Annex 6

APPRAISAL OF THE NUTRITIONAL STATUS OF POPULATION GROUPS

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The cross-sectional appraisal of the nutritional status of population groups is carried out by means of nutritional surveys. The purpose of this annex is to discuss some of the main practical problems that should be considered in the planning, development and utilization of such surveys and to provide some general guidelines.

Innumerable reports of nutritional surveys of various kinds conducted all over the world abound in the pertinent literature. The information offered has undoubtedly contributed to the knowledge of the nutritional status of different population groups, but, with few exceptions, these studies have not been fully and properly utilized for action programmes aimed at correcting the problems encountered. Although other reasons can be adduced, there is no doubt that the way in which these studies were planned and carried out has contributed to this situation. With the present growing and justified pressure for a more rational and efficient utilization of public funds and other resources, a review of nutritional surveys in terms of their objectives, methodology, and utilization is pertinent.

The experience obtained in Central America in the planning, execution, and utilization of a national nutrition survey conducted in each one of the six countries of the area is presented after this general review.

Objectives of a nutritional survey

The first and most important consideration in the planning of a nutritional survey is to define its objectives as clearly and precisely as possible. This is vital because the definition should serve as the basis for deciding on the sampling of the population, on the methodology to be used, and on the analysis and utilization of the information obtained.

The objectives of a nutritional survey may be very general and comprehensive, for instance: to determine the nature and magnitude of the prevailing nutritional problems of a given population and to obtain as much information as possible on the responsible factors.

In this case, what we might call a *comprehensive* epidemiological nutritional survey would be needed. This type of survey should include methods of assessing the situation at all the different stages in the natural history of nutritional diseases (*1*), including the prepathogenic stages.

This type of survey can be of great value in the planning of applied programmes because it provides information not only on the problems themselves but also on the responsible factors in the specific populations studied, as well as on their relative importance. It therefore offers an adequate basis for deciding on the corrective actions needed. In addition to its usefulness for diagnostic purposes, such a survey also provides baseline information for evaluating the results of future programmes or of directed or naturally occurring changes.

On the other hand, a nutritional survey can be more limited in scope, its objective being to obtain data on only one or several stages of the problem. For example, its purpose might be to collect information only on the dietary intake of the population under study or to assess the nutritional situation exclusively by biochemical methods or by anthropometric measurements. In such cases, the limitation of the information obtained should be recognized. For example, if only a dietary survey is carried out, the data obtained cannot be expected to demonstrate the nutritional status of the population. In this case, and since we are studying exclusively one factor of the prepathogenic stage, the problems affecting the population can be assumed only if there is evidence that the food intake situation found has been stable and that there are no other modifying factors. However, limited surveys of this kind can be useful as original studies for specific purposes or as a follow-up of previous studies carried out in more detail. They may be needed, for instance, when the epidemiological factors of the specific nutritional disorder are well known but there is a lack of quantitative information on the magnitude of the problem. As follow-up studies of more comprehensive previous surveys, only one or two methods of assessment need be used as indices for measuring natural or induced changes.

Independently of the scope of the survey in relation to the number and nature of the methods used, these studies can be planned to collect data in regard to most nutrients for the whole population under study. On the other hand, they may be directed toward obtaining information on specific nutrients or restricted sectors of the population. For example, we may be interested in knowing the situation concerning only vitamin A or energy or in gathering data on certain specific population groups clearly defined on the basis of age, sex, social status, or other pertinent characteristics.

To summarize, a nutritional survey can be of a comprehensive epidemiological nature for the purpose of obtaining information on the whole population under study in regard to all nutrients and of assessing all the developmental stages of the problems. This would include analysis of the problems themselves, as well as of the responsible factors and consequences. On the

other hand, a survey can be more limited in scope, covering only specific nutrients or selected population groups. The choice must be determined primarily by the objectives of the survey, which should therefore be precisely defined.

Methodology

A variety of methods can be used in the execution of nutritional surveys (*2*, *3*). Some provide direct information relevant to the actual nutritional status of the population. They include:

— clinical examinations,
— anthropometrical measurements,
— biochemical determinations, and
— physiological studies.

Others yield information on the factors determining the nutritional condition of the population under study or on related factors. These include:

