PART 7

ASSESSING NUTRITION STATUS
CHAPTER 21

NUTRITION SURVEILLANCE

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Outline

• Concept and purpose of nutrition surveillance
• Functions and indicators of nutrition surveillance systems
• Surveillance for medium- to long-term planning
• Surveillance for programme monitoring and evaluation
• Surveillance for problem identification and advocacy
• Setting up a surveillance system
• Implementation of a surveillance system
• Assessment of nutrition-related health problems using surveillance
• Selection and establishment of a nutrition surveillance system
• Design of the surveillance system
• Limitations of nutrition surveillance data
• Community nutrition surveillance system in a developing country: the case of Indonesia

Objectives

By the end of this chapter you should be able to:

• Understand the concept of nutrition surveillance
• Explain the purpose of nutrition surveillance
• Describe the functions and identify indicators of community nutrition surveillance
• Describe surveillance for medium- to long-term planning
• Describe surveillance for programme monitoring and evaluation
• Describe surveillance for problem identification and advocacy
• Apply knowledge gained in the selection and establishment of a nutrition surveillance system
• Identify the limitations of nutrition surveillance data
• Describe the components of a surveillance system in a developing country
1. INTRODUCTION

The Centers for Disease Control (CDC, 2001) defined public health surveillance as “the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health.... Data disseminated by a public health surveillance system can be used for immediate public health action, program planning and evaluation, and formulating research hypotheses.” As ongoing suggests, a surveillance system is a cyclical process, one in which the data gathered and analyzed form the basis for subsequent planning, as illustrated in Figure 21.1.

As the CDC (2001) notes, “public health surveillance systems have been developed to address a range of public health needs.” Among these are the need for adequate nutrition and the need to address nutrition-related health problems in a timely manner.

At the World Conference on Nutrition in Rome in 1974, nutritional surveillance was proposed as a key strategy as part of efforts to alleviate world hunger. This conference was held on the heels of a major famine in Ethiopia and massive flooding in Bangladesh, which likewise contributed to widespread famine. Two important agreements were reached at the end of the meeting. The first involved the creation of the World Food Programme (WFP) and a Global Information and Early Warning System for Food Security at the Food and Agriculture Organization (FAO) (Jost, 1996). Second, a resolution was passed inviting the FAO, the World Health Organization (WHO), and United Nations Children’s Fund (UNICEF) to establish a worldwide nutritional surveillance system.

Nutrition surveillance was part of the 1990 UNICEF summit on children, where one of the goals was to eradicate hunger, food insecurity, and malnutrition within a decade. Surveillance data were to inform the improvement made in child health, roles of women in reproductive health, and the situation on food and nutrition security. Several key international meetings have taken place since 1990 and 2009 (see Chapter 1, section 2.1). More recently, the international community has agreed on what is known as the Millennium Development Goals (MDGs) (see Chapter 1, section 2.6). These goals are quantitative and therefore have measurable indicators. Surveillance data are required to monitor the performance of the strategies to be used and to inform planning.
2. USES OF NUTRITION SURVEILLANCE

When nutritional surveillance was adopted as a concept, it was to serve as a source of information for the planning and monitoring of nutrition programmes, both at the regional and national levels (Mason et al., 1984). However, a paradigm shift has occurred in its core function to a set of new tasks which are: problem identification and advocacy (Tucker et al., 1989), monitoring the effects of structural adjustment policies on food and nutrition surveillance systems (Arnauld et al., 1990), and early warning systems (Brown, 2008).

Nutrition status data are commonly accepted as indicators of social, economic, and health conditions. Such data can be used to create objectives for the improvement of the nutrition of populations and to monitor the progress of social and economic development.

In a developing country with an agriculturally based economy, surveillance activities are geared towards gathering information for stakeholders in the agricultural sector (Jerome & Ricci, 1997). Information gathered from such surveillance may include the amount of food crops grown, quantity exported, and amount reaching households and families for consumption, as well as wastage along the path.

Nutritional surveillance data can also be used for several other purposes:

- To evaluate dietary guidelines
- To influence policy (Akhter & Haselow, 2010)
- To revise food selection guidelines
- To develop and evaluate fortification programmes
- To develop serving sizes for nutrition information panels on food labels
- To make decisions about specific food processing regulations
- To predict the impact of bioterrorism threats from food contamination (Chapman, 2005)

The data collected through nutrition surveillance systems should therefore satisfy certain criteria. Jerome and Ricci (1997) note that the resulting information should be:

- population-based,
- decision- and action-oriented,
- sensitive,
- accurate,
- relevant,
- timely,
- readily accessible, and
- communicated effectively.

