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CHAPTER 12

*Nutritional Surveillance: Principles and Practice**

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Nutritional surveillance programmes provide regular data collection, interpretation, and linkages to decisions in order to improve nutrition in communities. They are therefore either parts of, or supportive to, most of the policies and programmes described elsewhere in this book. Put otherwise, almost any programme intended to improve nutrition needs a minimum source of data for purposes of planning, evaluation, and initiating new activities. Nutritional surveillance programmes should never exist in isolation.

Suveillance is a term derived from the epidemiology of infectious diseases. It was used at the World Food Conference of 1974 to recommend 'that a global nutritional surveillance system be established by FAO, WHO, and UNICEF to monitor the food and nutrition conditions of the disadvantaged groups of the population at risk, and to provide a method of rapid and permanent assessment of all factors which influence food consumption patterns and nutritional status' (UN, 1975, Resolution V. 13, p. 9). The FAO/WHO/UNICEF Joint Expert Committee which met in 1975 to follow up on that recommendation stated that 'survelliance should provide on-going information about the nutritional conditions of the population and the factors that influence them. This information will provide a basis for decisions to be made by those responsible for policy, planning, and the management of programmes relating to improvement of food consumption patterns and nutritional status' (WHO, 1976, p. 8). More recently an international WHO meeting on nutritional surveillance (Cali, Colombia, July 14–17, 1981 – see ACC–SCN, 1982) stated that 'nutritional surveillance means to watch over nutrition, in order to make decisions which will lead to improvement and prevent deterioration of nutrition in populations'.

Data may be obtained actively, by deliberate collection; and passively, by using

* Some material for this chapter has been adapted from a working paper prepared by the authors for the US National Academy of Sciences, and a book to be published by WHO, entitled *Nutritional Surveillance* by J. B. Mason, J-P. Habicht, H. Tabatabai, and V. Valverde. These will not be extensively referred to in the text, but elaboration of many points may be found in them.

whatever relevant sources are available. Furthermore, the information is gathered only to the extent necessary to improve or maintain adequate nutrition through taking policy or programme actions. The range of possible actions to prevent and alleviate malnutrition and dysnutrition (e.g., obesity and other ills of diets with excess amounts of food (energy, sodium, fats, etc.) or unhealthy food components (certain additives, contaminants, etc.)) is extensive, and although not often well-defined, extends beyond the health sector.

The first criterion to define nutritional surveillance is that there should be regular data collection. This was highlighted in the 1976 document (WHO, 1976), and distinguishes surveillance from assessment by one-time nutrition surveys. The second criterion, the importance of which is now even more apparent than in 1976, is that the data are collected and analysed in such a way that they can be used for decision-making towards improving nutrition. The requirements for this use of the data are that: the data are inherently interpretable for this purpose; institutional links exist; and a planning or intervention mechanism exists.

Nutritional surveillance is distinguished from nutritional screening by having different objectives. Nutritional screening identifies persons at risk in order to provide intervention *on an individual basis*. Nutritional surveillance is concerned with data on population groups, and actions to improve nutrition at community, area, or national levels.

1 PURPOSES OF NUTRITIONAL SURVEILLANCE

Actual practice rarely follows the precept of the WHO (1976) document which stated that 'the surveillance system must be developed to fulfil the information needs of the intervention programmes planned'. There have been many reasons for this failure. The most pernicious is a blinkered concern for the data collection process itself. Such data collection to produce 'all-purpose' statistics has been widespread, but it is generally found that attempts to use the data showed them to be unsatisfactory for *any* specified use.

Such considerations led us to examine the actual uses attempted with nutritional surveillance data (Mason *et al.*, 1982). Some claimed that such data are part of a continuing attempt to change government policy in favour of nutrition or social equity, where such concerns are missing. We found no example of any actual surveillance activities which were achieving this purpose – probably because it is unlikely that the ongoing character of nutritional surveillance can be established in the face of governmental policy which is unconcerned with nutrition and social equity. This may be contrasted to the usefulness of short-term nutritional assessment endeavours which do not require long-term commitments, can be accomplished in spite of a lack of governmental interest, and can indeed on occasions change policy. On the other hand surveillance data can in theory reinforce public and government policy in favour of better nutrition and more social equity – but some initial interest must exist to start nutritional surveillance.

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Once a policy is established to promote equitable well-being, options are chosen to further that policy. These could range from taxes to discourage certain behaviour to subsidies to foster the production and consumption of a more healthy diet, environment, and life style. Subsidies can range from outright distribution of funds for food for the needy to lowering the price of food through subsidies or tax incentives for producers. Similarly allocation of resources by region, or to promoting alternative production strategies (notably through rural development) constitute further important options to promote welfare and combat the causes of malnutrition. Choosing which option is most efficient and effective in attaining policy objectives requires knowledge about previous experience in similar situations. Nutritional surveillance may occasionally be able to provide these experiential data although they usually come from research not requiring surveillance. It must also take account of local circumstances. Such data are often provided by assessment surveys tailored to the particular programme options under examination. One surveillance system, in Costa Rica, is linked to recurrent decision-making about welfare food distribution and other services, and the system uses continuously collected data to help in making choices about programme options (Valverde *et al.*, 1981).

Once a programme option has been chosen its design requires knowledge about targeting needs, and likely effects of different strategies. Tailored assessment surveys could provide these data, but many of the surveillance systems are directed towards this objective. In situations where targeting needs and characteristics, and other relevant factors change with the seasons or in longer cycles, or when the planning process is more continuous and flexible, a surveillance system will have an advantage over one-time surveys.

Efficient programme management requires a certain flow of information. It is clear that this is still an evolving art and technology (World Bank 1981). The division between programme management and recurrent redesigning of a programme must be hazy. Some of the nutritional surveillance systems seem directed to providing such generalized programme support, intending to evolve from planning to include an evaluation function.

Another specific kind of programme so exemplifies the concept of surveillance as a data gathering system for rapid decision and timely intervention that we will also discuss it separately as an early warning and intervention programme. It is the only kind of surveillance activity which is mostly self-contained – but at present we know of only one such system which is actually functioning, in Botswana.

Any system can fill all, some, or none of the above purposes. Some purposes apparently lead to sufficiently similar characteristics in operation that they can be discussed separately. The two covered here are surveillance for programme management, and early warning and intervention programmes. Before this however we discuss in some detail the more general and common form of nutritional surveillance, using data for policy purposes and for choosing and designing interventions, sometimes called 'nutritional surveillance for planning'.