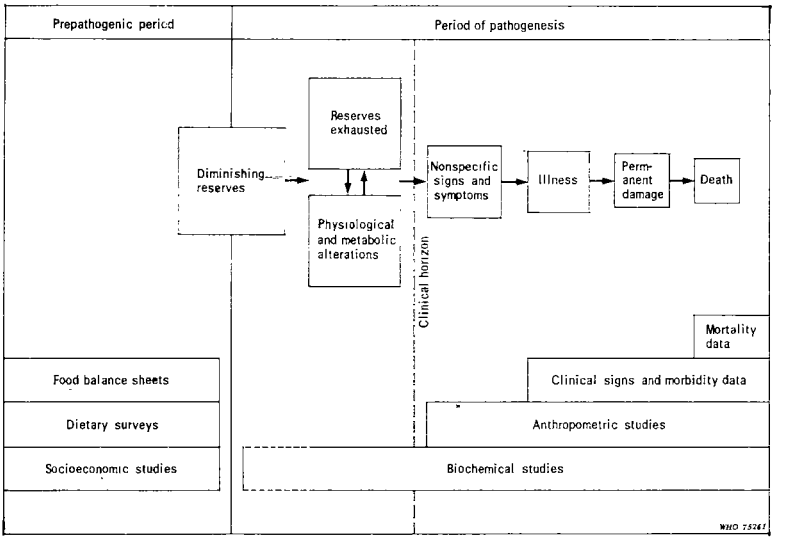
— studies on food production or on total food availability in relation to the nutritional needs of the population,
— studies on dietary habits and practices,
— measurement of food and nutrient intake,
— studies of the pertinent sociocultural and economic conditions of the population,
— studies on other health conditions directly related to the nutritional status of the population, such as infectious and parasitic diseases, and
— determination of pertinent characteristics of the physical environment, such as altitude and climate.

It is important to emphasize that these methods are used to measure different things. Consequently they cannot be used indiscriminately, and care should be taken when drawing conclusions from the data obtained. For instance, it is frequently concluded from information collected in a dietary survey that the population is suffering from certain nutritional deficiencies, an appreciation that obviously cannot be derived with certainty from information on food intake. Such studies can indicate the strong probability of health problems, but they do not suffice to establish the presence of ill health.

The different methods used for the appraisal of nutritional status are not mutually exclusive; on the contrary, they are complementary. We shall therefore try to classify them in such a manner that their values in relation to one another will be better understood. For this purpose we shall use the concept of the natural history of a disease (*1*, *4*), placing the different methods at the levels at which they operate, as indicated in Fig. 1.

As shown graphically in this scheme, methods such as the determination of food availability in relation to population needs (food balance sheets), dietary surveys, and socioeconomic studies (or other studies of environmental

Fig. 1. Methods of nutritional assessment and their relationship to the natural history of disease



factors that can affect the nutritional status of a population, e.g., the prevalence of intestinal parasitism) can define the situation in the prepathogenic stage. In other words, these methods indicate whether conditions conducive to the development of nutritional problems are present or not, but they do not actually assess the problems.

Biochemical methods are particularly useful at the pathogenic but preclinical stage, when they constitute the only available basis for diagnosis other than more complicated physiological or metabolic studies. Biochemical methods may also, of course, be useful in the clinical stages, where they have a confirmatory value.

Clinical nutrition surveys, studies of morbidity data, and anthropometric studies may be carried out to assess the problem in its clinical stages. It is important to remember that anthropometric studies do not necessarily indicate whether the problem is present at the moment of conducting the survey, because they may merely record the permanent damage resulting from previous nutritional deficiencies.

Finally, analysis of mortality rates and information from post-mortem examinations provide data related to the final stage of the nutritional problems. Here again, post-mortem examinations can also be used for assessing the problem at previous stages, but together with the analysis of mortality data they are the only ones available for the last stages.

No attempt will be made here to analyse in detail each of the different methods mentioned or its relative value, because this has already been

done in previous publications (*2*, *3*, *5*, *8*). Nevertheless, we shall discuss some aspects of general methodology that are applicable whatever methods are used.

Firstly, mention must be made of the important problem of reaching agreement on the use of comparable methods, which would allow the possibility of making meaningful comparisons of studies carried out in different countries. Although some work has been done in this connexion by organizations interested in nutrition—mainly by WHO, FAO, and the Interdepartmental Committee on Nutrition for National Development (later known as the Office for International Research of the National Institutes of Health, USA)—further efforts are still needed.

Secondly, the techniques to be used must give results that are comparable with accepted standards, and the personnel who are to use them must be trained to use standard methods.

Thirdly, it is necessary to consider the development, testing, and standardization of techniques that can be used by non-specialized personnel. This applies to all the different methods mentioned at the beginning of this section, particularly when they are to be applied in continuous surveillance. Personnel with a specialized knowledge of nutrition and related subjects are scarce—too scarce, frankly, to cover the needs, since these needs are not only for diagnostic and evaluating procedures but for applied programmes as well. Furthermore, all these activities depend largely on the extent to which they can be incorporated into regular programmes of non-specialized sectorial activities, such as those dealing with health, agriculture, and education. Techniques that could be applied by regular health service personnel (physicians and nurses), home economists, teachers, and similar workers could therefore be of great benefit in determining the nutritional status of population groups. The role of the specialist in nutrition would then be to develop, test, and standardize these techniques, to supervise their application, and to collaborate in the analysis and interpretation of the data collected.

