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GENERAL GUIDELINES FOR ESTABLISHMENT OF A DATA SYSTEM FOR THE ASSESSMENT OF NUTRITION AND HEALTH STATUS

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GENERAL GUIDELINES FOR ESTABLISHMENT OF A DATA SYSTEM FOR THE ASSESSMENT OF NUTRITION AND HEALTH STATUS*

Preliminary Report

May 1973

To be presented at the Twelfth Meeting of the PAHO Advisory Committee on Medical Research by Dr. Arnold E. Schaefer, Adviser, Nutrition Surveillance, Health Services Department, Pan American Health Organization, Washington, D.C., USA.

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P R E F A C E

Prevention of malnutrition requires an interdisciplinary approach of the Health, Agriculture, Education and Economic sectors. Baseline assessment of nutrition and health status as well as the evaluation and monitoring of the effectiveness of intervention programs are essential components for implementing a coordinated intersectoral National Food and Nutrition Policy.

The technical workshop convened by the Pan American Health Organization in Buenos Aires, Argentina in November 1971, directed its efforts in outlining the basic concepts for establishing a computer programming system for the storage, retrieval and uniform analysis of basic nutrition, health and socio-economic data. The survey forms and data linkage formats were designed to be adaptable and flexible for the analysis and retrieval of a wide range of health assessment data from simple anthropometric to complex survey data including dietary, physical examination, biochemical and other socio-economic health data.

The proposed data analysis and retrieval system and the various types and priorities of nutrition assessment procedures including sample, size and selection will be tested in a collaborative PAHO effort with Chile, Argentina, Peru and Brasil. Retrospective analysis of nutrition survey data, in reference to identification of the most meaningful tests, sample size, and correlations is in progress by INCAP as regards further analysis of the Central America and Panama survey data. Simplicity of the

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methodology for assessing health - nutrition status and cost of such programs are directly related to the sample, size and type that is required to provide informative, reliable data that can be projected to population groups. In addition to evaluating simple methodology is the need to identify and collaborate with such existing health units that could be used for the systematic collection of data on a continuing basis of one or more key indicators of nutrition-health status employing standardized methodology.

This manual is intended as a tentative working document to be tested, reviewed and re-edited. We encourage and welcome your comments, criticism and suggestions.

CHAPTER I

Introduction

PAHO/WHO, FAO, UNICEF, and other United Nations agencies are currently cooperating in promoting the formulation, planning and implementation of nutrition policies in Latin America and the Caribbean. Nutritional deficiency disease is one of the major public health problems in this Hemisphere. Knowledge of the nature, magnitude, and epidemiology of nutritional disorder in the Region is essential for planning health programs. To plan and evaluate programs, the availability of baseline data is of utmost importance.

Little information is available to health services in this Region on the subject of family size, child spacing, maternal nutrition and their relationship to infant and maternal health. A better understanding of nutrition problems through epidemiological surveys is needed to assure better utilization of resources for the combat of malnutrition and to increase the effectiveness of current health nutrition and social programs.

The "diagnosis" phase of planning entails the collection of basic data for defining or appraising the general situation, identifying the principal areas in which health problems occur, and, whenever possible, quantifying them, so that subsequent programming, execution, and evaluation can be undertaken.

The Third Technical Advisory Committee of Nutrition to PAHO, in September 1970, recommended that research be undertaken aimed at discovery of valid survey-type tests, analyses, and

observations by low-cost procedures adaptable to: (1) national nutrition surveys, (2) surveillance of action programs, and (3) for periodic assessment of changes in the national nutritional status. In this connection, it would be desirable to develop techniques to determine the human and economic loss to the community through malnutrition.

The principal objectives of a nutrition survey are:

1. To provide data on the incidence of nutritional diseases. The priority areas in the Region are: protein-calorie malnutrition; nutritional anemias; endemic goiter; hypovitaminosis A; and ariboflavinosis. The priority vulnerable groups of the population are: pregnant and lactating women and preschool-age children. The data collected should be in a format capable of being compared with other results obtained at different times or locations, or in different countries.
2. To provide socio-economic food and health data which may be correlated with nutritional findings in order to identify high-risk groups and local causative factors.

The purpose of the conference held in Buenos Aires, Argentina, 1971, was as follows:

1. To exchange the latest information concerning the advantages and limitations of the methodology for analyzing nutrition survey data.
2. To design a standard questionnaire form for nutrition surveys in Latin America and the Caribbean, the layout of the form to be such that it can easily be adapted for different types of surveys.