2 NUTRITIONAL SURVEILLANCE FOR PLANNING

One striking characteristic of actual nutritional surveillance programmes for programme choice and design is that the analyses are usually *ad hoc* to meet the particular perceived and changing needs of the analysts. Where the analysts succeed in responding to planners' questions the analyses tend to be worked out and developed with the technical decision-makers, who then use the results to support informed political decision-making. These surveillance units, although rare, provide one model for others to follow. In Costa Rica, for example, they have found that even when policy is clear (i.e., the disadvantaged are to be provided with adequate services), the choice among programme options and programme designs is still highly political, more than purely technical factors needing to be taken into account. Nonetheless, good technical information is crucial for good decisions. It is interesting to note that units which provide data for such decisions feel a greater need for better analytic methods and for better sampling procedures than they do for better 'indicators'. In such cases routine data collection is occasionally supplemented by special surveys with different sampling and measurement characteristics.

The reason that the analyses tend to be *ad hoc* in surveillance for planning purposes is that it is hard to predict most of the questions that arise in choosing and designing programmes. For a similar reason data collection is not designed to address any specific question. Certain kinds of data collection are, however, similar among surveillance programmes which are directed towards planning because they appear to be generally useful for programme choice and design. Moreover, it is possible – and important – to define in general terms the questions that the surveillance programme is intended to answer. A summary of these is proposed in Table 1.

TABLE 1 Issues addressed by surveillance

	Question
1. (a)	Are there certain areas/people with appreciably worse nutritional conditions than others, and what are their characteristics?
(b)	Which characteristics are most closely associated with outcome?*
2. (a)	Is the overall health, nutrition, and socio-economic situation deteriorating or improving?
(b)	Is the trend the same for all groups, or are there some groups different from the trend?
(c)	How are deteriorating or lagging groups defined?
(d)	What characteristics are associated with this difference in trend?*
3.	Is a specific short-term problem indicated? (e.g., food shortage, epidemic)
4. (a)	Are there fluctuations that indicate recurrent short-term deterioration, or
(b)	Trends that indicate projected crisis in the future?

*Dependent variable is, for question 1, outcome, for question 2, change in outcome.
Source: Mason *et al.*, 1982.

2.1 Data needs

One characteristic of nutritional surveillance for activities which are said to be useful for planning is to produce *disaggregated indicators of nutritional and related factors over time.* Examples exist (Habicht, 1980; INUAL, 1978; Colombia-FES, 1979, 1980, and Trowbridge *et al.*, 1980), but represent the exception rather than the rule. This may be because these programmes have not existed long enough for meaningful analyses of longitudinal data. Nevertheless data collection in all the surveillance programmes for planning proceed so that data can be compared longitudinally.

The most familiar factors used to disaggregate data are geographical or administrative divisions – as for example in Table 2. These are appropriate and useful for design and monitoring of programmes that are controlled by administrative area, for example many health programmes. However, other factors of disaggregation are needed for other programmes – primarily socio-economic and ecological. There are two reasons for disaggregation: (a) for targeting programmes -- in which case factors for disaggregation must be relevant to the programme design, e.g., by cropping pattern, land holding area, etc.; (b) because certain groups may be of particular concern, and/or may show important changes over time which are not apparent at aggregated level. As an example, the large changes in certain agro-ecological areas in Kenya shown in Table 3 are not apparent at national level. Identifying the criteria which distinguish different groups of people in terms of nutritional status is therefore of particular importance. Another common finding is that landholding areas and occupation are related to nutritional status and other indicators (e.g., Valverde *et al.*, 1977); these findings relate both to targeting – e.g., a programme aimed at larger landholders might have minimal impact on malnutrition – and have important implications for programme design; for example, quite different interventions may be needed to improve conditions for small farmers, or the landless.

Factors of disaggregation can include:

(a) At community level (e.g., village): urban/rural; administrative/geographical area; climatic, ecological, etc. zone; cropping area; accessibility; access to services, markets; etc.
(b) At household level: occupation; size of landholding; tenure; cropping pattern; access to irrigation, credit, productive inputs; etc.

The choice of the sampling and analytic procedures needed to produce disaggregated results clearly requires an understanding of the determinants of mal- and dysnutrition. This understanding comes from knowledge acquired from a combination of assessment surveys and research. Research is directed towards answering specific questions about causality through controlled intervention trials (Habicht and Butz, 1979) and through analysis of non-experimental data (Blalock, 1964; Cook and Campbell, 1979). Both approaches are *ad hoc* and

TABLE 2 Social profile of the 10 Cantons with highest and lowest levels of height retardation in children attending first grade of primary school. Height census of 1979 and population and housing census of 1973 Costa Rica

Canton	Height retardation	Illiteracy	Poor dwelling	Dwellings without latrines	Dwellings without running water
		Percentage			
High height retardation					
Coto Brus	24.6 (1045)*	17.9	20.2	39.2	78.2
Los Chiles	23.1 (485)	34.8	15.8	53.3	88.8
Buenos Aires	23.0 (824)	23.4	29.2	51.6	84.2
Aserri	22.8 (758)	12.6	17.4	15.8	11.8
Pocosi	22.1 (1137)	14.7	15.3	18.9	61.8
Turrubares	21.7 (184)	30.1	17.4	37.4	45.0
Guatuso	21.6 (259)	28.6	16.1	44.0	87.2
Guacimo	21.3 (286)	17.5	14.9	21.3	54.7
Tarruzu	21.2 (212)	15.7	18.4	18.0	17.8
Golfito	21.0 (891)	16.7	11.8	23.9	38.0
Low height retardation					
Tibas	7.0 (884)	3.7	10.2	0.7	1.0
Moravia	6.9 (435)	3.1	7.8	1.9	5.4
Alfaro Ruiz	6.8 (133)	6.8	5.8	2.4	12.2
Montes de Oca	6.4 (466)	3.0	8.2	0.8	1.7
Barva	6.4 (282)	6.2	11.2	1.8	1.8
Central San Jose	6.3 (4193)	3.5	10.4	0.4	0.9
Atenas	5.7 (297)	10.5	15.3	7.4	14.8
Goicochea	5.3 (1183)	3.7	9.2	0.7	1.5
Palmares	4.9 (268)	6.2	8.4	7.1	8.0
Belen	4.4 (203)	5.3	5.9	3.6	1.9

*In parentheses is the number of cases of children evaluated by Canton in height census of 1979.

Source: Valverde, V. *et al.*, *Bol. Inf. SIN 2 (10):* 4–10 (1980).

require an expenditure of resources and talent which are not usually available for long-term surveillance (Habicht, 1980). Because surveillance activities to support planning also include some *ad hoc* analyses there is in practice no clear demarcation in activities between research and longitudinal nutritional surveillance. However, the longitudinal component of surveillance is cumbersome and expensive, so it should be pared to the essential data.

