

Conceptual Framework for Nutrition Surveillance Systems¹

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This article describes the evolution of nutrition surveillance as an intervention strategy and presents a framework for improving the usefulness of nutrition surveillance programs. It seems clear that such programs' impact on nutritional well-being will depend increasingly on their ability to reach and influence decision-makers. Therefore, it is important to consider political and social forces, and also to realize that if a program is too decentralized or too far removed from key decision-makers, its ability to influence resource flows may be limited. It is of course important that the surveillance information provided be appropriate and of good quality. Therefore, the data collected should be analyzed to ensure they are accurate and representative. Once that has been done, relevant findings should be presented in a readily understandable form designed to meet the intended recipients' information needs. Such findings should also be disseminated to all important decision-maker constituencies, including external donors of nutrition assistance and the general public.

The term "nutrition surveillance" was first used in the mid-1970s. At that time a joint FAO/UNICEF/WHO expert committee defined the term as follows: "Nutritional surveillance means to watch over nutrition, in order to make decisions which will lead to improvements in nutrition in populations" (1). The concept was an outgrowth of an earlier international program strategy known as national nutrition planning, which was introduced in many countries around the world—including Bolivia, Chile, Colombia, and the countries of the Central American Isthmus (through the Institute of Nutrition for Central America and

Panama). Nutrition planning sought to draw attention to the importance of social equity, stressing the role of nutritional status as an indicator condition and a national planning concern. It also explicitly recognized the need for multisectoral coherence in national planning directed at improving the nutritional status of populations.

By and large, the concept of nutrition planning was ahead of its time, partly because there was no information system that could provide the data needed to determine the population's nutritional status and so assess the extent to which planning goals were being achieved. The inability of national governments to implement policy also created difficulties for the nutrition planning movement. More developed nutritional surveillance methods and techniques (2) came partly in response to an awakened understanding of the need to determine what was happening.

Around this time, regional and national programs developed in several Latin American and Caribbean nations with the

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vision and strategic sense to understand the importance of coherent assessment of the quality of life (3). Within this context, as part of the struggle toward development, the tools of nutrition surveillance were felt to offer a logical way of measuring social and economic progress. Largely for this reason, even though nutrition surveillance has not yet been adopted by several of the region's major countries, Latin America and the Caribbean have come to assume a unique and leading role in establishing operational nutrition surveillance in a sustainable manner.

The Figure 1 map shows the general status of nutrition surveillance activities in the region. Specifically, it indicates which countries have had major national nutrition surveys or have begun school height census programs, which have established routine reporting of anthropometric data, and which have official national food and nutrition surveillance programs (with or without routine reporting of anthropometric data). As may be seen, most of the countries of the region have engaged in some activity related to nutrition surveillance; several have routinely reported anthropometric data originating from the health and social services; and nine have national food and nutrition surveillance programs. One of these, the Colombian program, has been operating for more than 10 years, accumulating an extensive data base relating to the food system, nutrition, health, and socioeconomic status. This rich history provides the foundation for the observations reported here.

Another feature unique to Latin America is the extent to which professional networks, regional training, and technical support programs have developed. The Institute of Nutrition for Central America and Panama (INCAP), the Institute for Nutrition and Food Technology in Chile (INTA), the subregional food and nutri-

tion program in Costa Rica (PROSBAN), and Valle University in Cali, Colombia, all have regional training programs in nutrition surveillance methods. In addition, INCAP and INTA have provided technical assistance to country programs for designing and implementing nutrition surveillance systems; and various United Nations agencies—including PAHO, FAO, and UNICEF—have collaborated to catalyze professional networking in the region through programs of conferences and workshops.

On the other hand, in the wake of the world recession, nutrition surveillance as a donor-supported development intervention is being scrutinized carefully and criticized because few national programs have demonstrated an impact on administrative decision-making related to nutrition problems (4). Commonly, national programs report only process measures, such as the number of reports or bulletins generated, as indications of surveillance program outcomes. Given the current economic climate, interventions must provide more convincing evidence that they are worth continued investment.