Sampling

It is essential to ascertain that the sample selected for study is qualitatively and quantitatively adequate to allow the information obtained to be extended to the population under investigation, within an accepted degree of confidence. If it is not representative of the population as a whole, interpretation must be restricted to the population that it does represent. In general, we can say that the larger the sample the greater the confidence in relation to the reliability of the data collected. On the other hand, large samples make the study more expensive and time-consuming, and there may not be a sufficient number of specialized personnel to utilize more elaborate and precise techniques, which will result in a loss of accuracy in the data collected.

Consequently, a compromise is necessary, and the ideal appears to be to have the smallest sample that can possibly provide reliable information. The availability of previous data on the approximate prevalence and variability of the characteristics being investigated can be most helpful in deciding on the size of the sample. If such data are not available, it would seem advisable to carry out a preliminary study to obtain information on the approximate prevalence and variability. In the last resort it may be necessary to rely on data collected in the course of similar studies in other comparable areas or on any other information that may give an idea of the magnitude of the problem to be studied. In this respect the services of an experienced statistician are usually essential. The effort is worth while because time and resources can be saved by reducing the sample size without loss of reliability.

Another important decision in the sampling phase concerns the choice of sampling unit, which in nutritional surveys could be the community, the family, or the individual. The objectives of the study will determine this decision. In surveys designed to establish the prevalence of specific nutritional deficiencies, for instance, the individual may be the unit sample of preference; individuals of special interest in relation to age, sex, or other characteristics can then be properly included. On the other hand, if the survey is intended to determine environmental factors that affect or are related to the nutritional situation of a population group (e.g., socioeconomic status and dietary practices), the family is a better unit for sampling. The community will serve as a sampling basis when factors such as social structure, communications systems, marketing, and ecological conditions are of interest. Finally, there are some types of information, such as *per capita* food availability, that can only be attained on a state or national basis. It is therefore clear that for a comprehensive survey information is obtained from all these sources—the whole area under study, the community, the family, and the individual.

Previous demographic information on the population to be studied (such as total number of inhabitants, composition, and geographic distribution) is fundamental for adequate sampling. These data are not always available, particularly in developing countries, but in that event surveys can still be carried out in specific population groups without adequate sampling. However, great care must be taken in extrapolating the results to the total population of the area.

After the sample to be studied has been selected, it is advisable to identify the individuals to be studied before the survey is carried out in the particular town or area. This identification consists in visiting the families or individuals selected in order to prepare them and ensure their willingness to collaborate. This course of action will facilitate the logistics of the operation. Certain general information about the families may be collected at this time. It is often advisable to prepare alternative sample units that may serve for

substitution if those originally selected cannot be studied. In this situation, measures should be adopted to ensure that absenteeism is unconnected with the factors to be studied, otherwise the samples might be biased when making the substitutions. Provision should be made for assessing the characteristics of the families that did not participate in the survey as well as of those that did; information collected at the time of the first visit to the house can be invaluable in this regard. Normally, volunteers should not be included in the survey, or they should at any rate be considered as a separate group from the probability sample; the fact that they were sufficiently motivated to volunteer without being requested suggests that they may be a very biased group.

For a further discussion of approaches to sampling the reader is referred to the tenth report of the WHO Expert Committee on Health Statistics (*7*).

Analysis and interpretation

It is important to obtain significant and clearly understandable information from the analysis of the data collected in nutritional surveys in relation to the objectives previously established. For example, data obtained on nutrient intake are frequently analysed only to derive average values for the population or for its different sectors classified by age, sex, location, etc. The average values are then compared to recommended allowances and conclusions drawn on the degree of adequacy. In this case, it would be more valuable to obtain information on the percentile distribution of the intake values within the population or its different sectors. In this way, percentages of the individuals or families studied that are above or below certain limits in relation to recommended allowances can be established. Whenever possible, the limits for the different groups should be established on the basis of their significance in relation to health. These limits are known for some biochemical parameters, and there are also certain guidelines available for the purpose. The limits recommended by the Interdepartmental Committee on Nutrition for National Development (*3*) for "excellent", "adequate", "low", and "deficient" constitute an example. In any event, the important point is that populations are frequently very heterogeneous and mean values have little practical significance.

Another general point in relation to the analysis of nutritional surveys is the need to correlate and integrate data relating to the different parameters measured whenever such correlation can contribute to the interpretation of results. Restricting the analysis to the separate units in which the information is obtained may limit the value of the study.

Finally, with regard to data analysis, it is necessary to call attention to an administrative problem frequently observed in the execution of nutritional surveys, particularly those of a complex and extensive nature. Most of the effort (in terms of personnel, budget, time, etc.) tends to be devoted to the data collection phase, while the needs for analysis, interpretation, and

reporting are neglected or underestimated. In these circumstances, the efficiency of the total effort is significantly decreased, and valuable data may be insufficiently utilized.