The *outcome indicators*, meaning those that reflect nutritional conditions, depend on the kinds of nutritional conditions one wishes to monitor and on the availability of data. The following recommended biological indicators (WHO,

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TABLE 3 Kenya: Changes in nutritional status 1977 to 1979

	Agro-ecological Zones									
	Tea W of RV 1	Coffee W of RV 2	Upper Cotton W of RV 3	Tea E of RV 4	Coffee E of RV 5	Upper Cotton E of RV 6	Lower Cotton E of RV 7	High Alt. Grass 8	Coast 10/11	Population Weighted
% Population	13	15	19	7	15	5	11	9	6	
% < 90% H/A										
1977	21	21	30	25	35	28	44	40	20	29.6
1979	25	27	27	21	26	31	20	19	40	25.7
% < 80% W/H										
1977	4	6	3	3	3	8	6	3	9	4.5
1979	2	2	4	4	2	0	3	3	6	2.9
Changes H/A	+4	+6	−3	−4	−9	+3	−24	21	+20	−2.5
Changes W/H	−2	−4	+1	+1	−1	−8	−3	0	−3	−1.7

	Province						
	Central	Coast	Eastern	Nyanza	Rift Valley	Western	Total
% < 80% W/A 1977	39	24	41	24	34	27	33
% < 80% W/A 1979	23	29	29	27	27	21	26
Changes W/A	−16	+5	−12	+3	−7	−6	−7

Abbreviations: W = west, E = east, RV = Rift Valley, H/A = Height-for-age, W/H = Weight-for-height, W/A = Weight-for-age.
Source: Compiled and calculated from tables in Kenya/CBS 1977 and 1979.

1976, pp. 34–37; Beaton and Bengoa, 1976) are now being collected in some programmes (see, for example, Table 4):

(a) Anthropometry of preschool children (from surveys, clinics, home visits by health workers, etc.),
(b) Heights or weights of children at school entry (from schools);
(c) Prevalence of low birth weight (from health centres);
(d) Infant and child mortality rates (from vital statistic registration, health sources, etc.)

Socio-economic and environmental indicators, closely related to nutritional conditions, can usefully be presented along with the biological indicators given above, to give a more rounded and comprehensive picture: e.g., housing, sanitation, literacy, and access to services. For example, the results from Costa Rica given in Table 2 are more convincing because they include non-biological indicators on literacy, housing, and sanitation. Conversely, the data showing changes in nutritional status in Kenya given in Table 3 would have a more powerful impact if such socio-economic indicators were also included – over the two year period much slower rates of change in these would be anticipated, and they would serve to check that comparable populations were in fact being measured. Only in Costa Rica have these additional indicators been routinely incorporated, although they would be available in other countries in most cases.

Data sources in general are of two main types: (a) use of data already collected by – or that can be readily added to – existing service operations: health centres, schools, birth and death registration, censuses, retail price indices, agricultural reports, etc.; (b) from household surveys, either adding nutrition measurements into these, or initiating surveys specifically for nutritional purposes. Both types have advantages and disadvantages, and the operation of nutritional surveillance usually involves a mixture of these; some include the capacity to undertake *ad hoc* investigations. A summary of data sources used in certain surveillance systems is given in Table 5.

The advantages of using data already available – or easily obtainable – from existing sources are clear, provided the data can be analysed and interpreted usefully. The reasons they may not be interpretable satisfactorily – their disadvantages – are first because their representativeness is not known, and more important, the extent to which this changes over time is unknown. Second, the reliability and validity of the data are difficult to determine, as are changes in these. In planning a surveillance programme it is important to look into potentially available data, but decisions on whether to use these and how to improve reliability and to allow for uncertainties in representativeness should depend on clear specification of the outputs needed. Thirdly, few nutritional surveillance programmes for planning have found efficient ways of distilling or subsampling the masses of data available from routine sources.

Use of sample surveys is appealing not only because the representativeness is

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TABLE 4 Examples of surveillance systems for planning purposes

Country	Data source	Coverage	Data type	Frequency
Kenya	Multi-purpose ongoing survey	Sample of 1500 households representing 80% population	Agricultural Socio-economic Nutritional	4x/year to every 2 yrs.
Costa Rica	(a) Min. Health agents	National total enumeration (250 000)	Nutritional Health Socio-economic	Annual Every 2 yrs
	(b) Schools	National (52 000)	Nutritional	Every 2 yrs.
	(c) Census	National	Socio-economic	Every 10 yrs.
	(d) Employment/income surveys	Sample of 6000 households, national	Socio-economic	3x/year
Colombia	(a) Govt. Health Clinics	Department (= 40 municipalities)	Infectious disease incidence, immunization	Monthly
	(b) Agr. Census	Department	Food production	Annual
	(c) Agrarian Bank		Area planted by crop production	Seasonal

Source: Mason *et al.*, 1982.

TABLE 5 Routine data sources used for planning purposes

	Clinics/ health workers	Schools	Local govt. admin. records	Census	Household surveys	Agr. reports	Community weighing	Retail price reporting	Village surveys
Chile	Y*		Y	Y					
Colombia	Y		Y			Y		Y	
Costa Rica	Y	Y	Y	Y	Y			Y	Y
El Salvador	Y		Y	Y				Y	
Honduras	Y	Y	Y	Y		Y		Y	Y
Kenya					Y				
Malaysia†	Y		Y		Y(?)				Y
Papua New Guinea	Y								
Philippines (OPT)	‡				Y(?)		Y		
St Kitts/Nevis†	Y		Y			Y		Y	
Sri Lanka	Y	Y		Y	Y	Y	Y	Y	Y

*Y indicates Yes.
†Proposed, actual use uncertain.
‡Health workers assist community weighing programme.
Source: Mason *et al.*, 1982.

known, but often more importantly because data can be more readily analysed with respect to causative and disaggregating factors. The best approach therefore, as used in Kenya (1977, 1979) or in the USA (Hamill *et al.*, 1978; McDowell, 1981), is to include anthropometry within a multipurpose survey. If this is not feasible directly, it is important to allow matching of nutritional data with those from other surveys, by using the same households, or a subsample of these, or by sampling strictly comparable households. This last possibility is often feasible but overlooked (NAPA, 1980, pp. 64–65). There are numerous surveys carried out in developed and developing countries, many with multiple purposes; design of a nutritional surveillance system should give priority to looking for opportunities for inserting nutritional status measurements within these as one element of a surveillance programme.