3. To develop a guideline for computer programming adaptable for different computer models. (Use of standardized forms and programs should produce the required statistics sooner and less expensively than previously-used manual methods), and the results from different surveys will be more easily comparable when use is made of a standard system of recording and analysis.
4. To identify those areas of research which are needed to further improve data collection and analyses.
5. To establish an information system which, through health departments or other appropriate agencies, could make data available to planning officers (national or regional) for diagnoses, planning, and/or evaluation purposes.
6. To provide the basis for selection and identification of better (more reliable, sensitive, inexpensive) indicators, as well as a continuous self-improvement, of the information system through proper feedback channels.

Associate Objectives

1. To make possible the use of the information contained in the system for descriptive purposes (establishment of profiles), as well as in the establishment of guidelines for diagnosis. For this purpose the system must be consistent and continuous in data, time, and space.
2. To stimulate the continuous improvement of data collection procedures through regular use of the information contained in the system.

3. To help in the integration of intersectorial efforts in the fields of nutrition and socio-economic development.

To fulfill the stated objectives, the conference participants agreed that the information system should have the following general attributes:

1. Basic standardized data and homogeneous specialized data
2. Continuous in time and complete in geographic coverage
3. Flexible indexing facilities and data structure with linking to other information system
4. Built-in mechanisms for self-improvement

CHAPTER II

Planning and organization of the survey

1. Definition of scope

The first and fundamental consideration in the planning of a nutrition survey is to define its objectives as clearly and precisely as possible. This is essential, as it serves as a basis for sampling, methodology to be used and on the interpretation and utilization of the information obtained. Regardless of the scope of a nutrition survey, its primary goals should be to assess nutrition health status, identify the major nutrition problems, prevalence, location and causes, and resources (manpower, economic, agricultural-food, educational and health services) - for potential practical solution. Of equal importance is the establishment of nutrition - health baseline data from which future evaluation of the success or failure of action programs can be assessed in terms of health, economic and social benefit. Since nutritional health status of a population group is not static there is need for continued surveillance of the effects of the changing food supply, economic and social status, on health of the population. In many situations, where resources are limited, the most useful service a nutrition survey can make is to point to the critical nutritional areas in which large gains in health and efficiency can be obtained.

The term nutrition survey has a multiplicity of meanings. To some it connotes an epidemiological survey of specific nutritional diseases, or of selected population groups such as school

children, or a combination of these. Similarly, the methods employed may be limited to one assessment method (such as anthropometric) or a combination of physical, anthropometric, biochemical and dietary -food availability appraisal.

1.1 Simplicity or complexity of a survey

A survey is carried out to enable inferences from the sample to the population. Generally, stratifications are made of the whole population, based on prior information suggestive of subpopulations more nearly homogeneous in nutritional status than the total. These may be based on differences in amounts and types of food available, urban-rural division or on nutritionally vulnerable age groups such as pregnant-lactating mothers, infants and preschool children.

Simplicity of a survey reference methodologies to be employed and Cost in terms of money, personnel and time are directly related to sample size and type of sampling.

The logistics of presenting the subjects for study is the greatest cost item. Next of course, is the time and effort for examination of each subject. The suggested methodology included in this manual are proposed for use irrespective of the degree of simplicity or complexity. Hopefully, simple methodology will evolve which can serve as a health barometer to monitor change.

Throughout the text, various priorities have been given to individual tests to indicate the first priority dependent upon resources.

Of the various methodologies given - anthropometric, physical, biochemical and dietary, the first priority of methods beyond question is the simple anthropometric assessment.

2. Priority of nutrition survey methodology - brief outline (number in parenthesis indicates priority)

2.1 Sample

(1) Random cluster stratification of vulnerable population groups directed toward 0-5 year olds, pregnant mothers

(2) Other groups

(3) Random probability sampling*

2.2 Anthropometric measurements**

(1) Height for age

(1) Weight for age

(2) Arm circumference

(2) Skinfold thickness

(2) Head circumference

(3) Others

2.3 Physical - examination

(1) Short - abbreviated form - see Ref. (*)

Lists only key indicator lesions of malnutrition

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*Ref. "Manual for Nutrition Surveys"; 2nd Edition 1963, Inter-departmental Committee on Nutrition for National Defense, NIH, Bethesda, Maryland, U.S. Govt. Printing Office, Wash., D.C.