Despite having the above common characteristics, nutrition surveillance systems vary widely and comprise a broad range of nutrition-related issues. The end users of the information may include communities, governments, non-governmental organizations (NGOs), and international organizations that have an interest in the nutritional problems being addressed. Nutrition surveillance systems can therefore be set up to collect data on a broad range of factors that affect nutritional status. These may include information on agriculture, dietary intakes, health practices, and socio-demographics of communities. The targets of the surveillance system can also be a specific group, such as pregnant and lactating women, children under 5 years of age, or elderly persons. The purpose of the surveillance system dictates its various features.

3. INDICATORS OF COMMUNITY NUTRITION SURVEILLANCE

3.1 Type of Indicators

A single surveillance system cannot perform all the functions listed above because the modes and types of data collection are different, and the purpose and the end users of the surveillance information vary. Indicators
Leading indicators are used for measuring immediate vulnerability and resources. Concurrent indicators assess current food availability and its related socio-economic determinants, such as income and prices. Indicators of food availability may include farming practices, types of seed sown, and time taken to mature; associated socio-economic determinants may include the amount of money spent on fertilizer, farmers’ knowledge of best practices, and the use of mechanized labour on farms. Outcome indicators are used to determine the past and continuing shortfalls in food availability. All three types of indicators may be useful for evaluation purposes. In 1990, UNICEF produced a conceptual framework for the causes of malnutrition among children (see Figure 21.2). Depending on the causes identified, indicators are selected for the purposes of (1) measuring objectives and (2) monitoring and evaluating the programme.

![Conceptual framework of causes of childhood malnutrition](image)

**Figure 21.2:** Conceptual framework of causes of childhood malnutrition.

### 3.2 Anthropometric Data

Anthropometric indicators are the easiest, cheapest, and fastest way of measuring and assessing nutritional status in developing countries. The dimensions usually taken are height, weight, and mid-upper-arm-circumference (MUAC). These measures can be made more meaningful by transforming them into indices that may then be compared with reference tables (e.g., NCHS/WHO) or standards (e.g., WHO, 2006). References are used to standardize a child’s measurements by comparing them to the median or average measures for children of the same age and sex. More details on the methodology are given in Chapter 22.

### 3.3 Factors Leading to Malnutrition

Malnutrition is used to describe not only undernutrition, but also overnutrition. However, in most nutrition texts malnutrition refers to low intakes of energy and nutrients necessary for growth and development. Some of the conceptual factors related to malnutrition in a community include food security, food intake factors, access to food, caring practices, and household characteristics. Accordingly, surveillance systems collect data on these factors.
3.3.1 Food security

Food security factors include anything that affects the availability, accessibility, utilization, and stability of food within the community. The food security indicators used in nutrition surveillance may fall under the following broad headings:

- Ecological zone
- Farm size
- Use of extension services
- Food prices
- Population response to food shortages
- Use of wild fruits and vegetables

In some developing countries where agriculture is the mainstay of the economy and provides employment for the majority of the rural communities, extension services are provided to boost agriculture. Extension services are provided by agricultural experts employed by the government.

3.3.2 Food intake

Food intake indicators used for nutrition surveillance measure the amount of staples eaten at the household level as well as the distribution of the food among household members. Measures of food intake may include the amount of rice or other staple foods, cooking oil, and eggs consumed per person. They may also assess the distribution of both micronutrients and macronutrients in the diets of women and children under age five. In Chapter 22, we describe the methodology for assessing people’s food intake.

3.3.3 Access to food

Economic factors that affect the quantity and quality of food intake underlie issues regarding access to food. For instance, it is assumed that when a household consumes produce from a small backyard farm, the produce will be used to supplement food bought in the market such that every member of the household will have enough food. The use of fortified products, such as iodized salt, may also generate information of interest for policy implementers on the success of the directive. Some indicators that may be used to profile accessibility to food may include:

- ownership of a farm,
- access to a home garden,
- food expenditure,
- food prices, and
- use of fortified foods, such as food containing iodized salt.