Data analysis. The requirements for adequate and appropriate data analyses are often underestimated. The first requirement is for *basic* analysis, which essentially provides tabulations of selected indicators, by appropriate group (e.g., geographical, socio-economic) (NAPA, 1980, p. 113) and eventually compares these over time. Such analyses need to be produced *without excessive delays* in order to serve their main purposes. Computer processing is generally used for this. The results shown in Tables 2 and 3 are results of basic analyses.

On the other hand, some of the meaning of the data is not brought out in this way, and it is often necessary to proceed to *advanced* analyses, using more sophisticated statistical techniques of which multiple regression analysis and its variants are the most common. Here the boundaries between surveillance and research are blurred. Advanced analyses can take months or even years, and require the use of large statistical programmes on mainframe computers. However, such investigations are needed to elucidate policy implications of data, for evaluation purposes, and also to improve the nutritional surveillance programme itself.

2.2 Organization

The institutional arrangements for nutritional surveillance for planning appear to be crucial for an adequate flow and use of analysed information. Informal experience indicates that an organization which is responsible for data collection is hard put to find the resources necessary to analyse the data and pass on the information in a form and with the timing necessary for decision-makers to use. This means that a nutritional surveillance unit is primarily a focal point, depending on data from other sources; and that a surveillance system is not self-contained. The linkages with decision-making bodies are the most important factor, as reviewed in the following examples.

In *Costa Rica* a political decision was made to channel substantial resources into improving family welfare, and a national programme known as Assignaciones Familiares (Family Allowance Programme) was established in 1974. In

this case the information needs were first for targeting the programme by administrative area, so that outputs such as those in Table 2 were used. Secondly, monitoring was needed of long-term changes in indicators such as these, with others causally related to food purchasing power (such as working hours required to buy a minimum food basket). Thirdly, identification of specific problems requiring actions outside the Family Allowance Programme – e.g., nutrition problems were identified in families of workers on banana plantations – was undertaken. The surveillance system, which is known as the Sistema Informacion de Nutricion (SIN) is now evolving into a more general socio-economic/basic needs surveillance, with inputs into economic planning. These requirements define the type of information needed. Actual data collection then depended on capitalizing on the available sources, which in this case were from home visits by health workers, from a specially-initiated census of heights of children at school entry, from birth and death registration, from census data, and from several surveys that had been completed (including a nutrition survey) and others planned for primarily non-nutritional purposes (e.g. three-monthly labour surveys). Many of the resources in the nutritional surveillance programme have gone into analysis of available or readily obtainable data. The definition of required outputs in the first instance has been quite clearly to support year to year planning of the Family Allowance Programme (Valverde *et al.*, 1981).

In *Kenya* nutritional surveillance is developing mainly to support non-nutritional government activities in a number of sectors, coordinated through a nutrition unit in the Ministry of Planning, and an Interministerial Coordinating Committee for Nutrition. In this case the available data to some extent dictated their use, which is primarily to provide a description of nutritional problems, and hence a basis for assessing government programmes for their impact on nutrition. On the other hand, these data can also be used for further defining the needs of the surveillance programme (Mason, 1978).

3 NUTRITIONAL SURVEILLANCE FOR PROGRAMME MANAGEMENT

The purpose of nutritional surveillance for programme management is to provide data to allow decisions on programme modifications during implementation. Most discussions so far refer blithely to linking nutritional surveillance data to programme evaluation with no idea whether surveillance and programme designs make this feasible. Clarification of this position is needed and we propose the following approach.

Scientific evaluation of a programme's *net impact* on nutritional status seeks to ascribe changes in nutritional outcome to programme activities excluding the possibility that effects seen are due to other, confounding, factors. A confounding (epidemiological terminology) or exogenous (econometric terminology) variable is one which may be responsible when the true cause of an association between the

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intervention and the outcome is not the intervention. For instance, better organized families manage to both look after their children adequately and send them to collect freely distributed food. These children may be taller than other children, not because of the free food, but because of their family organization. Similarly, families which value food distribution services may migrate preferentially to areas where such services exist. Such families also make better use of other opportunities and are better off nutritionally than other families.

Negative confounding is also possible. Families which need free food more may migrate to areas of free food distribution. This free food permits them to attain the level of nutrition of their neighbours. In this case there is no apparent association between availability of free food and nutritional status, when in fact the free food has improved these families' nutrition.

There is only one method which can assign a statistical probability statement to the chance that a net impact is not caused by confounding and which permits one to state with a defined probability that the impact observed is due to an intervention. This rigorous method of defining programme impact is done through properly controlled randomized trials which alone can deliver probability statements about impact. Properly controlled means that no biases are introduced after the randomization of assignment to the intervention (Habicht and Butz, 1979).

For most funders of programmes the certainty to be derived from randomized control trials is not necessary – so statistical analyses of quasi-experimental and non-experimental data suffice which control for confounding variables in the analysis stage. This requires collection of a wide range of data, and the use of complex statistical techniques (Chernichovsky, 1979) which can allow plausible inferences on causality, albeit with less confidence than from randomized trials.

Programme managers require much less certainty about causality, but they must know whether conditions for programme target groups are changing at an *adequate* rate, or are being maintained at adequate levels. They need the results of 'adequacy evaluation'. This evaluation does not preclude statistical analyses to investigate whether observed outcome is due to programme activities, but it does not depend on these. Finally, adequacy evaluation is concerned first with evaluating the process of project delivery, then with outcome.

The two minimum questions which an adequacy evaluation should answer are:

(a) To what extent are the intended target groups being reached by appropriate activities?
(b) Is there evidence that the nutritional conditions of the target groups are improving or adequate?

Affirmative answers to both questions would lead managers to conclude that the programme is proceeding satisfactorily even though sustained or improved nutritional status cannot be ascribed with high certainty to the programme. Negative answers should lead to more detailed active investigation and eventually to

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modifications in the programme. It must be stressed that while adequacy evaluation will *not* give a quantitative evaluation of programme impact, it will be of sufficient quality to generate and justify operational decisions and it is as 'scientific' as more complex procedures. The prerequisites of adequacy evaluation require advance identification of target groups, and sufficient flexibility and resources in the surveillance programme to support *ad hoc* investigations and trouble-shooting.