**"Manual for Internationally Comparable Growth Studies of Latin America and the Caribbean" - Draft Report PAHO 1972

(1) Pediatric - Maternal questionnaire, see Ref.(**)

(2) Detailed physical examination - (*)

2.4 Biochemical - laboratory studies on a random subsample

(Dependent upon sample size may be 1 in 5 or 1 in 10- If feasible hemoglobin and hematocrit determinations to be conducted on all subjects - again priority given to pregnant mothers and preschool age children)

2.4.1 Blood analysis *

(1) Hemoglobin

(1) Hematocrit

(2) Serum iron or transferrin saturation index on subsample(1)

(2) Red blood cell and serum folate (subsample)(1)

(2) Serum vitamin A (subsample)

(2) Serum albumin (protein electrophoresis or a subsample)

(3) Serum vitamin C

(3) Serum vitamin B_{12} (subsample)(1)

(4) Other tests as modified glucose tolerance test, serum cholesterol, aminoacids, RBC, etc.

2.4.2 Urinary analysis *

(2) Urinary creatinine (subsample)

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(1) Identification of primary cause of anemia can be restricted to intensive study of a relatively small number having evidence of anemia.

(2) Urinary iodine - (subsample) of adolescent girls

(3) Urinary riboflavin (subsample)

(3) Urinary thiamine (subsample)

(4) Urinary N'methylnicotinamide - (only on subsample if pellagra suspected)

2.4.3 Parasitological analysis

(2) Fecal analysis (subsample if risk identified)

2.5 Dietary studies: on subsample

(1) Twenty four hour recall on subsample - usually to include those in biochemical sample - if possible

(1) Frequency - food pattern data

(2) One day- home food weighing method.

(3) 3 to 7 day FAO, home food weighing method

(3) Food composite chemical analysis

2.6 Socio-economic data

Information obtained on subsample (to include those in dietary survey sample). Information to be simple and have relevance to potential cause of malnutrition.

2.7 Agricultural food production, processing, marketing and pricing

Specific questions for rural and urban areas to be surveyed.

2.8 Summary of nutrition assessment procedures

Method	Rating as per Simplicity and cost	Basic Value	Sample Size	Resources Required	Advantages	Constraints
Anthropometric Height \ Weight / For age	Rank No. 1	a. Identifies individual and/or group status b. Predicts % of Grade I, II and III malnutrition c. Predicts % of obesity and degree d. Enables construction of groups or country growth curve	a. Very adaptable b. May be restricted to vulnerable or special group study c. Regional or country wide sample d. Adaptable to monitoring via MCH or Health Centers	a. Simple measuring devices which should be employed at all Hospitals, MCH or Health Clinics b. Standardization of personnel and equipment is essential c. Central processing of data desired d. Non-professionals can be used	a. Good baseline of Health status b. Simple c. Cheap d. Useful on an individual or group basis e. Provides base for future evaluations	a. Does not define type or cause of malnutrition b. Provides no base for combating malnutrition
Physical	Rank No. 2	a. Identifies the clear cut severe types of malnutrition b. Provides a measure of assessing contributing factors other than malnutrition that may affect growth	a. Very adaptable b. May be restricted to vulnerable or special group study c. Regional or country wide sample d. Adaptable to monitoring via MCH or Health Centers	a. Medical personnel trained in clinical nutrition b. Standardization of physicians required	a. Ease and speed of assessment b. Can be compiled in 5 to 10 min.	a. Does not define subclinical malnutrition b. Identifies usually only the severe cases of malnutrition c. Many lesions are variable and thus reproducibility between physicians is low d. Subjective evaluation is difficult
Biochemical	Rank No. 3	a. Identifies the % of population at risk or severe risk of malnutrition as related to a specific nutrient Protein Vitamin Mineral b. Identifies the nutrient useful in evaluating toxicity due to excess tissue levels of various nutrients and other chemicals or minerals	a. Subsample of No. 1 or No. 2 b. Can be restricted for diagnostic purposes c. May be applied only to special groups i.e. urinary iodine/creatinine in adolescent girls for iodine nutritive or serum vitamin A for 1 to 5 year olds	a. Laboratory facilities and professional personnel b. Requires biological standards c. Requires the taking, preservation of samples in the field and transportation to base lab.	a. Diagnostic tool b. Reproduceable objective test c. Limited numbers of samples required d. Provides base for future evaluation e. Useful for individual or group basis f. Provides base for therapeutic or saturation evaluation tests	a. Requires laboratory facilities and trained professional personnel b. Requires facilities to preserve, store and ship samples c. Is not diagnostic by itself d. Requires further study and treatment for evaluation
Dietary	Rank No. 3	a. Identifies the general food pattern and nutrient intake at time of survey b. Enables estimate of nutrient adequacy of key nutrients. c. Identifies foods consumed and amount of each nutrient contributed d. Cost of each food e. Describes food preparation f. Identifies habits likes and dislikes	a. Subsample of No. 1 or No. 2 b. May be applied to vulnerable or special groups as in No. 3.	a. Professional nutritionists b. Trained interviewer c. Computer facilities d. Food composition data bank	a. Essential for providing data for prevention programs b. Provides data for developing food fortification c. Serves as guide for agriculture production priority	a. Time consuming b. Requires professional trained personnel c. Limited number of interviewers per day d. Considerable computer time required e. Provides data which reflects recent intake f. Does not account for seasoned food variation