The remainder of this article assesses the evolution of nutrition surveillance as an intervention strategy and describes a framework for improving the utility of nutrition surveillance programs. This framework and related recommendations are derived from the authors' participation in numerous country studies and several expert conferences on the subject.

THE BACKGROUND

As Table 1 suggests, the history of nutrition surveillance can be regarded as paralleling the evolution of computer-driven information systems. Computer progress is commonly discussed in terms of "generations" distinguished from one another by qualitative and quantitative differences in the technology employed.

Figure 1. Nutrition surveillance activities in Latin America and the Caribbean.



Major national nutrition survey or school height census

Belize
El Salvador
Guatemala
Honduras
Nicaragua
Panama
Uruguay



Routinely reported anthropometric data

Barbados
Chile
Grenada
Guyana
Jamaica
Saint Lucia
Saint Vincent and the Grenadines



Food and nutrition surveillance system without routinely reported anthropometric data

Ecuador



Food and nutrition surveillance system with anthropometric data

Bolivia
Colombia
Costa Rica
Cuba
Dominica
Mexico
Saint Kitts and Nevis
Venezuela

Table 1. Parallels between the evolution of nutrition surveillance and computer systems.

"Generation"	Nutrition surveillance	Computer systems
First	One-shot surveys; no link to policy/program managers	Single user; no interaction
Second	Time series nutrition data; some linkage with health sector planning	Higher capacity, faster processing with multiple applications
Third	Multivariable/time series; ad hoc linkage with policy/program decision-makers	Multi-user, faster, smaller, less expensive
Fourth	Nutrition decision support directed at decision-makers actively involved in requesting and using information	Powerful multi-user systems with graphic interface to expert or decision support systems

Similarly, one can describe "generational" differences in nutrition surveillance and can also observe instructive parallels between the evolution of nutrition surveillance programs and computer systems.

One such parallel involves the ease with which information can be obtained and used. Increasingly sophisticated computer tools progressively reduce the barriers between man and machine, with the result that decision-makers get interpretable information quickly. Similarly, nutrition surveillance has increasingly involved policy-makers and planners in defining the information to be collected and generated by the system. While early surveillance systems were remote from managers, often being housed in epidemiologic surveillance units, there has been a growing tendency to place them administratively closer to program managers who make major decisions affecting the population's nutritional welfare.

Also, both computer systems in general and nutrition surveillance systems have moved from measuring and analyzing discrete events to continuous monitoring. Early surveillance efforts concen-

trated on one-shot surveys that measured the nutritional status of populations and some basic correlates. In contrast, current data-gathering strategies increasingly stress continuous collection and analysis of data relating to both nutritional status and its key determinants. The resulting ability to monitor and explain changing nutritional conditions will improve the usefulness of such data for administrative decision-making.

Another important evolutionary feature of computers has been the development of multi-user systems. That is, the computer is increasingly capable of meeting the demands of many different individuals simultaneously. Similarly, nutrition surveillance systems must generate information that can be used effectively by a variety of policy-makers and program managers.

In sum, the computer revolution brings important lessons to bear on the development of nutrition surveillance systems. "Fourth generation" computer systems exhibit increased responsiveness to users. Similarly, comparable "fourth generation" nutrition surveillance systems must be increasingly responsive to the needs of man-

agers responsible for deciding how and where social resources will flow. This "new generation" of nutrition surveillance may be viewed as an information-intensive intervention directed at facilitating management decisions on how to improve the population's nutritional status.

THE DECISION-MAKING PROCESS

A general outline of elements involved in social sector decision-making is presented in Figure 2. Obviously, the quality and appropriateness of information reaching the decision-makers is a key factor influencing this process. However, as Latin America's nutrition surveillance experience demonstrates, various other factors also enter into the equation determining policy-maker and program manager decisions; and it is important to understand these other factors when designing and implementing surveillance programs.

Decision-maker Accountability

One set of interrelated factors determines the extent to which decision-makers are held accountable for improving nutritional conditions. That is, they determine what incentives (aside from abstract moral incentives) motivate decision-makers

to focus on improved nutrition for the population.