Few examples of such routine evaluations for management of nutrition programmes can be found in the published literature. Those that do exist (e.g., Caedo and Engel, 1973; Arroyave *et al.*, 1979) approximate to adequacy evaluation, although they were not referred to as such. These examples should be distinguished from specific studies – usually at pilot level – undertaken to test nutrition and health interventions, on which a body of information is now accumulating (Habicht and Butz, 1979; Beaton and Ghassemi, 1982; Gwatkin *et al.*, 1980; Drake *et al.*, 1980; Austin and Zeitlin, 1981). There is more experience in the monitoring and evaluation of development programmes, from which it is clear that monitoring of process – which is correctly given priority for management decisions – can often proceed satisfactorily, whereas procedures for evaluation of outcome are still relatively rare (Deboeck and Kinsey, 1980). Procedures for monitoring and evaluation as now set out by the World Bank (1981) are very similar in concept to those put forward here; moreover, nutritional status is identified as one of the selected list of possible indicators to evaluate outcome in terms of level of living or basic needs satisfaction.

3.1 Evaluating the process of programme implementation

When nutritional outcome is of interest in programme evaluation, the assumption will normally be made that the programme activities will affect nutrition, usually positively. This may be from a systematic procedure of pilot testing, then scaling up. It may be otherwise assumed by comparison with other programmes, or because the causal connection is clear in theory (e.g., feeding programmes). Commonly, the reason that the outcome is less than expected is because of failure to implement as planned, not because the underlying assumptions are incorrect. This can mean that programme activities are not delivered in quantity and quality as intended; or that they reach others than the target group; or both. There is little purpose in estimating outcome without the knowledge that a change in outcome due to the programme could anyway be expected.

Typical process measurements, for example in nutrition or health programmes, are the following:

1. Timing of delivery of supplies and equipment.
2. Participation of target groups:
   (a) by attendance, (b) by receipt of food, immunizations, health care, health and nutrition education, etc.
3. Staff performance:
   (a) contacts with recipients per worker, (b) contact hours per worker.

TABLE 6 Quantifying target groups, 'needy', and programme recipients

A.

	Needy? (e.g. malnourished) Yes	No	Planning (pre-programme)
Targeted?			
Yes	a_1	b_1	Base-line data
No	c_1	d_1	

Proportion of total targeted that are needy $= \frac{a_1}{a_1 + b_1}$ *

Proportion of total needy that are targeted $= \frac{a_1}{a_1 + c_1}$ **

B.

	Targeted? Yes	No		Evaluation (during programme)
Recipient?				
Yes	a_2	b_2	– Programme data	Survey data (directly)
No	c_2	d_2		

Proportion of total recipients who are targeted $= \frac{a_2}{a_2 + b_2}$ *

Proportion of total recipients not targeted $= \frac{b_2}{a_2 + b_2}$

Proportion of total targeted who are recipients $= \frac{a_2}{a_2 + c_2}$ **

Proportion of total targeted not recipients $= \frac{c_2}{a_2 + c_2}$

C.

	Needy? Yes	No		Evaluation (during programme)
Recipient?				
Yes	a_3	b_3	– Programme data	Survey or non-programme data (directly)
No	c_2	d_3		

Proportion of total recipients who are needy $= \frac{a_3}{a_3 + b_3}$ *

Proportion of total needy who are recipients $= \frac{a_3}{a_3 + c_3}$ **

(With delivery exactly as targeted, recipients = targeted)

Note: In epidemiological terminology: (Weinstein *et al.*, 1980).
* = positive predictive value of screening test.
** = sensitivity of screening test.
Source: Mason *et al.*, 1982.

Equivalent variables can be given for other types of programmes.

For assessing targeting, at least three groups of the population can be distinguished: those in need (e.g., malnourished); those targeted; and programme recipients or participants. These are related as shown in Table 6, which also shows the derivation of suitable indicators.

Data on programme delivery can be obtained from administrative records, from reports of programme personnel, and similar sources. In the present context, it is important to relate these data to definitions of target groups, so that the extent to which the intended target groups are reached can be calculated. Similarly, a link with outcome data is desirable to assess how far the needy are reached – need being defined by outcome variables. In the short term this may not be required if a baseline survey has been carried out, since the proportion of needy and non-needy in the target group(s) – determined from the baseline survey – may often be assumed not to change very rapidly.

Analysis of process data involves calculation of (a) the adequacy of delivery of programme activities, and (b) conformity with targeting (Table 6).

3.2 Evaluating outcome

Selection of an outcome indicator will depend not only on the feasibility of data collection but also on the objectives set in planning the programme. There should be good published evidence that the outcome indicator is adequately responsive to the programme's intervention to reveal an impact (Habicht and Butz, 1979; Habicht, Meyers, and Brownie, 1982). The most usual measures of outcome in nutrition projects directed against protein energy malnutrition are anthropometry of preschool children. There is evidence that both height and weight are sensitive to nutrition interventions, especially if measured longitudinally in the same children (Habicht and Butz, 1979). Increments in height have been shown to be more sensitive than increments in weight in the sense of producing greater statistical significance. Many other measures of nutritional outcome such as decreased mortality and morbidity (Habicht and Butz, 1979), much less measures of behaviour, have not been shown to be responsive to protein-energy interventions even though they may be responsive to other public health measures.

In many programmes the monitoring of effects on anthropometry of beneficiaries is relatively simple if the programme involves individual contact (e.g., feeding programmes, medical care, etc.). However, for example, in a portable water programme, data on the population participating might need to be drawn from sample surveys, from clinic attendances, etc.

Sources of data for outcome evaluation. The methods of data collection and analysis for planning purposes are likely to be suitable, with some adaptation, for adequacy evaluation of programmes. The main differences are:

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(a) the population in question will generally be smaller, and a higher sampling rate will be needed; disaggregation of national data to refer to programme areas is often not feasible because of sample size limitations;
(b) process data need to be included;
(c) data from programme contacts may be available (e.g., from children receiving food supplements, farmers visited by extension workers);
(d) linkage to decision-making should be much closer in relation to specific programmes.

Sources, limitations, and complementarity of such data are discussed below.

Data from programme contacts. A distinction needs to be made between data on recipients and on the population as a whole. Process data are often drawn from direct contacts with programme recipients, and with suitable organization outcome data – e.g., weights of children – can also be obtained. Under other circumstances, data from programme contacts may not be available, or may be inadequate, as when programmes do not have individual contact for outcome data, e.g., rural development programmes; or when changes in the population as a whole are needed. Other methods may be suitable in these cases.

Routine data from administrative sources. The main problem with trying to use such routine data for evaluation is that the interpretation of changes detected in such samples is confounded by possible changes in coverage. Periodic representative surveys are one solution, but are constrained by cost. Another possible solution would be to control for changes in coverage, for example by including indicators of outreach.