CHAPTER III

Data Collection

1. Sampling Considerations

1.1 Screening - surveys

In some cases when a full scale nutrition survey is not possible, it is desirable to screen small communities in a given area or region in order to select locations for action programs on a reasonable priority basis. In this case, the group of children under 5 years of age can be used as an indicator of community nutritional problems. In this case, measures of height and weight, in combination with an abbreviated food consumption questionnaire and the determination of hemoglobin values could serve for an approximate evaluation of nutritional status and identification of community problems. For this purpose the following sample sizes are suggested:

Communities with	$\leq$ 800	inhabitants	all preschool children
Communities with	900-1200	"	65% of preschool children
Communities with	1200-1500	"	50% of preschool children
Communities with	1500-2000	"	40% of preschool children
Communities with	2000-3000	"	30% of preschool children
Communities with	3000-5000	"	20% of preschool children
Communities with	$\geq$ 5000	"	15% or less to insure sample of about 150 preschool children

The sample sizes given by this scheme will allow approximate estimates of the proportion of children within lower bound groupings of

weight for age; height for age; weight for height; and, hemoglobin deficits. The dietary inquiry should allow identification of gross calorie, protein or vitamin deficiencies as established from food groups consumption patterns.

The sample of preschool children to be studied should be randomly chosen from a complete roster of preschool children in the community. For large communities, when it is not possible to establish a roster for all children in the community, such roster could be established for randomly selected sectors and then sample from these rosters to composite a sample of approximately 150 children for study.

1.2 Probability sampling

The application of probability sampling techniques is essential to validate statistical inferences from the samples studied to the total population under consideration.

In this connection, it should be emphasized that the selection of samples for study should be made from well defined sampling frames and in accord with a true random selection procedure. When considering the resources available for determining preferred sample sizes, the cost of collection procedures and the cost of data processing for analysis should be taken into consideration.

In order to comply with the above stated stipulations, expert statistical advise should be obtained in the early planning stages of the survey. Likewise, and as soon as field procedures are defined, it

is advisable to obtain professional counsel to be able to establish a viable system for the processing of the information. To be able to do this, it is essential that the analytical procedure be defined before collecting any information. This procedure can be complemented later to make the basic analyses required more explicit and comprehensive in their scope.

2. Attributes of the data collected

The nutritional and allied information to be collected will, in general, relate to hierarchaly different population aggregates or units. The data which will be accessed to the information system will be tagged in such a way as to permit identification of its association with a definite population aggregate or unit. The general identification tag will include information that is applicable to the various populations considered, going from major aggregates (the general) to minor aggregates (the particular, the individual).

In this connection, all survey data that is accessed to the information system should be relevant to food, nutrition, and related problems; it should be viable in terms of feasibility and dependability (accuracy, repeatability, and sensitivity) and should satisfy a minimum of conditions to permit the establishment of a standard processing system. The use of the data contained in the information system will be restricted to official, national and international agencies through agreements which will establish the norms of a modus operandi for use of data contained in the operation system.

