Methodology of Nutritional Surveillance
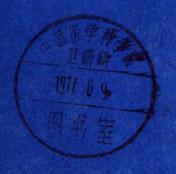
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1. INTRODUCTION

Surveillance of the nutritional status of populations has become a subject of increasing concern to both national governments and technical agencies in the fields of food, agriculture, and health, and the World Food Conference in Rome in 1974 made a specific recommendation [a] for the coordination of surveillance activities of international agencies and emphasized the need for a collaborative approach to planning in this area.

The aim of this report is to provide guidelines on the nature of a surveillance system, on the methods for setting it up, and on the principles for its operation. Although the Committee recognized that many of the fundamental causes of global malnutrition lie in the weakness of contemporary social organization, a field outside its terms of reference, it considered that technical guidance on systems by which nutritional problems can be characterized and quantified would increase social awareness of these aspects and contribute to their solution.

Surveillance is not an isolated activity, but goes hand in hand with the formulation and execution of policy. At the outset a dilemma has to be faced : on the one hand, it is impossible to develop an efficient system of collecting information without knowledge of the purposes for which the information is to be used. On the other hand, problems cannot be defined and policies formulated in the absence of information. Initially, any programme of surveillance and any definition of policy can only be based on the information that is available and on the objectives that appear to be important at that time. However, surveillance must produce feedback, which may be expected to modify the policy and the system itself, and lead to redefinition of objectives. Only experience can show how far the information collected is relevant, and thus the ways in which the surveillance system needs to be modified. For these reasons the proposals made in this report represent only a starting point for surveillance activities.

An obvious difficulty in specifying systems of surveillance is the very great diversity between different countries in conditions and available resources. The Committee has been particularly concerned with the surveillance of nutritional problems in developing countries, but this

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[a] *Resolution V.13* " ... recommends 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. "

should not be taken to imply that surveillance is considered unnecessary in developed countries. However, the system of surveillance may be *different in these different situations.*

Surveillance is a matter of great urgency in countries where the food supply and nutritional status of vulnerable groups is marginal and where malnutrition may be endemic. In many regions there is a constant threat that unusual variations in environmental factors may induce disaster situations in which malnutrition reaches epidemic proportions.

Where these conditions exist, the administrative and technical framework for collection, transmission, analysis, and presentation of data is usually deficient and poorly utilized by bodies responsible for planning and making decisions. As a consequence, the need for action is rarely anticipated and the disposal of resources, when committed, is often wasteful. Similarly, action to reduce the frequency and severity of both acute episodes and chronic situations requires longer-term planning, which again will only be effective when it is based on adequate information.

Thus surveillance is seen as providing at one and the same time an early warning system for nutritional disasters and a method of monitoring trends in a situation of chronic deprivation.

Global surveillance, as recommended in Resolution V.13 of the World Food Conference, must be based on integration of information systems operating at the national and local levels. Consequently, action directed towards establishing a global system must be initiated at these local levels and must concentrate on developing and improving systems of information as far as may be realistic for each country. Therefore, surveillance information should, whenever possible, be analysed and presented in such a way that international comparisons and global forecasts can be made.

1.1 General objectives of surveillance

Surveillance should provide ongoing 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.

Countries differ in their requirements for planning, their needs for information, and their sources of data. Although a single design for all surveillance systems is neither feasible nor desirable, some principles, examples, and characteristics of systems are presented in this report.

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1.2 Specific objectives

Nutritional surveillance is a continuous process, that should have the following specific objectives :

(1) To describe the nutritional status of the population, with particular reference to defined subgroups who are identified as being at risk. This will permit description of the character and magnitude of the nutrition problem and changes in these features.

(2) To provide information that will contribute to the analysis of causes and associated factors and so permit a selection of preventive measures, which may or may not be nutritional.

(3) To promote decisions by governments concerning priorities and the disposal of resources to meet the needs of both normal development and emergencies.

(4) To enable predictions to be made on the basis of current trends in order to indicate the probable evolution of nutritional problems. Considered in conjunction with existing and potential measures and resources, these will assist in the formulation of policy.