3.3.4 Caring practices

Care practices by household members as well as government employees at health posts, clinics, and hospitals are also essential data. The coverage of nutrition and nutrition-related activities that guarantee the health of communities is often of interest to different users of surveillance data, such as government agencies and NGOs. Examples of data to be collected are

- breast-feeding practices,
- complementary feeding practices,
- environment sanitation and access to health services,
- sources of drinking water,
- type of latrine used by households,
- garbage disposal,
• vitamin A capsule coverage among children aged 6 to 59 months and post-partum women,
• immunization coverage,
• iron tablets received by pregnant women, and
• family planning participation.

3.3.5 Household characteristics
It is believed that household heads who are educated tend to earn more than uneducated individuals in the same position. A relatively large amount of the household head’s earnings is used to buy food. Educated individuals are also expected to be likely to have a better knowledge of the relationship between nutritional issues and well-being, which should lead to good household food choices. Some basic factors to consider that have implications for nutritional status are
• household demographics,
• level of education,
• occupation, and
• participation in social programmes.

It is important to note that the groupings of the factors and indicators listed in this section are not based on any firm set of rules. Rather, these factors can be selected and grouped under headings that convey the most meaning to the data collectors and as directed by the objectives of the exercise. Classical manifestations of nutrient deficiencies exist, as described in Chapter 22; when the programme goals require it, these signs can also be recorded as part of the data for nutritional status assessment.

4. SURVEILLANCE FOR MEDIUM- TO LONG-TERM PLANNING
There is no set definition of medium-term or long-term in planning: how these designations are defined generally depends on the goals of the surveillance system. The information generated aids in future policy formulation as well as decision-making at the individual, household, community, and regional levels (Brinkman et al., 2010). For this process to be successful, policies must be in place to support decisions based on surveillance data.

4.1 Purpose of Medium-to-Long-Term Planning Surveillance
An important purpose of nutritional surveillance is to help develop better plans for the use of resources. This is crucial because the nutritional status of communities changes over time. In a typical farming season, for instance, failure of the rains can lead to deterioration in nutritional status. Surveillance information can help authorities to channel resources to address nutritional needs (FAO, 2007). Communication within the community is important to making this process effective. This can be done through traditional ways of dissemination of information, such as through chiefs, elders, opinion leaders, local radio stations, and the distribution of leaflets.

4.2 Population Sampled
For the purpose of advocacy, the population considered in medium-to-long-term planning should comprise the vulnerable, such as pregnant women, children, and elderly people. The samples selected must be homogeneous and compare well in the medium to long term. This is done so as to obtain a representative sample of the population and also to ensure that the data are comparable over time. The sampling frame also informs planning such that all requirements are provided for.
4.3 Types of Data Collected

The type of data collected in nutrition surveillance are similar to those collected in health and nutrition surveys. Data types are anthropometry, biochemical, clinical, and dietary. The same data types are recorded for the population of interest on a number of occasions. As to whether to collect data on all of the parameters mentioned above will depend on the available resources (i.e., money, time, personnel) and the surveillance objective. These data are compared over time to identify variability in indicators, thus informing planning and, to some extent, policy. Anthropometric data are usually collected with respect to age, sex, weight, and height.

Deleterious nutritional status can be predicted by other possible factors, such as care practices and environmental health. The UNICEF conceptual framework of causes of malnutrition can serve as a useful guide (UNICEF, 1998). The socio-demographic, knowledge, attitude, and practice data of the community can also be considered and may be important in explaining trends in malnutrition.

4.4 Analysis and Application of Data

The analysis of surveillance data takes into account the prevalence over time of selected indicators, based on values that are above or below predetermined cut-offs. The population may be classified based on socio-demographic and other selected variables that are used for planning. The information generated serves to inform the managers of the surveillance system and stakeholders in the community, whilst also feeding into policy.

Nutrition surveillance findings have played an integral part of policy documents. For instance, findings of a high level of anaemia in Bangladesh led to the development of a national policy on prevention and reduction of the condition among children (Ahmed et al., 2006). Economic crises, such as changes in food prices as a result of failure of rains and increases in fuel prices, are common occurrences in the developing world and can have significant effects on the frequency of malnutrition. Nutrition surveillance data guide policies in order to reduce the effects of these factors on vulnerable people in the community. The application of nutrition surveillance data is therefore very important in achieving some of the targets of the MDGs. Performances per the indicators are monitored, and requisite amendments in policies and programmes are then made (UNDP, 2000). Additionally, surveillance data are used to guide national policies on the realization of the right to adequate food and nutrition.