In general, the data included in the information system will contain:

a. Information collected from national publications and pertinent to the major aggregates of demography, vital statistics, and general socioeconomic indicators.

b. Pertinent information which defines sampling procedures and the methods of data collection used in the survey, including specific data identifying the techniques of quality control applied in each phase of the survey, with an indication of time and biological dependencies.

c. Specific information of various kinds collected in the survey and applicable to:

i. The community

ii. The family

iii. The individual

3. Data format guidelines

3.1 Preliminary considerations

In general, nutrition surveys are concerned with clinical, anthropometric, biochemical and dietary information. In most cases, and depending on specific interests, this basic information is complemented with ancillary studies, principally of diverse socioeconomic nature. In accord with this practice, and for indexing purposes, the data collected in nutrition studies should be considered as belonging in the following major categories:

00 General information

10 Clinical examination

20 Anthropometric measurements

30 Biochemical measurements

40 Dietary inquiries

50)
)
60)
)
70) Ancillary studies
(family structure, economic information, etc.)
)
80)
)
90)

Note that specialized studies under each of the principal headings can be incorporated with specific identification using the 10 decimal subclassess available for each principal heading, as for example the 01 designation given to the category of general information included in the leader card.

3.2 General information on the survey area, data type 00

The information collected from national publications will accompany the bulk of information from a given survey in tabular form. The procedure for accessing these data into the information system will be established at the center selected as custodian of the information system. The general data included should cover the following items, preferably for the same year of the survey:

a. Total population at midyear, by age* and sex.
b. Total number of live births.
c. Total number of deaths by age and sex.

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* The customary age groupings used in reporting deaths, including the subdivision of infant deaths into neonatal and postneonatal. Whenever possible, this information should be complemented with a yearly breakdown in the death counts up to the age of five years.

d. Deaths from diarrhea and infectious diseases, Codes 008 - 009.*
e. Deaths due to TBC, Codes 010-019.
f. Deaths due to measles, Code 055.
g. Deaths due to diabetes, Code 250.
h. Deaths due to avitaminosis, Codes 260-269.
i. Deaths due to protein malnutrition, Code 267.
j. Deaths due to marasmus, Code 268.
k. Deaths due to iron deficiency anemia, Code 280.
l. Deaths due to other nutritional anemias, Code 281.
m. Number of maternal deaths, Code 640-662 (Pregnancy and complications of pregnancy); code 678 (other complications).
n. Abbreviated list of 50 causes of death.
o. Number of deaths medically certified.
p. Morbidity due to avitaminosis and other deficiency diseases from hospital records (primary and associate diagnosis is available).
q. Number of discharges from hospitals by location age and sex - (cause?).
r. Possible links to other surveys.
s. Illiteracy rate.
t. Number of children in the first and second grade of school, to estimate dropout rate.
u. United Nations socioeconomic development index.**
v. Gross national product.
w. Per capita income.
x. Food consumption or food balance data.

Conceivably, in some circumstances, the information enumerated above could be collected at the national level and at the primary administrative division levels. When this is the case, the total information could be accompanied by meaningful partitions of the total - Administrative health regions within a country, for example.

3.3 Survey data collection formats

The specific information collected in the survey can be indexed and recorded in many different ways. In the pages that follow, some examples of data codes and data recording form structures that may be of help in the planning of survey activities are presented in some

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* Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death - International Classification of Diseases. WHO, Geneva, Switzerland. Volume 1, 1968, Revised 1965.

** Developed by the United Nations Research Institute for Social Development, Geneva, Switzerland, July 1970.

detail. To illustrate the degree of diversification in the construction of data record forms, some examples of tested protocols are given in the country nutrition survey reports of Central America and Panama.* The important feature to be noted in the examples to follow is the considerable flexibility in the choice of variables for study in the different categories covered in any given survey. This is made possible by the inclusion of a leader card in each set of detailed data cards which defines in every case the specific variables included in the record. It should be noted also that all sets of detailed data cards are properly linked to constitute a corrected integrated set of information.

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* 1. "Evaluación Nutricional de la Población de Centro América y Panamá - Guatemala". Instituto de Nutrición de Centro América y Panamá (INCAP); Oficina de Investigaciones Internacionales de los Institutos Nacionales de Salud (EEUU); Ministerio de Salud Pública y Asistencia Social; 1969. INCAP V-25.

2. "Evaluación Nutricional de la Población de Centro América y Panamá - El Salvador". Instituto de Nutrición de Centro América y Panamá (INCAP); Oficina de Investigaciones Internacionales de los Institutos Nacionales de Salud (EEUU); Ministerio de Salud Pública y Asistencia Social; 1969. INCAP V-26.

3. "Evaluación Nutricional de la Población de Centro América y Panamá - Nicaragua". Instituto de Nutrición de Centro América y Panamá (INCAP); Oficina de Investigaciones Internacionales de los Institutos Nacionales de Salud (EEUU); Ministerio de Salud Pública y Asistencia Social; 1969. INCAP V-27.