Another problem is how to maintain a flow of reliable data from routine sources, which applies also to surveillance for planning purposes. A possible solution is to employ staff for this purpose, or to assign programme staff to these activities. Recorded information could be sampled at source, for example it could be envisaged that an enumerator could obtain adequate data from visiting a clinic approximately monthly; the enumerator could extract data from a sample of existing records, or gather data on a sample of patients attending a clinic on that particular day. Such an approach would assure a regular flow of data of relatively consistent reliability, and would also impose record sampling at source.

Community weighing programmes and school height measurement. These exist in a few countries (e.g., Philippines, Indonesia). The results, usually as weights and ages, are available by village, and comparison of these results over time could give indicators of programme adequacy. Coverage can be very variable, often well below 50 per cent of the preschool population. This complicates interpretation, somewhat as for clinic data. In many countries the heights (and weights) of school entrants are routinely measured. Such data could be used, including

retrospectively, to detect long-term changes in nutritional status at village or area level. Utility depends on school enrolment, but with potential wide availability more use could be attempted. In South Korea, height data have been used successfully to evaluate the applied nutrition programme (Miller, 1976).

Special purpose surveys. Small-scale nutrition surveys have been used for baseline assessments for programme design (Garcia, 1980; Mason, 1980). These have proved feasible with relatively low cost and short time requirements. Surveys such as these regularly repeated would be suitable for adequacy evaluation. The data produced could be used to assess changes in certain aspects of nutrition and living levels. Indicators chosen are objectively measurable (e.g., child's weight), easy to observe (e.g., housing, sanitation), or need the minimum of recall (e.g., current sickness). This imposes certain constraints, because data on flow variables like income and food availability are not included. The feasibility of repeating such surveys depends on administrative capacity, personnel available, funds, and so on. The financial cost of such surveys falls within the allocations usually made for more general monitoring and evaluation (see e.g., Deboeck and Kinsey, 1980).

It may often be more practical to include nutrition measurements in other surveys with obvious advantages. Not only are resources easier to come by, but many other aspects of survey procedure – e.g., sampling, hiring and training enumerators, logistics – will already be partially taken care of. The nutrition module needed within these surveys has been described (Kenya, 1977; Shorr, 1980).

3.3 Organization

Evaluation of programme adequacy involves two activities – process evaluation, and following changes in gross outcome – both of which should only be undertaken if they are of interest to the management of a programme. The organization should be mainly internal to the programme, and in this respect is identical with what may otherwise be referred to as programme monitoring and evaluation (World Bank, 1981). Therefore it will be necessary to have a certain amount of programme staff time allocated to evaluation. This applies both to field staff, for collecting data, and management, for their analysis, interpretation, and consequent decision-making. Realistic assessment of the amount of data needed, and that can be processed, is essential.

It is likely that only programmes of a substantial scale will be able to afford the necessary organization for ongoing evaluations. This is also true because the programme planning has certain requirements. First, baseline information is needed, to determine targeting and expected changes in outcome. These latter need to be expressed as quantified objectives and the changes in outcome that will be regarded as adequate should be decided in advance. Target groups must be specified sufficiently clearly that deviations from intended delivery of the programme can be determined.

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Although most of the work for ongoing evaluation will have to be done by programme staff, some of the needed expertise may have to be sought from outside institutions. Sampling, collection and interpretation of nutritional data, data analysis methods, etc., may require advice from specialists; however, these requirements should be kept to a minimum. As for planning, the likelihood is that rather straightforward and readily understandable indicators will suffice, and the important consideration is efficient and timely analysis and presentation of relevant information. This will depend largely on the effective management of the evaluation activities of the programme.

4 EARLY WARNING AND INTERVENTION PROGRAMMES

In some situations major episodes of malnutrition are brought about by relatively short-term events – imposed on conditions of severe poverty – such as drought, crop damage, pests, price changes for agricultural products, and, certainly, conflicts and wars. It is possible to plan a series of interventions to forestall the nutritional effects of some of these. Such interventions must be triggered in good time by information on impending problems. In such situations, interventions and information are closely linked, as far as possible in a predetermined way, and can be called early warning and intervention programmes. These can be regarded as a specific case of nutritional surveillance programmes. The definition is partly for historical reasons. In the WHO (1976) document, a lot of emphasis was given to early warning. Such programmes have distinct resource, organizational, and data needs which are different from those of either planning or evaluation. This is not to say that early warning and intervention cannot be a specific part of a more general nutritional surveillance programme. However, its purposes and requirements are sufficiently different that they merit discussion in their own right.

Warning needs to be only early enough to set in motion interventions to prevent the next step on the path to a severe food shortage. A series of interventions is thus best planned, each with its own information needs to trigger it off. The intervention will be completely specific to the causes of the problem and the population concerned, as will the information. The three examples available on early warning and intervention programmes are all primarily related to drought – Botswana, Ethiopia, and Indonesia (Table 7).

The time factors involved can be described, as shown in Figure 1, as: the time from when a predictive indicator (e.g., rainfall, food prices) reaches a warning point to the reporting and analysis of this; the time from this point to the implementation of an intervention to protect affected families (e.g., seed distribution, public works employment); and the time for the intervention to take effect and reverse the trend threatening food consumption. A series of indicators and interventions follows the same pattern. Provided that the overall time period is practical – e.g., rainfall changes *can* give sufficient warning (which in fact they usually do) – then the problem is one of organization, selection of appropriate interventions, and monitoring of appropriate indicators.

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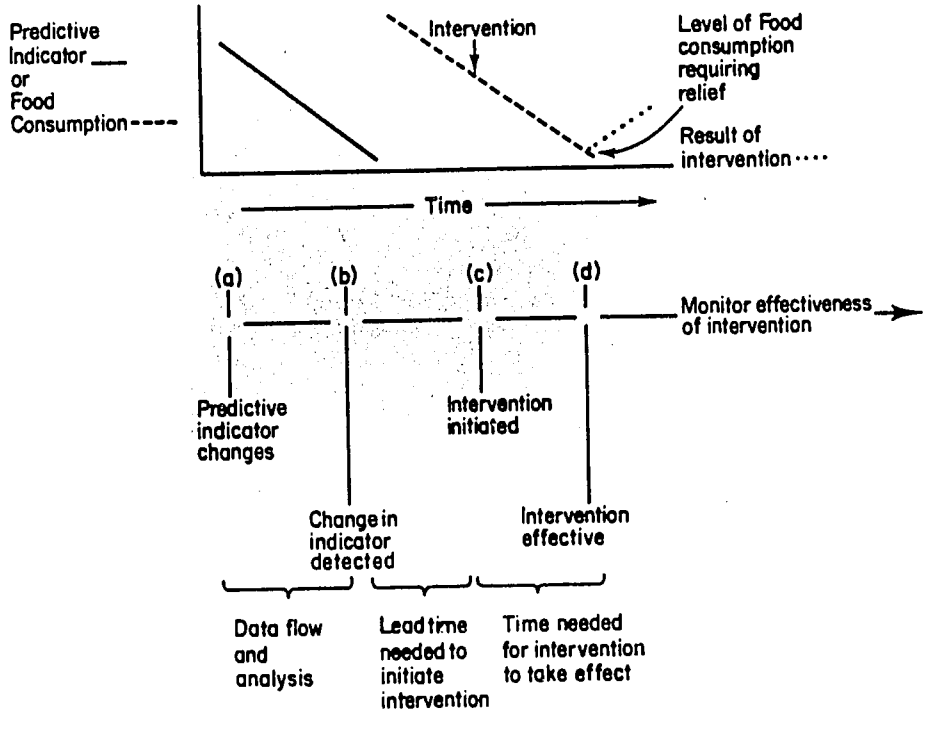
TABLE 7 Examples of interventions linked to indicators