Reporting

The last stage of a nutritional survey, the reporting stage, should be carried out in accordance with the objectives. Its basic purpose should be to encourage the most effective utilization of the information obtained. This phase therefore merits much care and attention. In general terms, it is recommended that, in addition to the technical reports prepared for publication in scientific journals or to be presented at scientific meetings, less-technical reports should also be prepared for those who are not specialists but who will be responsible for making decisions on the study's recommendations. This is not usually done, and as a result the persons in charge of applying the information may not understand or appreciate its value. It is the responsibility of the specialists to present information in terms understandable by the non-specialist.

It may also be useful to prepare popular reports for the benefit of the general public in order to foster the understanding and cooperation that may be required in carrying out activities designed to correct the problems found.

An Example of a Comprehensive Nutrition Survey in Central America and Panama

Organization of the survey

From 1965 to 1967 the Institute of Nutrition of Central America and Panama (INCAP), in cooperation with the governments concerned and with the support of the Office for International Research of the National Institutes of Health, USA, carried out a comprehensive nutrition survey covering the six countries in the area (*6*).

The objectives of the survey were to collect data on the nature and magnitude of nutritional problems of public health significance and on the main factors responsible, in order to provide appropriate background information for the planning and development of national and regional health programmes. The survey was also intended to serve as a baseline for evaluating the effectiveness of these programmes. In view of the complexity of the nutritional problem, a broad epidemiological approach covering the characteristics of the host, the agent, and the environment was considered necessary.

On the ground that the presence of malnutrition in the individual is the direct result of the microenvironment within the household, the family and not the individual was taken as the unit of observation. The sampling

method adopted, on the advice of an experienced statistician, was to use a "rural" sample of families such that the total number of persons involved was four per thousand of the population and to include 30–40 locations in every country, depending on the number of inhabitants. This was done on the basis of existing administrative or political divisions, the number of locations to be studied in each division being proportionate to its total population.

From existing census maps, 25 households were selected at random in each location—20 to be surveyed and five to serve as alternatives. In addition, an "urban" sample consisting of 100 families was selected from each of the capital cities of the countries, the various socioeconomic levels being represented in proportion to their size.

A very important factor in the success of the survey was an initial visit to each selected household by a team of two social workers with the aim of interviewing the family, requesting their cooperation, and preparing a family roster that included the name, sex, age, and occupation of each household member. Thus, at the start of the survey, the complete "ideal sample" was known.

In addition to the basic information required, ancillary data were collected to permit comparison of different methods of gathering the same data. Advantage was taken of the survey to collect further data not directly related to nutrition but of special interest to some of the participants. Table 1 lists the determinations carried out in the Central American nutrition survey.

Table 1. Determinations carried out in the Central American nutrition survey

Host (Population)	Agent (Diet)	Environment (Physical, biological, socio-cultural)
Clinical-nutritional examination	Investigation of the dietary pattern and specific nutrient intake	Altitude
Anthropometric measurements		Climate
Biochemical values in blood and urine		Food availability
		Food technology
Haematological values		Intestinal parasitology
Oral examination		Prevalence of serum antibodies to infectious agents
Wrist and hand radiograph		
Glucose tolerance test		Sociocultural patterns
Electrocardiogram		
Mortality studies (whenever possible)		

All forms and questionnaires were prepared in advance and designed according to the type of analyses to be made. The field personnel were instructed in standard techniques in order to avoid errors of interpretation. This was particularly important for the clinical, oral, and anthropometric determinations. Sturdy portable equipment was selected and packed in individual wooden boxes.

Field work

In the actual field work it was found most convenient to assign collection of the data to three separate working groups, each one sequentially visiting each location at weekly intervals. The first group collected the sociocultural data, the second the dietary data, and the third the clinical data. It is important that the latter group be the last to enter into action because the taking of blood, faecal, and urine specimens may affect to some extent the willingness of the population to cooperate. The first two groups worked exclusively in the home, while the clinical group asked the families to attend a central examining station, usually the local school. It was found extremely helpful to send social workers to visit all the sample families on the day prior to the arrival of the clinical group, so that schedules could be arranged throughout the day to avoid prolonged waiting.

A detailed itinerary was prepared for each group indicating the daily time of departure from the place where they had completed their work, time of arrival at the next working location, and the approximate time of departure for the following destination point. These itineraries were distributed to every group member, and great importance was attached to maintaining them exactly, to prevent the different groups from working in one location at the same time. Obviously each group had to be provided with transport facilities appropriate to the conditions in the area. An efficient central administrative team was established to serve as an information and control centre. A high-ranking official was available at all times in the field to solve any problems that occurred and to make pertinent changes and decisions without loss of time. Each group was always provided with the necessary official identifications and letters of introduction to local authorities to avoid delays and misunderstandings. These documents were signed by a high government official, such as the Minister of Health, to give the required authority.

The sociocultural team consisted of four experienced field workers and one agronomist.