4. "Evaluación Nutricional de la Población de Centro América y Panamá - Costa Rica". Instituto de Nutrición de Centro América y Panamá (INCAP); Oficina de Investigaciones Internacionales de los Institutos Nacionales de Salud (EEUU); Ministerio de Salud Pública y Asistencia Social; 1969. INCAP V-28.

5. "Evaluación Nutricional de la Población de Centro América y Panamá - Honduras". Instituto de Nutrición de Centro América y Panamá (INCAP); Oficina de Investigaciones Internacionales de los Institutos Nacionales de Salud (EEUU); Ministerio de Salud Pública y Asistencia Social; 1969. INCAP V-29.

6. "Evaluación Nutricional de al Población de Centro América y Panamá - Panamá". Instituto de Nutrición de Centro América y Panamá (INCAP); Oficina de Investigaciones Internacionales de los Institutos Nacionales de Salud (EEUU); Ministerio de Salud Pública y Asistencia Social; 1969. INCAP V-30.

3.3.1 Tentative leader card format, data type 01

Item	Cols. in Field	Acc. Cols.
Country	2	2
1st. Administrative Division	2	4
2nd. Administrative Division	2	6
Locality	2	8
Type of Data	2	10
Date of Survey (day, month, year)	6	16
Urban-Rural Spectrum	1	17
Sampling Method	1	18
Sampling Unit	1	19
Sampling Rate	2	21
Recording Unit	1	22
Quality Control of Data	1	23
Source of Information	2	25
Number of Cards per Recording Unit	2	27
Total Number of Cards	4	31
Data Fields per Card	2	33
Variable-field Definitions	42	75*
Continuation Indicator	1	76*
Record Number	2	78
Card Number	2	80

Most of the items included in the leader card are self-explanatory, but a few may need clarification in terms of establishing the intended purpose for their inclusion. Also, the illustrations which follow are given as examples of general guidelines; in this context, the formats and/or the contents can be modified to satisfy the specific requirements of a particular survey.

The codes to be recorded in the first six columns of the leader card, corresponding to three items, specify the geographic location in hierarchical sequence. Next, a two digit code specifies the type of data (general, clinical, anthropometric, etc.) to be recorded.

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* Note that when more than 21 variables have to be defined in a card, the leader card may have as many continuation cards as needed to define all variables. Note that with this system, equal size fields should be the preferred way of recording the data for every variable defined.

The next five items included in the leader card, give information with regard to date of the survey, urban or rural spectrum of the location studied, and sampling procedures. In the latter case, appropriate codes can identify the sampling method and define the sampling unit, indicating also the relative size of the sample studied in terms of sampling rate.

The following three items in the leader card specify the recording unit (individual, family, household, village, etc.) and give pertinent information with regard to the quality and reliability of the data itself. For example, quality control procedures during the collection of the data could be specified as non-existent (Code 0), as occasional checks but with no records (Code 1), quality control applied only to equipment (Code 2), quality control procedures properly planned and executed at regular intervals - records available (Code 3), and so on for other conditions relevant to quality control.

The terminal seven items in the leader card define characteristics of the records as registered, identify the variables considered and give general linking indicators within the data class being recorded.

An important feature in the data system under consideration is the provision for specific identification of the variables measured (leader card cols. 42-75). Note that in some cases, as for example the case of anthropometric or biochemical data, the variables can be identified and localized in position within the recording sequence. On the other hand, in the case of clinical records, for example, the variables considered (clinical signs in this case) are identified by the codes recorded in cols. 42-75 in the leader card, but the items considered in this case need not be localized in position within the recording sequence, since

in this case it will be convenient for recording purposes to register only the appropriate identification codes for positive findings. The identification of items, however, is of fundamental importance in this case in order to a) establish the scope of the survey in terms of the clinical signs investigated, and b) to identify the clinical signs that were not encountered in the course of the survey.

3.3.2 Tentative format for detail cards containing data collected in the survey

Item	Cols. in Field	Acc. Cols.	
Link to leader card	10	10	Geography and type of data
Identification code	6	16	Family, individual, or serial number
Birth date	6	22	Day, month, year
Age	3	25	Code and amount
Sex and Physiological Status	1	26	Male, female, pregnancy and lactation states

After this information, the following general types of data are listed:

A. For Clinical Examination (data type 10) - 24 two-column fields available for recording codes of positive findings (see annex for code definitions), Column 75 free, available for recording additional linkings or categorical classification.