(5) To monitor nutritional programmes and to evaluate their effectiveness.

1.3 Definitions

It is important at the outset to specify the way in which terms are used in this report.

Surveillance, from the French " *surveiller* ", means to watch over with great attention, authority, and often with suspicion. By contrast, the word " *survey* " is used in this report to refer to the collection of information at a particular point in time. Thus a surveillance system may indicate the need for special surveys of particular problems.

Assessment is the appraisal of available information to offer a preliminary description of the nutrition situation in a country.

Evaluation is the process of reaching a judgement, on the basis of clearly defined criteria, about the success of any operation. This includes considerations of effectiveness and efficiency.

The word *monitor* also implies an ongoing or continuous activity. It is used in this report to describe an activity that is more specific than surveillance. Thus to monitor rainfall may be a part of surveillance.

Surveillance is based on the regular collection of data. These data are analysed to give *indicators* of present or future change of nutritional

status. The types of information from which indicators can be devised cover a broad range, and the classifications used throughout this report are intended to be illustrative rather than comprehensive. These types of information can be grouped in a number of ways, and a classification based on causal sequence, from level A to level D, could be :

	Level
A	Ecology : demography : infrastructure
B	Resources : production
C	Income : consumption
D	Health status

Under these headings, further categorization of subjects can be illustrated as follows:

Level A : Ecology : meteorology, land, water, vegetation.
Demography
Infrastructure : communications, community services.

Level B : Resources and production : agricultural production, livestock, food imports/exports/stocks, fuel.

Level C : Income and consumption : market data, income, food consumption.

Level D : Health status : nutritional status, disease patterns.

This report considers first, in section 2, the information essential for the design of a nutritional surveillance system : what the nutritional problems are ; who suffers from them ; where, when, and why ; and finally, what data sources are already available that could be utilized for nutritional surveillance.

The report then considers the indicators for nutritional surveillance (section 3). These indicators are derived from measurements, and have certain required characteristics (3.1). Some indicators are predictive, others are indicators of nutritional outcome. Both can be used together for national and global surveillance. The choice of indicators determines the selection of sources for the collection of information ; these data sources should complement each other (3.5).

The next step is the planning and development of the nutritional surveillance system itself (section 4). The basic practical principles for such a system are presented (4.1), the institutional structure is outlined (4.2), and the necessary steps are reviewed for implementation (sample design, definition of output, data collection, reporting timetable, implementation of operation, and data processing) (4.3).

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The report concludes with recommendations for future research (section 5) and for implementation of national and international nutrition surveillance systems (section 6).

2. INITIAL ASSESSMENT

Before a system of nutritional surveillance can be designed for any country there must be an initial assessment of the situation in that country. This assessment should include as far as possible information of four types :

— type, extent, and timing of the nutritional problems,
— identification and description of the groups particularly at risk,
— reasons for the existence of malnutrition,
— existing sources of data on which a surveillance system could draw.

Where no information is available, the first steps in setting up surveillance will have to be based on analogy with countries in which there are similar socioeconomic and ecological conditions. At the next stage qualitative information may be obtained from reports of cases of malnutrition in hospitals and spot surveys. This qualitative information may indicate what the nutritional problems are. At a more advanced stage data may be available from representative surveys that will give a quantitative answer to the questions " Who is malnourished ? " " Where ? " " How many ? " and providing some information on " Why ? ". This progression in knowledge is illustrated by the history of the protein-energy malnutrition problem : in many countries, the situation has improved from one in which the problem was not even recognized to a situation in which there are reports from hospitals, and sometimes community studies of prevalence, severity, and causal factors.

2.1 The nature of the nutritional problems

In developing countries the deficiencies most likely to occur are of energy (calories), protein, and iron. Vitamin A deficiency is very common in some countries, but not in all. Other deficiencies that may be of public health importance are of iodine, B-vitamins, vitamin D, and vitamin C. A preliminary assessment should attempt to pinpoint the deficiency states that are most prevalent and most serious. There may, of course, be other kinds of deficiency that are not of proven public health significance, but these must be regarded as subjects for research rather than of surveillance.