Examples of interventions to be initiated	Examples of indicators used to initiate each intervention		Examples of programme monitoring
	Early indicators	Concurrent indicators	Later indicators
Seed (or credit) for replanting	Rainfall deficit during vulnerable period in crop cycle	Failure of crop to germinate	No reseeding
Public works employment programme	Failed crop (or other income failure)	Decreased food purchasing	Increased malnutrition
Food distribution	Decreased food intake	Increased malnutrition	Continued rise in malnutrition

Source: Mason *et al.*, 1982.



Source: Mason *et al.*, (1982)

FIGURE 1 Illustration of some concepts in early warning and intervention

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4.1 Organization for timely intervention

In practice in these situations, administrators react with increasing readiness to reports on impending crises, and often have certain set procedures to follow. Developing the organization of an early warning and intervention programme depends considerably on strengthening and systematizing these existing procedures. In addition, organizational improvements are likely to involve (a) decentralization of authority to initiate interventions, backed with the necessary contingency resources to do so; (b) improving the efficiency of reporting and interpreting selected indicators; (c) a capability to institute special quantitative and qualitative data gathering either to substantiate a need for intervention or to monitor more closely an area where a need is likely to arise. This capability strengthens the hand of an administrator who has reason to believe action is needed but requires further evidence to justify this.

There are certain planning difficulties that need to be faced. Resources need to be kept in hand in case deterioration in the future is indicated. The resources can be financial, e.g. for public works; or physical, e.g. food. The understandable reluctance on the part of administrators to keep resources available is a constraint and has similarities to other aspects of 'disaster preparedness' in general. This problem can only be solved by careful calculation of risks and trade-offs in individual cases. These should be made at an early stage of design and only if adequate resources can either be set aside or diverted can the programme be established. Total reserve resources need be less if they are pooled at more central levels of government – but this usually results in delays in initiating action. The solution would appear to be to have local reserves adequate to deal rapidly with incipient problems, with larger reserves at more central levels.

Another difficulty is related: what if the prediction had been wrong – that is no acute food shortage would have occurred – but the intervention was anyway triggered? This issue makes it a lot more attractive to plan preventive measures such as public works, which even if it cannot be proven that they prevented a deterioration, also have other benefits.

4.2 Possible interventions

A wide range of possible interventions could be appropriate at different stages of a developing food shortage, and these will depend more on the causes of the shortage the earlier they are undertaken; later interventions will be more similar – e.g., food distribution and treatment of malnutrition. Broadly three levels of intervention are discernible.

First, interventions can be undertaken to prevent the basic effects of the events which will cause inadequate food consumption. For example, erratic rainfall early in the growing season may require replanting, hence the appropriate intervention may be provision of seed. Similarly, income lost due to falling prices of export crops could be eased by government intervention to subsidize producer prices or

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provide compensation. Secondly, interventions may attack intervening events, such as rising consumer prices, dwindling food stocks, etc. These should be implemented before food consumption falls substantially. Finally, interventions may be needed if those preceding fail to prevent declining food consumption. These then are the more familiar food distribution and feeding programmes, rehabilitation programmes, etc.

Interventions need to be timely, rapid, cost-effective and short-term. They can be timely and rapid if there is an organized flow of information to the planning agency when any indicator reaches the trigger level. When this is confirmed by a second or third indicator, or by data specifically gathered to substantiate need the agency is prepared for possible intervention since the initial warning can act before the food shortage has occurred. This allows a timely flow of data, the impact of which increases as the impending shortage is confirmed by different measurements. This is more effective and organized for rapid action than sudden observation of a food shortage. The information for operating such a system therefore needs to be both sensitive and specific. Local decision-making based on automatic trigger levels is likely to be faster and more specific than more centralized decision-making.

In Indonesia, for example, the organization of interventions is intended to operate sequentially. This also corresponds to the phasing of trigger information. Strategy is designed to ensure that interventions do not overreact to impending problems, thereby upsetting local markets and economics in the process. Initially appropriate local interventions are at the market level and include supplementing the markets with staple foods in short supply, or subsidizing the prices of such products. This is a less expensive intervention than screening the population for food handouts. An example of a well targeted, minimum cost intervention could be subsidization of the cassava price. Since cassava is eaten only when rice is not available or too expensive, the subsidy is restricted to those who require it. When the impending decrease in food consumption is due to loss of employment or income, this may be handled by provision of public works employment, conceivably targeted by offering a wage slightly below the usual rate.

There are famine situations where immediate food distribution is necessary with all its costs and inefficiencies. This must be reserved for situations where less expensive interventions have failed. Expensive interventions should anyway be replaced as soon as possible by less expensive self-limiting interventions.

Finally it should be a matter of policy that early warning and intervention programmes are stop gap measures and do not substitute for other efforts to get at the basic causes of vulnerability. The long-term solution is therefore not an effective early warning and intervention programme, but to abolish the need for this.

4.3 Indicators

Indicators are defined in relation to triggering required interventions rather than to predicting deteriorating food consumption (Table 7). In practice, the present usage

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of early and concurrent indicators is that the early indicators may lead to preparation for intervention, the actual initiation of which awaits evidence that this is really necessary – as confirmed by concurrent indicators. For example, as in Table 7, evidence for rainfall failure risking extensive crop damage during germination might lead to first steps being taken towards emergency measures to distribute seed; the actual distribution itself would wait until the crop damage was confirmed. It is then important to know that the seed distribution worked and that the crop was now progressing satisfactorily. This stresses that indicators are relevant to producing the required action; the expected germination failure may imply risk of ultimate food shortage, and itself can trigger the required remedial action.