The dietary group was composed of 12 to 14 nutritionists and auxiliary nutritionists working in teams of two or three and spending four to five days in each location. To compare the various methods of collecting dietary data, three of them were employed in the same families. A "24-hour recall method" was used for all families. Each interview with the housewife lasted about 45 minutes and covered all meals during the previous 24 hours. A "three-day record method" was applied to a quarter of the families selected at random and consisted in observing all meals during a three-day period. On a number of randomly selected families a "direct weighing method" was used for a 24-hour period.

The largest group was the clinical team, which was responsible for collecting all other information. The tasks assigned to the members of this group and the type of personnel used are listed in Table 2.

Table 2. Tasks performed by the clinical team

Task performed	Number and type of personnel
Reception and identification	2 public health nurses
Family flow and "trouble shooter"	1 physician
Clinical-nutritional examination	4 physicians
Oral examination	2 dentists and 2 auxiliary nurses
Anthropometric measurements	2 university students and 2 auxiliary nurses
Community preparation	2 social workers or public health nurses
Wrist radiographs	1 X-ray technician
Glucose tolerance test and electrocardiogram	2 medical students
Collection and preparation of stool samples	1 laboratory technician
Collection and preparation of serological samples	1 laboratory technician
Collection of biochemical and haematological blood samples	1 laboratory technician or nurse
Preparation of blood and urine samples	1 laboratory technician

This group spent one day in each location working usually from 08 h 00 until 15 h 00 or 16 h 00 without interruption. The most adequate location was found to be a school. A separate station was set up for each procedure. All the teams worked simultaneously and the persons studied had to pass successively from one station to another until covered by all of them. Each family was requested to arrive as a whole if possible, and special attention was given to the working men, who were examined as quickly as possible so they could return promptly to their work. Every individual passed first through the reception line, and from there the families were distributed at random among all the stations to avoid any prolonged waiting periods. Families of over 10 members were divided into two units. A family of 5–6 members would take about 3 hours to be processed. The average number of subjects processed per day was 115.

All blood and urine specimens were immediately refrigerated and sent to the branch laboratory in the capital city of each country before midnight of the day of collection. Depending on distance and roads this was done either by a land vehicle or small aircraft. Immediately on arrival at the branch laboratory the blood and urine samples were appropriately stabilized and sent the next day, either refrigerated or frozen, to the central laboratories at INCAP in Guatemala City.

Food availability and technology data at the national level were collected independently by an agricultural economist and a food technologist.

In general terms, the complete survey of a country took approximately 10 weeks at a cost of around US $160 000.[a]

[a] The countries of Central America are small, with surface areas ranging from 20 000 to 140 000 km² and populations from 1 to 5 million.

Data collected

The following list itemizes all the data collected and the laboratory determinations made.

(1) *Sociocultural survey*
- (*a*) At the community level
  - (i) natural resources
  - (ii) capital investment
  - (iii) social institutions
  - (iv) geographical mobility
  - (v) extra-community exchange
  - (vi) intra-community exchange
  - (vii) communications and exposure to mass media
- (*b*) Family agricultural survey
  - (i) products and area cultivated; losses, sales and purchases; storage, seed selection, and fertilization practices
  - (ii) animals owned, bought, and sold; breed, vaccination and feeding practices
- (*c*) Family survey
  - (i) housing
  - (ii) food production
  - (iii) occupation of head of family
  - (iv) income and salary
  - (v) exposure to mass media and education
  - (vi) knowledge of nutritional diseases

(2) *Dietary survey*
- (*a*) Availability and prices of food at the community level
- (*b*) Dietary habits and practices
- (*c*) Nutrient intake *per capita* on a family basis
- (*d*) Nutrient intake of individual preschool children

(3) *Clinical-nutritional examination*
- (*a*) Family history of births, birth spacing, and deaths of children by age
- (*b*) Weaning practices
- (*c*) Investigation of 60 clinical signs relating to nutritional deficiencies
- (*d*) Blood pressure

(4) *Oral examinations*

Investigation of abnormalities of the lips, gums, teeth, tongue, and mucous membranes

(5) *Anthropometric measurements*
- (*a*) Weight
- (*b*) Lengths: total height, sitting height, knee–heel length
- (*c*) Perimeters: head, chest, abdomen, arm, calf
- (*d*) Diameters: biacromial, bicristal, biepicondylar, bistyloid, bicondylar
- (*e*) Skinfold thickness: tricipital, subscapular, abdominal

(6) *Biochemical determinations*
- (*a*) In blood serum or plasma
  - (i) total proteins
  - (ii) essential amino acids
  - (iii) nonessential amino acids
  - (iv) vitamin A and carotenes
  - (v) ascorbic acid
  - (vi) iron and total iron-binding capacity
  - (vii) cholesterol

(viii) vitamin B_{12}
(ix) folic acid
(*b*) In red blood cells
(i) riboflavin
(*c*) In urine
(i) creatinine
(ii) urea
(iii) thiamine
(iv) riboflavin
(v) *N*-methylnicotinamide
(vi) iodine

(7) *Haematological determinations*
(*a*) Haemoglobin
(*b*) Haematocrit reading

(8) *Wrist radiograph*
(*a*) Appearance of centres of ossification
(*b*) Bone density

(9) *Faeces*
(*a*) Helminths and egg counts
(*b*) Protozoa

Presentation of data

As an example of the information obtained and to show how data were analysed and reported, some results are given below in tabular or graphic form (Tables 3–5 and Fig. 2).