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In developed countries the situation is rather different ; in addition to the possibility of some undernutrition, there are the additional problems of overnutrition, such as obesity and the dietary factors implicated in cardiovascular diseases.

The assessment should include some estimate of the relative importance of the different nutritional problems. It should provide information, where possible based on adequate sampling, about those people in whom the problem is most serious. It is also useful to distinguish groups at risk by the time pattern of the nutrition problem that affects them, the main categories being : cyclical incidence, as with yearly " hungry seasons " ; random incidence, as with famines associated with variable rainfall ; and chronic incidence, usually associated with extreme poverty in both rural and urban contexts.

At the same time a check should be made on the possibility of the incipient appearance of conditions that did not previously exist (or had not been recognized), and for an increase in conditions that were previously uncommon. Examples are the increasing prevalence of obesity in some developing countries, and the re-emergence of rickets in a developed country.

2.2 Identification and description of groups at risk

The process of identification and description should start by answering the question " Who is at risk ? ". This is essentially a selection procedure, narrowing down the description to identify, as precisely as information allows, the group(s) to be considered. As examples, a group at risk in a particular country might be described as : preschool children living in a certain district, in an area of that district in which the mean annual rainfalll is less than 600 mm, whose food is derived mainly from livestock or, the infants of recent urban immigrant families who are unemployed, in a certain town.

An approach to defining these groups is presented below in a three-fold classification :

(*a*) Biological situation :
- — age group
- — sex
- — physiological status, e.g., pregnant women
- — exposure to infectious disease and other health factors.

(*b*) Physical situation :
- — rural or urban
- — ecological zone : e.g., savanna, desert, rain forest, etc.

- type of food source : e.g., settled subsistence farming, pastoral subsistence, market
- geographical region
- sanitary environment and pattern of endemic disease.

(c) Socioeconomic and cultural situation :

- ethnic or cultural group
- socioeconomic status, e.g., income group, cultivated land per family, income source, livestock holdings per family
- access to and utilization of health services.

The accuracy with which groups at risk can be identified and described depends in the first instance on an analysis of existing information. Additional information might be needed and should be obtained by conventional survey methods as necessary. However, the information derived from a surveillance system itself would improve the identification of groups, so that the description would become more precise with operation of the system. Thus the description might need to be broader in the initial stages than in a fully developed surveillance system. Similarly, decisions will have to be made as to when in the agricultural and economic cycles surveillance measures should be taken. Such decisions will be modified as experience accumulates.

2.3 Identification of causal factors and formulation of a working hypothesis

The third aspect of preliminary description relates to cause, and should address the question " Why is a particular group at risk ? " From a consideration of existing data certain reasons for this should suggest themselves. These can be organized into a flow diagram or model as a working hypothesis (see below). The predictive indicators can then be chosen to monitor accessible factors in the food supply chain for the vulnerable groups. This process should highlight gaps in the existing information and indicate areas in which additional data may be needed.

This procedure, which is discussed in detail in section 3.2, together with a definition of who is at risk (section 2.2), provides the basic information for choosing predictive indicators. Again as surveillance progresses the procedure will itself become more precise, so that the less efficient indicators can be discarded.

At this point, the range of subjects (see page 10) to be considered must be taken into account, and an initial definition must be made of the type of food supply system operating for the identified groups at risk. These

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Food                          ┌ Climate
produced                      │ Type
                              └ Capital equipment

                              ┌ Average planted    ┌ Seed stocks
                              │ Crop mix           └ Dates of first rainfall
                              │ Fertilizer used
                              │ Rainfall
                              └ Labour applied

Food transported ┐
·less exports     │
·plus imports    ┘    Food
                     available
                   in the market
Excesses added to stocks ┐
Shortages made up from    │
stocks                   ┘

Market      Prices
demand              Household
                    purchases        Food
Household                         available in
income                            the household

          Changes in
          household
          stocks                       Nutrients
                                    obtained by the
                                     family member
          Food preparation ┐
          Allocation of food│
           within family    │
           Breast feeding  ┘          Nutritional
                     Infection ───────  status of
                                        individual
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classifications provide a framework for the initial assessment as much as for the design of a surveillance system   As an example, for a mixed, settled, subsistence/cash crop community, in the initial assessment existing data concerning ecology, meteorology, production, income, food prices, health status, and other subjects should be sought. For other food supply systems there will be a different list. This is discussed in more detail in section 3 3 1.