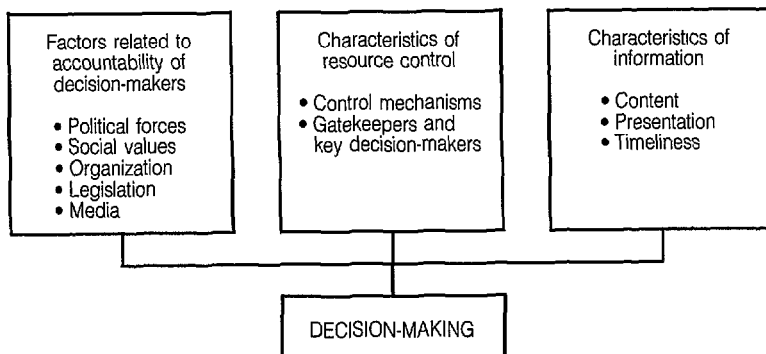
Political Forces

The profound influence that politics plays on resource allocation at all levels of social organization is well known. In Latin America the demands of election campaigns seem to play a large role in nutrition-related decisions, and in several countries major social programs (particularly ones providing food aid) have been initiated in an attempt to demonstrate that governments are addressing social needs. Situations such as these can provide opportunities for nutrition surveillance programs to place nutrition concerns prominently on the agendas of decision-makers. It is also true, however, that nutrition programs will need to promote social welfare "gatekeeping" in some cases, because politicians are often pressured to favor programs with short-term popularity that may not be in the public's best long-term interest.

Social Values

Countries vary substantially in their social commitment to development with equity. Decision-making in countries having a strong commitment to social equity, such as Costa Rica, is strongly

Figure 2. Key factors in the decision-making process.



directed toward improving the general population's nutritional status. This is not so clearly the case in countries with a more economically oriented set of values, or where, for whatever reasons, general social needs have less priority. In such countries, more creative approaches may be needed to effectively integrate nutrition surveillance activities with national policy.

Organization

Another contributing factor is the organization of decision-making bodies, a circumstance that determines who actually allocates resources. Such organization can vary dramatically from one country to another. In many countries, key decision-making is highly centralized. For example, within health ministries it is common for most of the important resource allocation decisions to be made at the level of the General Secretary. Consequently, if nutrition surveillance is to be effective, the General Secretary must be integrated into the nutrition surveillance dissemination strategy.

Another point to consider is the conservatism or liberalism of key organizations with respect to innovation. The pace of decision-making and the range of intervention options that will be palatable to decision-makers depends partly upon their receptiveness to change. It is interesting to note, for example, that organizations in countries undergoing radical reform at the national level may be especially receptive to relatively innovative intervention approaches such as ones decentralizing control over social resources.

Legislation

Another important element shaping decisions is the legislative environment in which decision-makers operate. Where social accountability is mandated by law,

senior managers have more incentive to focus on nutrition problems and indicators. Looking outside Latin America for a moment, new legislation in the United States of America is expected to define food security in such a way as to hold that country's food aid program managers accountable for improving the affected populations' nutritional status. This will greatly change the incentive structure for resource allocation. Historically, managers have been rewarded for how much food aid was committed and disbursed rather than for improved nutritional status.

The Media

The media play an important role in the Latin American context as a channel for disseminating information to the public. As discussed below, linkage between surveillance programs and the media provides a powerful tool for raising the profile of nutritional concerns.

Resource Control

In addition to decision-maker accountability, another driving force behind the decision-making process is resource control. Nutrition surveillance programs must commonly deal with the problem of being too far removed from the locus of important decision-making bodies. Such programs are typically housed or based in line ministries, most notably ministries of health. These ministries often have a very limited impact on the resources allocated to social programs. The best they can do is to improve the targeting of the health or nutrition programs that they manage.

With this in mind, it is worth noting considerable current discussion about the importance of decentralizing nutrition surveillance (4). Specifically, it should be noted that locally controlled information

processing and analysis will probably have very little impact on local nutrition if local authorities have few discretionary resources. Conversely, where resource control is also divested to the local level, decentralized information systems may have great impact. The widely acclaimed Iringa Surveillance Program in Tanzania is an excellent example of a successful nutrition surveillance program operating at the local level. In this case, noteworthy improvements in the affected population's nutrition were attained because available resources could be deployed in response to surveillance data (4).