5. PROGRAMME MONITORING AND EVALUATION

Stakeholders in community nutrition programmes are interested in the outcome and impact of nutritional interventions. Nutrition surveillance information should therefore include population-based indicators. The information gathered should be interpreted in its political and social context (Rodriguez, 1995; Shoekirman & Karyadi, 1995).

The following is a case scenario from Bangladesh. Data from a nutrition surveillance system were used to establish the associations of indicators related to the nutritional status of mothers and children (Semba et al., 2008), by observing and analyzing the trends over time. The findings were used to help design tools to monitor programme performance and evaluate the programme’s impact on nutrition and other related indicators. The questionnaire used included tools to monitor coverage of infant and child feeding programmes such as vitamin A supplementation (VAS) among children and post-partum mothers, immunization, and utilization of health service facilities. The surveillance system generated data that were used to assess vitamin A coverage (HKI/IPHN, 2005) among different target groups, such as children aged 6–59 months. The different target groups received intervention through different means. Earlier findings from the surveillance systems were used to emphasize the need for universal vitamin A coverage among children to prevent night blindness (Bloem et al., 1995). The surveillance data were reported in open-access journals, such as the FACTS Report (Akhter et al., 2008). These reports contributed to the work of the International Vitamin A Consultative Group (Torlesse et al., 2003) and the Micronutrient Forum (Shafique et al., 2007).

Surveillance systems are essential to the successful implementation and performance of nutrition programmes. When such a system is successfully set in place and monitored, the impact of any programme
is more likely to be felt (Swan et al., 2009). For example, in order to reduce malnutrition in Bangladesh, the
government launched the National Nutrition Program (NNP), the country’s largest nutritional intervention
programme. The surveillance findings on malnutrition at the national level allowed for assessment of the
impact of the programme against various trends over the same timeframe. Further in-depth analysis done
using Nutrition Surveillance Project (NSP) data in NNP areas found that the programme’s performance
varied widely by area and implementing agency (HKI/IPHN, 2006), and that coverage of the intervention
and targeting was inadequate. In most cases, evaluations assessing the NNP did not measure programme
performance but only assessed the impact on malnutrition. A lesson learned was that when assessing the
impact of programmes, an assessment of the quality of programme service delivery (such as targeting and
coverage) should also be included in order to use the data to improve strategies.

6. PROBLEM IDENTIFICATION AND ADVOCACY
Surveillance data inform stakeholders about the nutrition situation of a given population (WHO, 2009). Advocates, such as pressure groups within the community, government organizations, or NGOs can then use the information to support demands for improved resources. When such demands are based on hard facts, such as surveillance data, advocate groups are more likely to receive a positive response from responsible agencies. Table 21.1 summarizes the characteristics of surveillance for long-term planning, timely warning, and programme management.

Table 21.1: Characteristics of nutrition surveillance systems

<table>
<thead>
<tr>
<th></th>
<th>Long-term planning</th>
<th>Timely warning</th>
<th>Programme management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>To assess variations in nutritional status over time and thus aid in decision-making</td>
<td>To avoid nutritional problems by initiating a predetermined response</td>
<td>To ensure effective management</td>
</tr>
<tr>
<td><strong>Sample</strong></td>
<td>Targets that can be compared over time and are representative of the vulnerable population</td>
<td>Convenient sample of target population (e.g., children 0 to 59 months); sample does not need to be representative</td>
<td>Vulnerable individuals in the programme or target population; sample should be representative of the population</td>
</tr>
<tr>
<td><strong>Data to be collected</strong></td>
<td>Anthropometric data usually collected; in certain instances, a combination of anthropometric, biochemical, clinical, and dietary data may be collected, together with data on nutrition knowledge, attitudes, and practices</td>
<td>Example: Predictive data from weather forecasters used</td>
<td>Data that bear on the goals and the objectives of the programme and the nature of the intervention</td>
</tr>
<tr>
<td><strong>Sampling frame</strong></td>
<td>Takes into consideration planning needs; must allow for data to be compared over time</td>
<td>Depends on the target population; randomization may be useful</td>
<td>Target population selected in order to measure efficiency and effectiveness of the programme</td>
</tr>
<tr>
<td><strong>Analyses conducted</strong></td>
<td>Trends in prevalence</td>
<td>Trends in prevalence below chosen cut-off point</td>
<td>Requires quick data turnover</td>
</tr>
</tbody>
</table>