B. For Anthropometric Measurements (data type 20) - 12 four-column fields available for the direct recording of measurements (see annex for variable identification codes for leader card), Column 75 free for recording additional linkings or categorical classifications.

C. For Biochemical Measurements (data type 30) - 16 three-column fields available for the direct recording of results of laboratory examinations (Par. 3.6 - variable identification code for leader card), Column 75 free for recording additional linkings or categorical classification.

D. For dietary inquiries, (data type 40) - For the individual diet record each food recorded will require a 10 column field (five columns for food code and five columns for grams consumed), so that in this case 4 foods per card can be recorded, and as many continuation cards can be used to accomodate an individual's complete diet.

E. For additional studies, such as family structure, socioeconomic related data (data types 50, 60, etc.) - 49 columns available for recording data.

3.3.3 The specific information corresponding to any of the classes enumerated is followed by three connector indicators

Item	Cols. in Field	Accumulated Col. Headings
Continuation Indicator	1	76
Record Number	2	78
Card Number	2	80

The suggested formats given were structured for the recording of data collected on individuals. It should be noted, however, that the same structure can be used in collecting information for the family or the community. In the first case, the columns containing data pertinent to the individual identification, birth date, age and sex/physical status (cols. 15-26) can be used for data recording, making available a total of 61 columns for this purpose; the information in columns 1-10 and 76-80 are retained for linking purposes. In the case of community data there is a total of 65 columns available for data records since no case identification code (cols. 11-16) is needed.

Possible use of these materials are illustrated with an example for a leader card recording form and the recording form for selected anthropometric measurements. The recording forms appropriate for anthropometric data, presented in Figures 1 and 2, will be discussed in some detail. Note that forms for biochemical data will follow the same pattern. The clinical forms also allow a similar pattern, except in terms of the variable identification scheme in the leader card which does not specify position in the recording sequence. With this in mind, the sample clinical forms (Figure 3 and 4) should be self-explanatory. The leader card data form is divided in three sections. General data is recorded by writing the appropriate code for each item defined in the preprinted form in columns 1 to 33. All the items in this section are self-explanatory, although, as stated before, appropriate codes to define some of the items will have to be developed in accord with policies established by the custodian of the data bank. As an example, some

tentative likely numbers representing codes have been filled in. The next section in the leader card form is used to identify variables by writing in the proper two-digit codes which designate each of the measurements written in the item definition column; the only pre-printed material in this part of the form are the column definitions for the two digit fields which identify the variables to be entered by code and name. Since in this example only 10 variables are defined, the eleven terminal fields are left blank. The final section of the data form is reserved for definition of connectors to continuation cards (cols. 76-80). The continuation indicator is coded 0 to indicate there are no continuation cards; the record number 23 identifies a specific type of record within the anthropometry category. Note that the last item, card number, is used to identify sets of cards containing the same information uniformly coded. The use of the numbering scheme should become clear in the examples given.

The anthropometric data form corresponding to the leader card form just described is given in Figure 2. The first 10 columns of information for linking purposes need not be filled out for every case, but it is a good idea to fill in this data for sporadic uses at selected intervals for checking purposes. The remainder of data in this part of the form is self-explanatory, with the exception of the sex/physiological status definition; in this case, a 1 digit code can identify males and different conditions for females associated with pregnancy and/or lactation. The terminal link data is omitted in the form, since it can be duplicated at the time of punching from the leader card, except for the card number, which is recorded at the end of the

form for punching in cols. 79-80. Note that initial data cards will be identified by card number 02, since code 01 in the sequential numbering scheme is reserved for leader cards. Each continuation data card for a case will be identified by sequential card number assignment. Additional examples of leader and data forms are presented in Figures 3 and 4 for the case of clinical information. As stated before, these forms illustrate the use of continuation cards and the location for recording of data in the case of clinical examinations. Note that in this case the code 00 assigned to the item "number of cards per recording unit" is intended to indicate a variable number of cards per unit.