In Table 3 the distribution of values of vitamin A intake found in rural families is shown in accordance with the degree of adequacy. It is apparent that in Guatemala 66% of the families were consuming less than 50% of the recommended intake while only 17% were consuming the recommended intake or more. When the data are presented in this way rather than in terms of the average figure of adequacy, a better picture of the real situation is obtained.

Table 3. Percentage distribution of rural families by adequacy of vitamin A intake

	Number of families	Percentage of families with following percentage of adequacy: <25	25–49	50–74	75–99	⩾100
Guatemala	200	44	22	10	6	17
El Salvador	278	69	19	7	3	2
Honduras	323	57	26	9	2	6
Nicaragua	331	45	23	13	8	11
Costa Rica	414	44	26	11	7	12
Panama	352	42	32	13	5	8

Table 4 permits the differences between socioeconomic groups to be examined. The differences seem to be greater in some countries than in others, and an explanation of this variation might be sought in other data.

Again the point is made that this display of data is much more informative than simply the means ratio by country.

Table 4. Ratio of nonessential to essential amino acids in the serum in relation to socioeconomic level of rural families

	Socioeconomic level					
	Low		Medium		High	
	Male	Female	Male	Female	Male	Female
Guatemala	2.2	2.3	2.1	2.1	1.9	1.8
El Salvador	2.7	2.4	2.5	2.4	2.3	2.1
Honduras	2.8	3.0	2.7	2.6	2.5	2.6
Nicaragua	2.5	2.5	2.3	2.4	2.1	2.3
Costa Rica	2.4	2.5	2.4	2.3	2.1	2.2
Panama	2.6	2.2	2.4	2.3	1.9	1.7

In Table 5 the percentage of malnutrition found in the sample (by Gomez classification) is extrapolated to the whole population, giving a better idea of the magnitude of the problem. This type of presentation is very useful for health planners and policy-making officials.

Table 5. Cases of protein-energy malnutrition in children under 5 years of age by degree (based on weight by age) and country. Central America and Panama, 1965–1967

	Population under 5 years	1st, 2nd and 3rd degree malnutrition		1st degree malnutrition		2nd degree malnutrition		3rd degree malnutrition	
	(1965)	Number	%	Number	%	Number	%	Number	%
Costa Rica	294 300	168 928	57.4	128 609	43.7	35 904	12.2	4 415	1.5
El Salvador	554 400	413 028	74.5	268 884	48.5	126 958	22.9	17 186	3.1
Guatemala	833 400	678 387	81.4	408 366	49.0	220 851	26.5	49 170	5.9
Honduras	346 900	251 503	72.5	149 167	43.0	94 357	27.2	7 979	2.3
Nicaragua	287 500	163 503	56.8	120 175	41.8	37 950	13.2	5 175	1.8
Panama	207 900	126 195	60.7	101 455	48.8	22 453	10.8	2 287	1.1
Total	2 524 400	1 801 341	71.4	1176 656	46.7	538 473	21.3	86 212	3.4

Fig. 2 shows that endemic goitre was associated almost exclusively with populations with low urinary excretion of iodine, confirming that iodine deficiency is the main responsible factor. It can also serve to indicate the degree of deficiency below which clinical manifestations exist and therefore the amount of iodine that should be added to the diet.

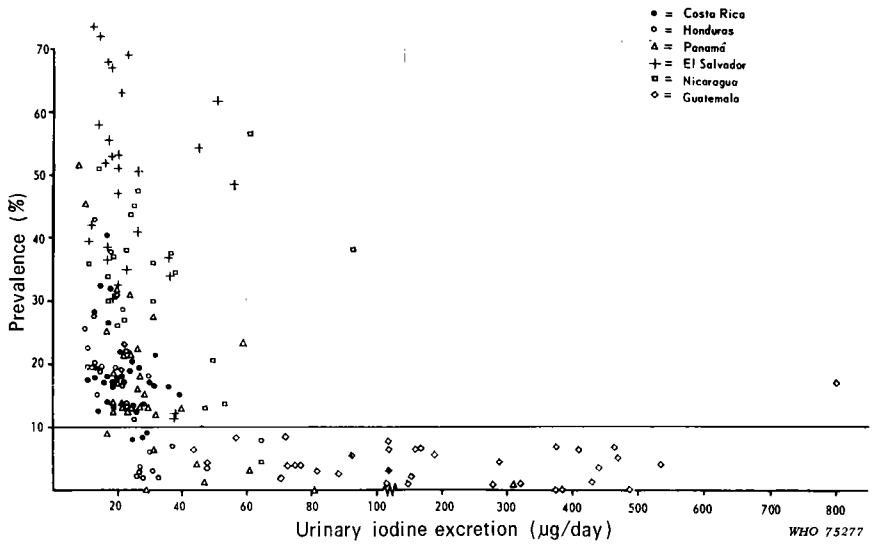
The kind of presentation illustrated in these examples makes it easier to interpret and use the data collected.