2.4 Sources of data for initial assessment

In the initial assessment, the sources of data must be identified and evaluated in order to define the nutritional problems, the groups at risk, and the possible causes. At the same time potential resources for the surveillance system must be appraised (see section 3.5). These clearly overlap in that the continuing data collection systems may be useful for both purposes.

Historical data from government statistical (including the meteorological service) agencies, the health system, and agricultural services, may

provide important information. In addition, previous survey data (for example, from household budget or food consumption surveys), where they exist, will be of value.

Finally, part of the initial assessment should include the identification of sources of suitable personnel for staffing a surveillance system ; these may be needed within the existing data collection system, for establishing new data sources, and for data processing and administration (see sections 4.2 and 4.3).

3. INDICATORS FOR USE IN NUTRITIONAL SURVEILLANCE

After an initial assessment has been made of the nutritional problems with which a surveillance system is to be concerned, the next stage is to consider the indicators for use in that system. First, the necessary characteristics of these indicators must be considered (3.1). Then the possible causes of malnutrition need to be examined (3.2) leading to a specification of the types of information, their predictive value, and hence the indicators, that are required.

The measurements from which these can be derived (3.3, 3.4) and the possible data sources can then be defined (3.5). This process, outlined in the following pages, is a prerequisite for the practical planning of a surveillance system (as discussed in section 4).

3.1 General characteristics of indicators

3.1.1 *Introduction*

Indicators are based on measurements but they are more than the measurements themselves. An indicator may be constructed from measurements taken from a population group, or an area. As an example, the weight for age of a single child is a measurement but not an indicator. However, an indicator may be constructed from the distribution of values of weight for age in a specific group of, say, two-year-old children.

Thus, it is not possible to discuss the general characteristics of indicators without reference first to measurements and the way they behave over time and, secondly to the characteristics and nature of the sample. Further, the necessary characteristics of indicators are not apparent until the purpose for which they are required is defined.

One purpose of surveillance is to predict or document a situation that requires action. In this context it is essential to know the distribution of any given measurement in order to be able to define the values that trigger action. When actual data support the assumption that the measurements follow the normal distribution, it is possible to use the mean and its standard deviation as an indicator. However, although it is common to assume a normal distribution for observed values, this is not always the case.

It is therefore often helpful to display the distribution of the variable as a frequency distribution curve, so that the proportion of the sample falling within critical limits can be observed. A special case is the specification of the proportion of the population that falls below a certain level (cut-off point).

3.1.2 " Cut-off points " and " trigger levels "

The value that marks the boundary of acceptability is called the " cut-off point " for individuals or for items of data. For instance, when the weight of a two-year-old child falls below a certain point, this indicates such a high risk of imminent clinical malnutrition that it is considered unacceptable for that child. Similarly when a family's income relative to the cost of food falls below a certain " cut-off point ", the risk that members of that family will suffer from malnutrition might again be unacceptable.

One advantage of using " cut-off points " is that surveillance can concentrate its measuring resources on a restricted range of the variable. Another advantage is that the proportion of the population falling below a " cut-off point " may be calculated quickly by hand, can be displayed readily, and is easily understood.

The proportion of observations below this " cut-off point " required to initiate intervention may be termed the " trigger level ". To take the example of weight : the indicator might be the proportion of children below 70% of expected weight for age. Here the value of 70% weight for age has been chosen as the " cut-off point ". A decision to act may be taken when the proportion of children with weight for age below that value is, for example, 10%. Here 10% has been chosen as the " trigger level ".

Clearly, both " cut-off points " and " trigger levels " must be defined carefully, taking into account " usual " and " acceptable " levels, the resources available for response, and other local factors.

In practice, it may be better to consider a series of " trigger levels " against which a graded response can be planned. Similarly, a band of

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