Early indicators can, for example, measure immediate vulnerability and resources, and could include seed and fertilizer availability, land planted, labour availability, food storage levels, household savings, rainfall, etc. Concurrent indicators can measure food availability and are related to flow data such as wages, prices, income, changes in household food stocks, changes in dietary patterns, consumption of famine foods, migration for food and work, etc. These indicators respond to changes accompanying the onset of a food shortage, and may reflect destitution as well as actual food consumption changes. Later indicators can measure the effects of past and continuing shortfalls in food availability, and include harvested outputs, morbidity, mortality and nutritional status indicators. These indicators may not be useful for predictive purposes, but are important for monitoring changes in a famine situation or for targeting famine relief. Distinctions between these three categories are not always clear cut. Household food storage levels, for instance, are an early indicator when they are used to measure vulnerability and a later indicator when they are used to measure the severity of a food shortfall. There is, however, a clear parallel between the three levels of intervention outlined in the previous section, and early, concurrent, and later indicators.

Nutritional status data are not predictive of themselves, but can have certain uses in an early warning and intervention programme. First, early preventive interventions may not be fully effective, and some monitoring of nutritional status may be needed as a fail-safe mechanism. Second, nutritional status is the obvious basis for targeting relief and rehabilitation measures. Third, nutritional status data should be useful for defining vulnerable areas or groups. It will sometimes be the case that areas with chronic malnutrition will be the most vulnerable to superimposed acute food shortages.

In circumstances of deteriorating incomes or increases in food prices (accompanying food scarcity) certain geographic areas, socio-economic groups, and kinds of individuals (e.g., the very young, the elderly) are more likely to suffer. Concentrating data collection on these sentinel groups in a staged way is essential to an efficient early warning and intervention system.

Indicators to monitor the country as a whole should, as far as possible, be measurements collected for other purposes as well. Where they indicate that an

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area is at risk, more monitoring and increased analytic capabilities are instituted. When situations deteriorate monitoring of special at risk groups, families or persons may be instituted, and these may even require special surveys. At every step an early warning and intervention system must be able to collect qualitative information tailored to the evolution of the situation by field trips of a qualified interviewer. Thus not only are the indicator variables to be collected and analysed in a staged fashion according to the evaluation of the situation, but the indicators used and the samples chosen can also be staged as the need for better information dictates.

5 STEPS IN DESIGNING A NUTRITIONAL SURVEILLANCE PROGRAMME

A procedure can be proposed to lead to decisions on establishing a nutritional surveillance programme (Mason and Habicht, 1981) – somewhat along the lines of the initial assessment procedure given in WHO (1976, Section 2). These are also in line with the conclusions of a recent UN meeting on nutritional surveillance (ACC–SCN, 1982). This is as far as it is feasible to go in general principles: thereafter the system will depend totally on local conditions. However, this initial phase (which may require substantial resources) is crucial. The steps would not be consecutive, and may need to be gone through several times. They are summarized in Figure 2.

A crucial step is to decide on the purposes of the nutritional surveillance system. These are in line with those discussed earlier in the chapter – i.e., for planning, for evaluation, or for early warning and intervention. The criteria which in general define which of these purposes should take priority can be laid out as follows.

The primary purpose of the system will be for planning when one of three situations exists. There may be government policies or programmes that affect nutrition, that are open to modification on nutritional grounds, and which have nutritional objectives. Alternatively, there may be large-scale social welfare programmes, such as those presently being operated in Colombia, Costa Rica, and Mexico. Finally, there may be a need to identify new programmes aimed at nutrition, or more generally at satisfaction of basic needs. Under these circumstances, the primary purpose of the nutritional surveillance system will be to provide data for planning. Essentially these address the questions which were given earlier in Table 1.

Secondly, acute problems of intermittent food shortages may be the priority, such that it is decided that early warning and intervention is the main purpose, in which case the three following conditions *all* apply. The first is that there are acute problems due to rapid fluctuations in food availability at household level. At the same time, the resources and organization for interventions to prevent these

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Identification of problems
Type of malnutrition, including chronic/acute
Who is affected, in geographical and socio-economic terms
Causation

Identification of users, decisions, hence purposes and types of surveillance
List:
policies and programmes currently or potentially impinging on (a) those most affected by nutritional problems and (b) causes of these problems;
ministries, departments, institutions responsible for potentially relevant actions (planning, implementation, evaluation).

Specification of information needed, and baseline statement
Draw up summary statement of what is currently known about nutritional problems. Use actual figures, presented as tables, maps, graphs, etc. Hence identify gaps in information needed for decision making.

Hence define:
existing policies and programmes relevant to nutrition;
institutions that are possible users of nutritional surveillance information;
decisions taken now or in the future that require information, and present information basis;
information therefore needed by relevant institutions for planning, initiation of programmes, monitoring, and evaluation.

These steps (above) are likely not to be consecutive, but will need to be undertaken so that they feed into each other iteratively.

Identifying sources of data, from those already used in initial assessment, plus for example:
data routinely available, if presently not utilized, from administrative sources;
possibility of including nutrition in household surveys.

Institutional arrangements
Decide:
organizational and analysis unit, including staffing;
linkages to decision-making;
means of supporting field operations, including need to hire staff for data collection and supervision.

Assess suitability for surveillance: variables, level of aggregation, linkage with other data, regularity, timing, reliability, etc.

Source: Mason *et al.*, 1982.

FIGURE 2 Steps in initial assessment for designing a nutritional surveillance system

fluctuations or their effects must exist. Finally it is also required that lack of adequate information to trigger these predetermined interventions is a constraint.

For chronic or acute problems, there may often be programmes with nutritional improvement as one objective, of sufficient scale that they can incorporate ongoing evaluation systems. The requirements here are both that there is a programme whose objectives include nutrition, and that there is a management organization that can adjust the programme during implementation based on regular evaluation of process and outcome. Under these circumstances, the adequacy evaluation purpose of the nutritional surveillance programme may be appropriate.

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Only when the purpose is defined and the specific decisions identified for which the data are required, should the indicators be chosen. They should consist of variables which are responsive to changes in the determinants of nutrition or nutrition itself (Habicht and Butz, 1979; Habicht, Meyers, and Brownie, 1982). Often the sampling area or person is as important as the variable itself in delivering a responsive indicator.

Finally, coupling the data collection, to data analysis, to decision-making, to appropriate action relative to improving or monitoring a people's nutrition is what differentiates a nutritional surveillance system from unfocused data collection.

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