Utilization of the information obtained

Report

A detailed report of the survey of each country was prepared. It included a short introduction indicating the objectives of the survey, a summary of the sample, and a short explanation of the methods used.

Fig. 2. Urinary iodine excretion and prevalence of endemic goitre, by country. Central America and Panama, 1965–67



A description of the results was provided, analysing the situation found with respect to each nutrient and, for better interpretation, combining the data collected through the different methods of assessment. This was followed by a description of the results derived from the various complementary studies carried out, such as anthropometry, bone maturation, and oral health. Results of the studies on environmental factors such as food availability, situation of the food industry, sociocultural characteristics, and prevalence of intestinal parasites were also included. The section concluded with detailed information on food habits and food consumption.

The next section, which proved to be of great value, dealt with conclusions and recommendations. It contained a summary of the results in a language appropriate to non-specialists, emphasizing the significance of the findings in relation to the health and wellbeing of the population and the socio-economic implications for the country as a whole. The summary ended with a list of the actions suggested to correct the problems found.

A series of appendices were attached to the report. They included the recommended daily allowances for the area and the guides used for interpreting the biochemical and haematological data. A table of contents of a report is given below for illlustrative purposes.

I. Introduction
II. Sampling
III. Methods and procedures

IV. Results
  A. Civil population
    (1) Host studies
      (*a*) Nutritional findings:
        Proteins and calories
        Vitamin A
        Riboflavin
        Haematological evaluation
        Thiamine
        Niacin
        Ascorbic acid
        Iodine
        Calcium
        Fat
      (*b*) Complementary studies:
        Anthropometrical measurements
        Bone studies
        Physical condition
        Oral health
        Studies on diabetes and cardiovascular diseases
        Mortality
    (2) Environmental studies
      (*a*) Food availability
      (*b*) Food industry
      (*c*) Sociocultural studies
      (*d*) Studies on intestinal parasites
      (*e*) Immunology
    (3) Agent studies
      (*a*) Dietetic study
  B. Nutritional study of military personnel
V. Conclusions and recommendations
VI. Appendices
  A. Participants
  B. Acknowledgements
  C. Recommended daily allowances for Central America and Panama
  D. Guides to the interpretation of biochemical and haematological findings
  E. Detailed biochemical data

The report was first officially presented to the Minister of Health of each country in a personal interview during which it was suggested to him that it would be useful if he could call a meeting of his colleagues in agriculture, education, finance, industry, and commerce and of high officials in the national planning office. In most countries this suggestion was accepted, and during the meeting the results of the survey and their significance were presented by the directors of the survey team and INCAP staff members, with appropriate audiovisual aids. The meetings proved to be very instructive and stimulating for government officials and most useful in later obtaining their support for the suggested action programmes.

Further presentations were later made to officials of the Ministry of Health, to university groups at a national medical meeting, and to other specialized interested groups.

The written report was distributed to responsible government officials and to universities. It was also made available to some interested groups in the private sector, including the press. A reprint of the introduction and of various chapters covering sampling, methods, conclusions, and recommendations was distributed on a wide scale.

Utilization of a report in the country concerned

The first and probably the most important effect of the survey report was to create among government officials and technical personnel, not only in the health sector but in others such as agriculture and education, a stronger consciousness of the magnitude and severity of the country's nutrition problems. It also became clear that these problems were of a multisectorial nature and that a comprehensive programme supported by political decisions taken at the highest government level was needed to solve them.

As an immediate result, the need to define a national food and nutrition policy was recognized. Multisectorial official bodies to define this policy and to plan programmes for its implementation were established in four of the six countries. In another, nutrition was defined as the area of primary interest in the Ministry of Health.

A review of the nutrition programmes already in progress was undertaken and the priorities for immediate action were defined more clearly. In this way, protein-energy malnutrition, vitamin A deficiency, endemic goitre (in five of the six countries), and nutritional anaemias were defined as the nutritional problems of major public health importance.

Prompt action was taken with regard to endemic goitre when it was clearly demonstrated that in one of the countries, where the iodization of salt had been carried out for about five years, this problem was under control, while it was still highly prevalent in the remaining countries. Shortly afterwards, three of these countries started a salt iodization programme, and the other two initiated the necessary legislation to implement one.

