internationale en cas de famine constituent une charge croissante pour les nombreuses organisations internationales gouvernementales ou non gouvernementales (Ligue des Sociétés de la Croix-Rouge, 1974).

La famine est un phénomène épidémiologique dont l'étude s'est particulièrement développée dans les dernières années. De même que les maladies transmissibles, les maladies chroniques et les accidents de circulation, les famines ou épidémies de malnutrition protéino-calorique (M. P. C.) présentent une dynamique propre dont la connaissance a permis de définir quelques principes à respecter dans les actions d'assistance nutritionnelle.

Les causes et conséquences des famines suite à un désastre naturel ou provoqué par l'homme ont été parfaitement décrites par Dupin et Raimbault (1976). Il est particulièrement important de souligner l'influence du développement économique de la région dans les relations entre catastrophes naturelles et malnutrition. En effet, l'état nutritionnel antérieur détermine le degré d'urgence et la gravité de la famine.

Une famine représente un constat d'échec de la planification agricole et économique quand ce n'est pas, lors des guerres civiles, le résultat d'une volonté délibérée.

La lutte contre les famines se place à divers niveaux :

— *la prévention* par une politique alimentaire et nutritionnelle visant à satisfaire tous les besoins de la population;

— *la prédiction* des famines causées par des événements fortuits : sécheresse, cyclone, inondations... Vu le laps de temps qui s'écoule avant l'apparition des famines, un système d'alarme précoce devrait permettre à la communauté nationale et internationale d'agir en temps utile. L'exemple

de famine du Sahel (Sheet *et al.*, 1973) confirme cependant que la réponse est souvent lente, par manque d'information scientifique indiscutable et absence de volonté politique Signalons également le rôle important, mais non prédominant, des épidémiologistes dans l'établissement d'un système d'alarme précoce L'apparition de manifestations cliniques de malnutrition décelables lors d'enquêtes ou de la surveillance constitue en effet un signe formel mais trop tardif d'une pénurie alimentaire. Il doit donc être fait appel aux indicateurs climatiques et agricoles, plus précoces mais en conséquence moins fiables (Mason, 1976);

— *l'assistance d'urgence*, seule connue du public, fait l'objet de cet article. On ne peut bien entendu étudier la situation d'urgence en dehors du contexte général de la malnutrition endémique sur laquelle elle se superpose;

— pour terminer, *la réhabilitation*, dès que possible, remplace et prolonge l'action d'urgence A son tour, cette phase est la plus propice pour initier des mesures à long terme destinées à éviter la répétition d'épisodes aigus de M P. C.;

— les degrés respectifs de participation souhaitable et effective des services de santé dans la gestion de ces différentes phases sont indiqués au tableau 1. Une intensification considérable de l'activité des services de santé lors de la période d'urgence va généralement de pair avec un désintérêt relatif celle-ci terminée.

TABLEAU 1

Participations souhaitable et effective des services de santé dans la lutte contre la famine

Phases	Degré de participation souhaitable	Effective
Prévention (politique nutritionnelle)	+	±
Prédiction (système d'alarme précoce)	++	±
Assistance d'urgence	+++	++++
Réhabilitation	++	+

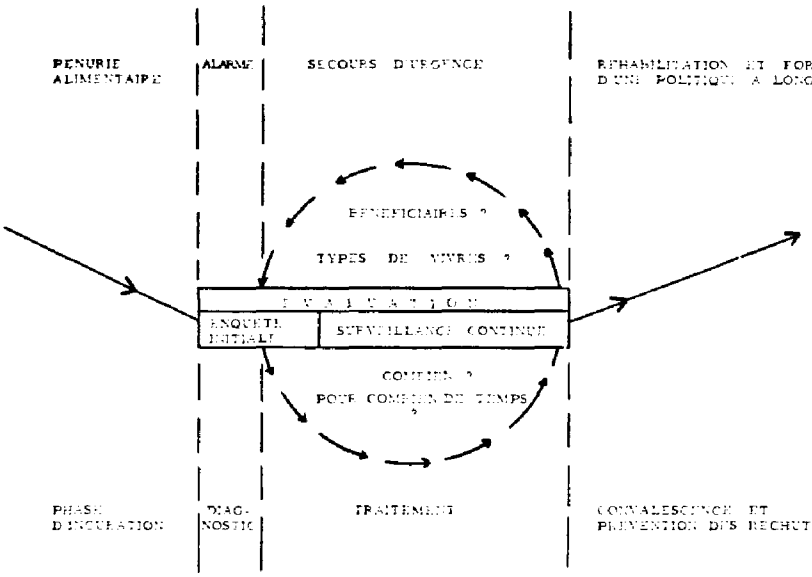
2. Assistance nutritionnelle d'urgence

2.1. L'assistance nutritionnelle apportée aux groupes de population souffrant de famine découle d'un compromis entre une improvisation habituelle et une planification occasionnelle. Les famines du Bihar (Inde), du Biafra, du Bangladesh et dernièrement du Sahel offrent des exemples d'une participation efficace et croissante d'institutions scientifiques et académiques dans les programmes de secours. L'expérience rassemblée lors de la guerre civile au Nigeria et de la famine du Biafra a amené le « Swedish Nutrition Foundation » à organiser en août 1970 le premier colloque international sur la nutrition en temps de désastre.

Depuis lors, les famines et en conséquence nos connaissances se sont multipliées. Les principes généraux présentés au collogue de 1970 se sont

précisés et ont gagné une acceptation de plus en plus large dans les milieux scientifiques et les principales organisations caritatives.