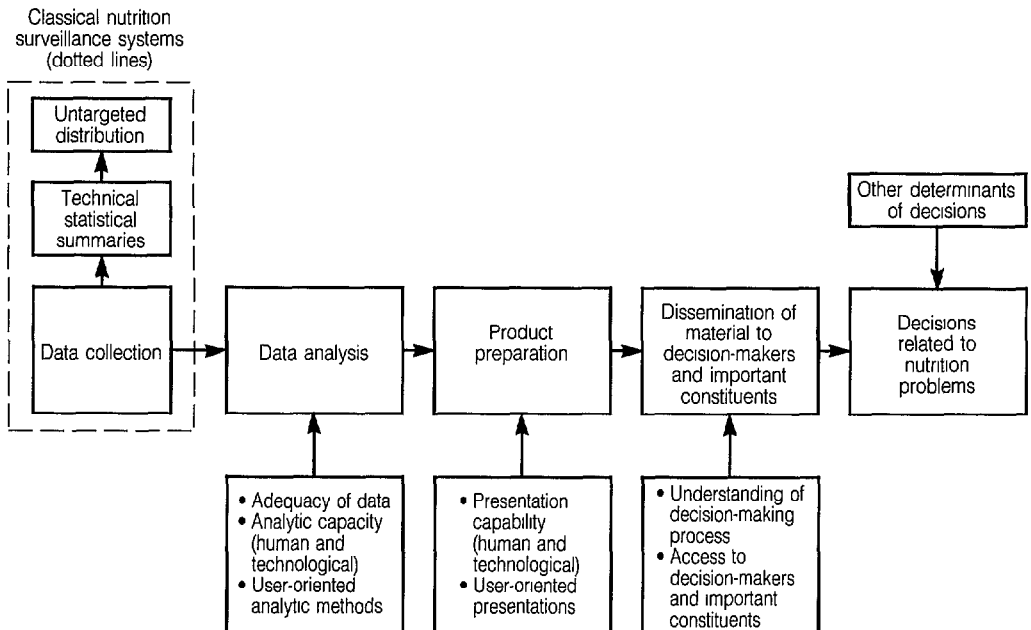
A CONCEPTUAL FRAMEWORK FOR EFFECTIVE PROGRAMS

Turning back to the information provided by nutrition surveillance activities, Figure 3 links that information to the decision-making process. A key point here is that many nutrition surveillance programs have no direct tie with decision-

making (see the left side of the figure, where the dotted line shows the limits of most classical programs). These programs function primarily as passive reporting entities, similar to the health statistics systems upon which they are based. Information is collected, processed, summarized, and circulated to a limited, largely technical audience. The resulting reports tend to be long and to present their data in a largely tabular format. Only technicians have the time and training to digest and analyze their contents. If the information presented is actually used for decision-making, it is the exception to the technocrat's rule.

A more proactive approach involves linking nutrition surveillance programs with their desired immediate objective: improved management of nutrition problems. Here analysis, the presentation of results, and the whole area of information dissemination become critical to the program's success. Using this model, the purpose of surveillance activities (con-

Figure 3. A framework for improving the utilization of nutrition surveillance systems.



ducted on the left side of the diagram) is improved decision-making. This purpose is accomplished by designing and managing the program so as to direct major attention at how decisions are made and who makes them. When this is done, it becomes evident that certain specific aspects of nutrition surveillance programs, discussed below, can help improve their utility.

Data Analysis

To be effective, the data must be both adequate and interpretable. This is a point that many nutrition surveillance systems have not yet addressed. Indeed, decision-makers often fail to find data on nutrition status credible. These data, most commonly weight-for-age measurements collected routinely by the health system, frequently have not been assessed to ensure that they are accurate and representative. One reason: although clinic data may not be useful for quantifying the magnitude of malnutrition in a given population, they are often useful for many other surveillance applications (5). However, if these data are to be used to arrive at decisions, they must be accurate and representative, and this accuracy and representativeness must be understood.