The report was also utilized for the planning of overall health programmes. In the development of national health policies the planners had had difficulties in quantifying the prevalence of malnutrition. The information in the report provided a solid basis for this purpose and permitted a better incorporation of nutrition activities into the health plans. The data collected in the survey are also being used as baseline information for evaluating programmes developed after the survey. The need for developing surveillance mechanisms to update the most important information was also recognized; some efforts have already been made in this direction.

With the information obtained, nutrition and health specialists were in a better position to convince planners, economists, and other high-ranking

administrators of the important role of malnutrition in obstructing national development.

The information was also useful to health personnel as a basis for preparing nutrition education programmes and materials.

The data on food intake, including consumption by socioeconomic groups and by specific age groups, were very useful for planning in the agricultural sector, since they provided guidance on the effective demand for foods in relation to income and permitted more realistic projections of future needs and levels of consumption.

The survey report is being extensively used in the universities as teaching material, particularly for students of such subjects as medicine and agronomy. Of course, it is also extremely useful in programmes aimed at the training of nutritionists, since it enables the study of nutritional problems to be illustrated and discussed on the basis of complete and recent information of a local nature.

Utilization of the reports by INCAP

For INCAP, as an advisory organization for its Member Countries, the survey was of great value. It permitted the organization to re-evaluate and redirect its overall programmes to accord with the needs of the countries concerned. An immediate result was the strengthening of its applied nutrition services and the readjustment of its research and training programmes. It was recognized, for instance, that the magnitude and importance of vitamin A deficiency was greater than had been suspected and that it would be difficult to expect significant improvement through dietary changes. Other approaches to correct the problem were considered, and research was initiated on food fortification. As a result, a method of fortifying sugar with vitamin A was developed. The magnitude of the problem of nutritional anaemias, particularly in young adults working mostly as agricultural labourers, was also recognized, and research on the implication of this problem and on practical ways to correct it were started.

The biochemical data suggested new unsuspected nutritional problems, among them the possibility of folate deficiency in all six countries and of thiamine deficiency in some population groups in one of them. Moreover, the dietary information indicated that for some population groups the most important limiting factor in the diet was energy intake rather than intake of proteins or other nutrients.

INCAP acquired up-to-date and very extensive data that placed it in a good position to satisfy the numerous requests for specific information received from interested agencies, institutions, or persons in Member Countries and elsewhere.

Finally, some of the collateral information gained, such as that derived from the sera bank established to store the blood samples taken for bio-

chemical studies, has been of extraordinary value in epidemiological research not directly related to nutrition.

The data collected are still being analysed to obtain information that was not originally contemplated or that could not be gathered in the first analysis. For instance, an attempt is being made to correlate the nutritional status of children with certain demographic variables such as number of siblings, birth order, and birth interval.

Some standards have been derived from the haematological and anthropometric data. Food composition tables have also been prepared giving nutrient content per common units of measure. This has been done not only for raw foods but for cooked or processed foods, taking into account the different usages in the various countries. These have already been published and are being widely utilized.

Many other useful publications and materials for teaching and for nutrition education purposes have been prepared utilizing the information derived from the survey.

The overall capacity of INCAP as a research, training, and advisory service for the countries of Central America was therefore strengthened by the survey.

REFERENCES

1. LEAVELL, H.R. & CLARK, E.G. *Preventive medicine for the doctor in his community*, 3rd ed. New York, McGraw-Hill, 1965, pp. 14–38
2. JELLIFFE, D.B. *The assessment of the nutritional status of the community*. Geneva, World Health Organization, 1966 (Monograph Series, No. 53)
3. US INTERDEPARTMENTAL COMMITTEE ON NUTRITION FOR NATIONAL DEFENSE. *Manual for nutrition surveys*, 2nd ed. Bethesda, MD, National Institutes of Health, 1963
4. BÉHAR, M. Evaluación de la situación nutricional en grupos de población [Evaluation of the nutrition situation in population groups]. *Archivos latinoamericanos de nutrición*, **22**: 335, 1972
5. ARROYAVE, G. Standards for the diagnosis of vitamin deficiency in man. *In : Metabolic adaptation and nutrition.* Washington, DC, Pan American Health Organization, 1971 (Proceedings of the special session held during the ninth meeting of the PAHO Advisory Committee on Medical Research, 16 June 1970: PAHO Scientific Publications, No. 222), pp. 88–104
6. INSTITUTE OF NUTRITION OF CENTRAL AMERICA AND PANAMA & INTERDEPARTMENTAL COMMITTEE ON NUTRITION FOR NATIONAL DEVELOPMENT. *Nutritional evaluation of the population of Central America and Panama: regional summary.* Washington, DC, US Department of Health, Education and Welfare, 1972 (DHEW Publication No. (HSM) 72–8120)
7. WHO Technical Report Series, No. 336, 1966 (Tenth report of the WHO Expert Committee on Health Statistics)
8. WHO Technical Report Series, No. 258, 1963 (Report of the WHO Expert Committee on Medical Assessment of Nutritional Status)