Source: Swart & Mauder, 2008.
7. **ASSESSMENT OF NUTRITION-RELATED HEALTH PROBLEMS**

The nature and degree of nutritional problems, as well as the people most affected by them, are used in specifying the surveillance information (e.g., agricultural, nutritional), the appropriate level for monitoring (community or regional), and the uses of the information generated for decision-making (Babu & Mthindi, 1994). It is important that the types and the levels of decisions are matched with the information needed at specific levels across the board and down to the community level.

Three aspects to the problem need to be described at this stage:

- **Evidence for the existence and type of malnutrition.** This information may be found in an analysis of food supply data (e.g., food balance sheets) and in records at community health-care centres and hospitals. A food balance sheet shows the total quantity of foodstuffs produced in a country plus the total quantity imported and adjusted to any change in stocks that may have occurred since the beginning of the reference period. After subtracting exports, feed to livestock, seed, industrial and other non-food use, and losses owing to wastage, the remaining quantity represents the food available for consumption. It shows quantities and contents of food supply, per capita availability, in terms of nutrient value.

- **Population groups most affected.** These populations need to be described in terms of geographical location, socio-economic status, types of production systems (e.g., manual versus mechanized), and resources available (e.g., crop types, water resources, land tenure). This type of information may be found in: national census reports; agricultural census and land use surveys; employment, income, and expenditure surveys; retail price reporting; local administration records; and research reports and publications.

- **Underlying causes.** A preliminary description should attempt to give an indication of probable immediate and underlying causes. It should also attempt to review trends over time with respect to the size and nature of the problem.

8. **SELECTION AND ESTABLISHMENT OF A NUTRITION SURVEILLANCE SYSTEM**

8.1. **Setting Up a Surveillance System**

The purpose of a surveillance system is to collect data that can be used to guide or develop a policy. The choice of indicators used depends on the established hypotheses regarding the cause of the nutritional problem to be tackled. These indicators can be measures of resources (e.g., farming systems or access to services), outcomes (e.g., nutritional status), or factors that link resources to outcomes (e.g., food production, food availability) (Mason et al., 1984). The indicators should be relevant, sensitive, specific, cost-effective, and appropriate for trends analysis (Ferro-Luzzi & Leclerc, 1991). Data should support community problem identification as well as the analysis and programmes essential for identifying appropriate and sustainable food and nutrition policies and interventions.

The process of setting up a functioning surveillance system involves assessment of the nutritional problem in the community in terms of causes, actions needed to improve the situation, and often a discussion with the priority users. The purpose of generating the surveillance information must be clearly defined, as must the channels for the dissemination of findings. The degree to which the nutrition problem can be managed by an intervention, given the most cost-effective allocation of resources, is a key factor in establishing priority areas for a good surveillance system. Institutions with adequate capacity may be strengthened and chosen to be part of the framework for facilitating organization and management of the system (Babu & Mthindi, 1994). The process of planning a community nutrition surveillance system is integrally linked to its intended functions. It should include the following (Swart & Maunder, 2008):

- Assessment of the type, magnitude, and context of the nutritional problems that may exist in the community
- Selection of the nutritional problem and putting in place the institutional framework
- Design of the appropriate surveillance system to include methods for data collection, its management, processing, analysis, and dissemination of the findings.
After designing the surveillance system, which takes into account the purpose it is intended to serve, the next step is the implementation phase. This depends on five critical pillars:

- A demand for nutrition surveillance
- A good perception and understanding of the system
- The capacity to co-ordinate and implement the system
- The resources for information systems
- The availability of the required resources

Another school of thought has merged the five steps listed above into what is called a triple-A loop design (Jonsson, 1995). This refers to a cycle of the following events: Assessment of a nutrition situation, Analysis of data gathered, and Action taken to address the situation. The triple-A loop process is based primarily on the prevalence of the nutrition problem, its cost to the community, and the feasibility of managing it (Ferro-Luzzi & Leclerc, 1991).