Unfortunately, in most countries undertaking nutrition surveillance, anthropometric data is being reported without such analysis, and senior managers are rightly concerned about the interpretation of information generated by these clinic-based data. This is an easy problem to overcome. Retrospective analyses can be performed on existing data and small evaluation studies undertaken to evaluate validity and representativeness. Where national statistics are found to be problematic, nutrition surveillance designers may be able to focus on gathering data from a subset of health facilities, thus ensuring adequate quality and represen-

tation of important population groups (sentinel surveillance).

It is also necessary to guide the information generation process by applying appropriate analytical techniques and a multidisciplinary base of experience. The human talent and microcomputer tools needed to make surveillance data interpretable by decision-makers must be brought into the analysis. Time series and spatial analytic techniques, as well as projection and simulation, are important tools. The use of Geographic Information Systems (GIS) to organize, analyze, and present data is a powerful approach that appeals to decision-makers because of the visual nature of the results. Beyond these considerations, however, nutrition is a multidisciplinary multisectoral problem, and so a broad range of expertise and experience are needed.

Furthermore, the analysis must be designed to address the information needs of users. The products of surveillance systems must answer questions that senior managers need answered in order to allocate resources. This includes determining the "trigger levels" where action is called for by indicators and models describing the likely results of inaction and of different intervention options.

Format and Presentation

The format of reports and bulletins has a tremendous impact on their use by senior managers. A good example of this has been provided by reports of the Tulane Famine Early Warning System (FEWS), developed to help confront the Sahelian food crisis. Two routine information reports were generated by the FEWS: one, a long-term report based on intervals of a decade, presented agricultural data; another, a quarterly report, analyzed the food security situation in depth. The former agriculture-related product was a highly graphic one-page summary, while

the latter provided a longer and relatively information-rich examination of the food situation. Unfortunately, senior decision-makers virtually never read this second report. They preferred instead to receive interactive briefings that provided insight into problems signaled by the highly popular agricultural bulletins.

Dissemination

Because the decision-making process is complex, as noted earlier, it is important to disseminate surveillance information to all important constituencies, most notably external donors and the general public. If all major constituencies that influence senior management decisions are included in the design and reporting cycle, the information feedback loop will be complete.

Several Latin American programs have already incorporated these elements into their nutrition surveillance dissemination activities. Among other things, in several cases material disseminated to program management is also distributed to the media. Such distribution can have a dramatic impact. In one recent case, information suggesting declining nutritional conditions in one country was disseminated to the public. The result was an immediate increase in social sector resource allocation (6).

In this same vein, external donors play a large role in many nations by either providing or leveraging resources needed for social sector programming. Such donors should therefore be identified as major recipients of materials to be disseminated.

Beyond this, dissemination strategies need to be varied and creative. Besides printed reports, they need to include workshops, briefings, oral reports, and presentations designed for the audio-visual media.

In addition, thoughtful planning is re-

quired to make sure nutrition surveillance programs have access to decision-makers. One of the difficulties that many programs have experienced results from their location in the health sector or in a technical section of the agriculture ministry. But while being buried too far below decision-makers is often a problem, it is not necessarily one. The fax machine has revolutionized scientific communication, and national and global computer and satellite networks will soon do the same for surveillance systems. One low-cost telephone-based communication network, FIDONET, is already in place around the world and will presumably be followed by increasingly cost-effective means of rapid communication. These means of communication should be made part of the expanding nutrition surveillance effort in order to help make nutrition information immediately relevant to current and potential users.

RECOMMENDATIONS

Given this conceptual framework, several practical recommendations for designing and improving the management of nutrition surveillance programs seem warranted. These are as follows:

Understand the Nutrition Problem

The nature and extent of a given nutrition problem must be understood in order to design a sound nutrition surveillance program with appropriately focused and prioritized activities. An assessment of the nutrition situation should spell out the types and magnitudes of existing problems, as well as the likely causes of malnutrition and data sources available for measuring both malnutrition and its causes. In many cases such an assessment can be performed by an interdisciplinary team of local experts.

Understand the Decision-making Process

To date, this area has been neglected in planning most nutrition surveillance programs. Nevertheless, it is absolutely essential that future program planning be based on knowledge of how relevant decision-making processes work in the affected countries or locales.