La place de l'assistance d'urgence dans le déroulement de la lutte contre la famine est illustrée dans la figure 1. La disparition progressive des ressources alimentaires, accompagnée éventuellement de l'apparition tardive de signes nutritionnels, conduit à l'étape de diagnostic (alarme) de famine menaçante. Le programme d'urgence vise à arrêter la détérioration progressive de l'état nutritionnel sans pour autant s'attaquer aux causes socio-économiques. La phase de réhabilitation (convalescence) débouche quant à elle idéalement sur la formulation d'une politique alimentaire et nutritionnelle à long terme (prévention des rechutes).



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Ils consistent essentiellement en une évaluation initiale de la situation nutritionnelle et des ressources disponibles, la provision d'aliments adéquats répondant aux besoins réels ainsi qu'une surveillance épidémiologique continue de la M. P. C. et des phénomènes associés (maladies infectieuses, migrations, etc.).

2.2. *L'évaluation initiale « assesment » de l'état nutritionnel et des ressources disponibles* vise à répondre rapidement aux questions suivantes : Qui a un besoin urgent d'assistance ? Que faut-il fournir ? Combien et pour combien de temps ? Il est étonnant de constater la mobilisation de moyens humains et financiers importants sans que bien souvent aucun effort ne soit entrepris simultanément pour déterminer l'étendue et la nature du problème (tableau 2), simultanément car il ne s'agit pas de conditionner toute action à une connaissance parfaite de la situation. Les impératifs humanitaires et la demande d'une action immédiate par le public ne permettent en effet aucun délai.

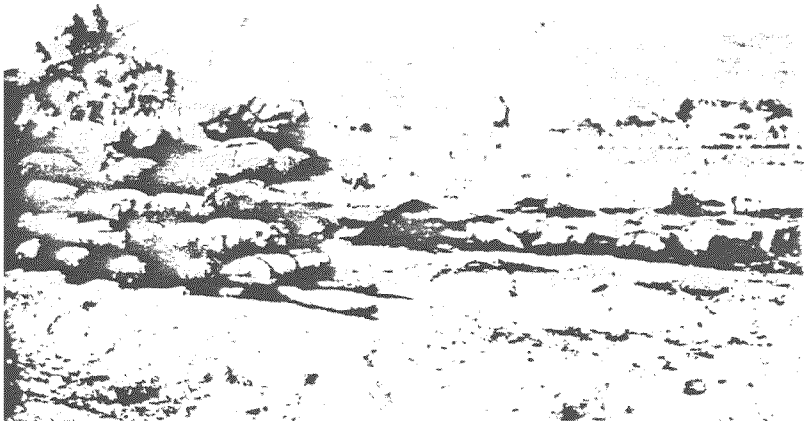

Fig 1

Haïti l'industrie du charbon de bois contribue à la détérioration du sol

Fig 2

Photo Croix-Rouge un cas de marasme dans la population nomade au Niger

L'évaluation préalable se justifie amplement par les avantages d'une aide adaptée et mieux dirigée Rappelons que la malnutrition revêt une distribution géographique très hétérogène. De nombreux facteurs rendent difficile et hasardeuse la généralisation d'impressions subjectives.

— Les cas sévères de M P. C. sont alités afin d'économiser leur réserve calorique et ne sont pas visibles pour un observateur superficiel.

— Ils tendent à être moins fréquents le long des axes routiers où une certaine économie de marché se développe et où les centres de santé et les postes de secours s'installent préférentiellement.

— Enfin, dans beaucoup de milieux culturels, un enfant atteint de M. P C. n'est pas un enfant malade et n'est donc pas présenté aux institutions de santé ou au médecin de passage.

Une situation géographique particulière peut créer des micro-environnements plus ou moins défavorisés. Au Biafra (1970), il était fréquent de constater des différences notables entre villages ou camps voisins (Davis, 1971). La même situation aurait été observée entre camps de réfugiés bengalis en Inde (1972).

En 1974, dans les camps de nomades nigériens, la prévalence de M P. C. était considérablement supérieure à celle constatée dans les villages voisins de sédentaires.

Les habitudes alimentaires fondamentalement différentes expliquent ces résultats surprenants. Pour leur survie, les nomades dépendent entièrement de leurs troupeaux. Ces derniers ont été décimés par la sécheresse de 1968 à 1974. Les sédentaires ont, pour leur part, subsisté sur de maigres récoltes de sorgho et de mil.

En Haïti (1975), la sécheresse a épargné relativement les sommets des collines où une pluie occasionnelle a permis d'assurer la subsistance de la population. Dans certaines vallées, seul un apport massif de vivres a permis de réduire l'incidence élevée de kwashiorkor.

Pour conduire à des conclusions valides, l'évaluation doit reposer sur des techniques d'échantillonnage statistiquement valides. Les paramètres importants tels que sexe, groupes d'âge, localisation, caractère socio-économique peuvent éventuellement servir de base pour une stratification de l'échantillon. Le nomadisme, par exemple, a été un facteur essentiel de risque de malnutrition lors de la dernière sécheresse au Sahel. Cela a été démontré par les enquêtes systématiques effectuées par le Center for Disease Control (Atlanta, USA) dans cinq pays et confirmé par l'enquête de la Croix-Rouge internationale au Niger

Le choix des indicateurs de M. P. C. est étroitement influencé par les objectifs particuliers et les conditions difficiles en cas de famine. En période d'urgence, l'objectif de l'enquête est de déterminer l'importance de la malnutrition aiguë. Afin de faire abstraction autant que possible du retard de croissance causé par une malnutrition chronique et de mesurer sélectivement la fonte des tissus mous (graisse, muscles), il est préférable d'utiliser des normes *en fonction de la taille et non de l'âge.* De plus, ce dernier est souvent d'obtention difficile dans des enquêtes sporadiques. Les indices de poids/taille ont été démontrés relativement indépendants du sexe, race et âge chez les enfants en dessous de 10 ans. Dans une