8.2. Design of the Surveillance System

The design of a surveillance system normally follows a structured approach. The steps in this process are described below.

8.2.1 Appraisal of existing data systems and identification of needs

Available data sources are identified, and their suitability and adequacy for the surveillance is assessed. The existing information may be found inadequate with respect to the assessment of nutritional status or the coverage of some population groups, distinguished by geographic location or socio-economic situation, who may be exposed to particular seasonal or other recurrent risks. Where needed, an existing surveillance system can be further developed.

It may be valuable to have standardized definitions and coding that are used in data collection. It is important that a needs identification and appraisal of data systems are carried out in conjunction with agencies and institutions that will use the information as well as those that will generate it.

8.2.2 Institutionalization of the surveillance system

Institutionalization of the surveillance system, with institutional financial support and commitment, is necessary for its success. This approach ensures commitment and makes institutions responsible for the management and presentation of data.

8.2.3 Considerations of cost and economic feasibility

With regard to cost, a distinction should be made between the resources needed for initially setting up the system and the requirements for its continuous operation. Generally, the initial intensive phase is expensive and requires special funds, while maintenance needs are much more modest. The surveillance system may have to be modified if the associated cost exceeds the resources available.

8.2.4 Selection and use of outputs

Outputs of nutritional surveillance systems depend on the objectives set at the planning stage. The precise nature of the outputs relevant to different institutions and uses should be determined through dialogue. Sample outputs can be generated from dummy tables for the perusal of users for their feedback. The institution responsible for nutritional surveillance should be sensitive to possibilities for disseminating newly available information. Possible behaviours of the population are taken into consideration when recommendations are suggested. When interim results are generated, they should be made accessible to users as early as possible; this may lead to early responsiveness to the community nutrition issues that will thereby be successfully
promoted and reinforced. Such endeavours may require the use of professional expertise in communicating nutrition issues.

8.3 Limitations of Nutrition Surveillance Data

Accurate and precise data from nutritional surveillance is of major importance in helping to solve the nutrition problems of a community or country and thereby aiding in its development (CDC, 2001). However, the data are collected based on the beliefs and perceptions of community members with respect to knowledge, attitudes, and practice about nutritional issues, so the information collected may not be accurate. The nutrition surveillance data also may not be representative, timely, or sufficient for use in long-term planning purposes (Beyers et al., 1997). There is a wide range of inaccuracies in these data sets; in some cases it can range from 45% to 83% (UNICEF, 1984).

9. INDONESIA: AN EXAMPLE OF A COMMUNITY HEALTH AND NUTRITION SURVEILLANCE SYSTEM

The health and nutrition surveillance system, of Indonesia, also known as the Nutritional Surveillance Project (NSP), consisted of several components: design and sampling strategy; questionnaire development; field preparation and training; data collection and entry; data validation and editing; data processing and analysis; and information sharing for advocacy, modification, or development of programmes. The NSP was initially set up in Java in 1995 to monitor a province-wide programme for vitamin A deficiency control, including a social marketing campaign (de Pee et al., 1998a, 1998b).

9.1 Conceptual Model, Indicators, and Questionnaire

The choice of data collected by the NSP was based on the UNICEF conceptual framework discussed earlier in this chapter. Various indicators were used to gather information about the different causes of malnutrition. When the programme was expanded or other new ones started, specific indicators were used. For example, when a surveillance system was set up in central Java in 1995 for monitoring and evaluating the impact of a social marketing campaign that promoted the consumption of dark-green leafy vegetables and eggs, specific questions related to the project’s implementation were added to surveys, such as whether people in the target population had seen the campaign’s materials and remembered its messages (de Pee et al., 1998b).

9.2 Sampling

Sampling methodologies for the NSP were based on parameters selected by programme managers. In some cases, sampling was done to provide a good estimate of the prevalence of the main outcome indicators — wasting, night blindness among women during their last pregnancy, and maternal underweight. Probability proportional to size (PPS) sampling methodology was used at other times. For PPS, all villages in the zone were listed, with their population size. The total population of the zone was divided by 40 to derive the sampling interval. A different method was adopted in urban areas with existing slums, which were listed and selected using simple random sampling (SRS) techniques, with clusters then selected within each slum. Households within the selected clusters were used to generate the surveillance data. For each round of new data collection, a new sample of households was selected. Poverty was one of the criteria for selection in poor urban communities. Households with children less than 6 years old were randomly, but purposefully, recruited.