A preliminary decision-making assessment can be accomplished through an information-decision audit. Such an audit seeks to identify who makes decisions, what information is currently used to make decisions, and when and how these decisions are actually made. It is commonly undertaken by a behavioral scientist or (preferably) a former senior manager with experience in the design and implementation of information systems. By means of this audit, the nutrition surveillance team will gain important insights into decision-maker priorities, time constraints, and information needs.

Build Adequate Analytic and Presentation Capabilities into the Program

Partly because neither staff resources nor computer equipment have been available to undertake the necessary analytic activities, this has been another failing of many programs. In the future, it is critical that these analytic capabilities be available to a program because this is the key to transforming nearly incomprehensible data into information that provides useful guidance for solving nutrition problems.

It should be noted that commercial software is available to perform such analytic work. In this regard, the Geographic Information Systems packages now available for microcomputers are an important tool. It may also prove sensible to contract out analytical work to private foundations or universities that possess the

senior research specialists required to develop useful analytical products.

Build Linkages to Decision-makers into the Organizational Design

In planning national programs, careful consideration should be given to selecting the loci of program activities. The head office or central coordinating unit is more effectively located close to the locus of major decision-making (for example, the offices of the Prime Minister or Planning Minister).

This is not to imply that health ministries do not have a major role. Indeed, health facilities are the major source of time series data on the affected population's nutritional status. In many cases, however, health sector-based nutrition surveillance programs have been distracted from the need to ensure that nutrition status data are available and interpretable by nonexperts. This is a very important matter, because improved nutrition status rather than nutrition data is the ultimate aim of nutrition surveillance interventions, and so it is imperative that adequate data be available. Regardless of where the head office is located, this should constitute a high priority for nutrition surveillance programs.

Consideration should also be given to the desirability of choosing a program director who is a former senior manager. Such former managers often have excellent access to decision-makers and generally have an excellent grasp of what sorts of nutrition surveillance can affect the decision-making process.

Focus Program Activities

The program's focus is important. Nutrition surveillance programs are frequently designed with very vague and general objectives. This may be acceptable for a statement of purpose; however, it is essential that the program's annual

work plans concentrate on specific issues, in a manner consistent with priorities identified by the nutrition situation analysis and information audit.

For example, when the first work plan for an Ecuadorian program was drafted, development of targeting criteria for food distribution programs was one of the three annual objectives. Having clear annual targets of this kind is important as a basic management principle.

It is also important, however, to maintain the flexibility needed to address emerging problems in a timely way. As windows of opportunity for nutrition surveillance activities open, a program should be prepared to shift gears. Such a shift could be appropriate, for instance, if the political climate changes to permit major social legislation, if food emergencies develop, or if helping a key decision-maker to solve a problem opens doors to closer collaboration.

In sum, a common principle behind development of an effective framework and recommendations for advanced "fourth generation" nutrition surveillance systems is the program's linkage to decision-makers and the decision-making processes that determine the nutritional well-being of national populations.

Latin America should prove a good area for the evolutionary movement of nutrition surveillance systems toward the nutrition information and decision-support systems described above. At the hemispheric level, the steps that need to be taken require the same attention and deliberation that development of anthropometry and other technical indicators have received from the surveillance community. New skills and expertise must be brought to bear, including the skills and expertise of management information specialists, political scientists, senior managers, and media specialists. At the country level, new training is required for both the producers and consumers of

data that provide improved understanding of nutrition surveillance and the decision-making process.

Generally speaking, Latin America now provides models and experiences that can be used to develop the discipline and applications needed to advance nutrition surveillance this extra step. It should also be noted that nutrition surveillance has evolved considerably over the past few years. Numerous nutrition surveillance applications now elucidate the determinants of nutritional vulnerability. This has provided a basis for targeting and assessing the impact of new national programs and policies. In addition, Latin America has developed some of the few models of decentralized and democratically oriented nutrition surveillance; and its leadership in the drive toward more advanced nutrition surveillance has encouraged Latin Americans working in this field to examine, synthesize, and teach others the methods they are utilizing to realize these major gains.

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