9.3 Quality Control

The NSP included clear definitions of duties, areas of operation, and lines of reporting. The data collected were cross-checked by a special quality control team that revisited the households interviewed within a few days after the first visit by enumerators. About 10% of the households that had already been interviewed and administered were selected to be part of the process evaluation. Furthermore, the quality of anthropometric
data collected by enumerators was also checked to ensure that the findings were within acceptable limits for each measurement (WHO, 1995).

9.4 Data Entry, Cleaning, and Analysis
The NSP nutrition surveillance data were entered into a computerized database for analysis. The control of data entry occurred in different stages, such as data entry clerks comparing data entered with information on questionnaires, or supervisors doing the same with randomly selected questionnaires. A repeat entry system was also used, in which queries were made in all cases where the second entry differed from the first entry of the same data. After entering and checking the data, they were cleaned. Clear guidelines on how to clean anthropometry data were provided to the data entry clerks. Data analysis was only started when the codebook was complete and the administrators had ensured that any changes made to the data set had been documented.

9.5 Communication of the Results
The mode of communicating the results took the audience into account. For instance, at the local level, the audience included the population surveyed and the local government and organizations working with them; at the national level it included government bodies; and at an international level it included donor agencies and international organizations. The presentation of the findings was fashioned to match the specific interests of each different audience. For example, findings from the NSP about the impact of Indonesia’s political and economic crisis on health and nutrition were communicated to the National Planning Board, while among the wider national and international audience, crisis bulletins that discussed special themes were distributed. For a wider audience, scientific articles were written and published in peer-reviewed journals. The data sets from the NSP were made available in the public domain through CD-ROMs.

9.6 Contribution to Policies by NSP
NSP data have contributed to policies and programmes such as

- vitamin A capsule distribution (Akhter et al., 2007; Dalmiya et al., 2007);
- vaccination programmes (Semba et al., 2007);
- food fortification (Melse-Boonstra et al., 2000; de Pee et al., 2004, 2007; Semba et al., 2008);
- assessing programme impact under real-life circumstances (de Pee et al., 1998b); and
- dual burden of overweight/obesity and malnutrition.

9.7 Comments on Indonesia’s Nutritional Surveillance Project
The NSP achieved several successes. It enabled the successful monitoring of health and nutrition programmes in Indonesia. It enhanced the implementation of successful interventions that had positive impacts on nutrition and health. And it pointed to the most important factors that limit further reductions in malnutrition. The surveillance system enabled a close and simultaneous look at the different aetiologies of the causes of malnutrition. It also brought to the fore how policies, programmes, and macro-level changes of these different factors interplay to cause malnutrition. This understanding of the major pathways to malnutrition, under particular circumstances in most developing countries, is important for identifying appropriate strategies and target groups for reducing malnutrition and achieving the MDGs.

A successful surveillance system, such as that used in Indonesia, takes into account cultural and socio-demographic factors when indicators for the system are being developed, established, and selected. It is obvious, therefore, that a surveillance system that collects information on a range of key factors that affect nutrition and health is more likely to achieve the stated goals and objectives. Careful analysis of cross-sectional data is important for the optimal use of nutrition surveillance data.
DISCUSSION QUESTIONS AND EXERCISES

1. Using growth promotion and monitoring, describe the concept and purpose for establishing a nutrition surveillance system.

2. Using any of the Millennium Development Goals, describe the type of data to be used in a nutrition surveillance system, in terms of the following:
   • The type of data to be collected
   • Sampling procedure(s)
   • The type of analysis to be performed
   • The end users of the information generated
   • The intervention that can be put in place to address the problem

3. Using a nutrition intervention of your choice, describe how you would set up a surveillance system showing the indicators, data to be collected, data processing to be used, and the type of intervention that the data will illicit.

4. Using surveillance data in your country, write a review of the progress achieved so far on Millennium Development Goal 1.

5. Using your country as a case study, write about the benefits of the various surveillance systems that monitor nutrition of children under 5 years of age.

6. Describe a surveillance system that can monitor the effects of global warming on the food and nutrition situation in your country.

REFERENCES


ADDITIONAL RESOURCES


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