3.3.4 FIGURE 1

Sample form for recording leader card data for anthropometric investigation

(Example filled in for an anthropometry survey with 10 measurements included)

Col.	Code	Item	Col.	Code	Item
1-2	01	Country	42-43	09	Leg circumference
3-4	03	1st. Administrative Division	44-45	10	Biacromial diameter
5-6	10	2nd. Administrative Division	46-47	11	Bicrystal diameter
7-8	20	Locality	48-49	15	Tricipital skinfold
9-10	20	Type of data	50-51	16	Scapular skinfold
11-16	070172	Start of survey: day, month, year	52-53	17	Abdominal skinfold
17	2	Urban (1) Rural (2)	54-55	--	
18	3	Sampling method	56-57	--	
19	1	Sampling unit	58-59	--	
20-21	00	Sampling rate	60-61	--	
22	2	Recording unit	62-63	--	
23	1	Quality control of data	64-65	--	
24-25	01	Source of information	66-67	--	
26-27	01	No. of cards per recording unit	68-69	--	
28-31	0317	Total No. of data cards	70-71	--	
32-33	10	Data fields per card	72-73	--	
			74-75	--	
Variable Definitions			Connectors		
34-35	01	Weight	76	0	Continuation Indicator
36-37	02	Height	77-78	33	Record Number
38-39	05	Head Circumference	79-80	01	Card Number
40-41	08	Arm Circumference	Comments:		

Data recorded by John Doe Date 30 (day) 11 (month) 72 (year)

FIGURE 2

Sample form for recording anthropometry data

(Example for the 10 variables identified in the leader card)

I. G E N E R A L

Col.	Code	Item	Col.	Code	Item
1-2	01	Country	11-16	030230	Case identification
3-4	03	1st. Administrative Division	17-22	171248	Birth date: day, month, year
5-6	10	2nd. Administrative Division	23	3	Age indicator: 1 day, 2. months, 3. years
7-8	20	Locality	24-25	23	Age quantity
9-10	20	Type of data	26	3	Sex and physical status

II. A N T H R O P O M E T R I C D A T A

Col.	Code	Item	Col.	Code	Item
27-30	0523	Weight, kg(clothing corrected)	47-50	051 1	Biacromial diameter cm
31-34	1535	Height cm	51-54	061 3	Bicrystal diameter cm
35-38	0678	Head circumference cm	55-58	008 4	Tricipital skinfold mm
39-42	0254	Arm circumference cm	59-62	005 1	Scapular skinfold mm
43-46	0386	Leg circumference cm	63-66	010 2	Abdominal skinfold mm

Anthropometrist: John Smith

Date 30 (day) 11 (month) 72 (year)

Recorder: Ray Jones

Card number: 02

FIGURE 3 (Part 1)

Sample form for recording leader card data for clinical investigation

(Example for a clinical survey for 35 signs requiring leader card continuation)

Col.	Code	Item	Col.	Code	Item
1-2	01	Country	42-43	09	Small pox immunization
3-4	03	1st. Administrative Division	44-45	10	DPT immunization
5-6	10	2nd. Administrative Division	46-47	11	Polio immunization
7-8	20	Locality	48-49	12	Measles immunization
9-10	10	Type of data	50-51	13	1-2 hospitalizations in previous five years
11-16	010172	Start of survey: day, month, year	52-53	14	3-4 hospitalizations in previous five years
17	2	Urban (1) Rural (2)	54-55	15	5 or more hospitalizations in previous five years
18	3	Sampling method	56-57	17	Hair, Depigmentation
19	1	Sampling unit	58-59	18	Hair, easy pluckability
20-21	00	Sampling rate	60-61	22	Eye, Bitot's spots
22	2	Recording unit	62-63	31	Face, Pigmentation (malar)
23	0	Quality control of data	64-65	35	Lips, Cheilosis
24-25	01	Source of information	66-67	36	Spongy bleeding gums
26-27	00	No. of cards per recording unit	68-69	47	Tongue, atrophic papillae
28-31	0400	Total No. of data cards	70-71	48	Tongue; geographic
32-33	--	Data fields per card	72-73	52	Thyroid, enlargement I
			74-75	53	Thyroid, enlargement II
Variable Definitions			Connectors		
34-35	01	Fever, current	76	1	Continuation Indicator
36-37	03	Diarrhea, current	77-78	24	Record Number
38-39	05	U.R.I, current	79-80	01	Card Number
40-41	01	Other, current	Comments:		

Data recorded by T. N. Lee

Date 30 (day) 11 (month) 72 (year)

FIGURE 3 (Part 2)

Sample form for recording leader card data for clinical investigation

(Example for a clinical survey for 35 signs requiring leader card continuation)

Col.	Code	Item	Col.	Code	Item
1-2	01	Country	42-43	69	Pot belly
3-4	03	1st. Administrative Division	44-45	76	Bow legs
5-6	10	2nd. Administrative Division	46-47	84	Unilateral ankle edema
7-8	80	Locality	48-49	85	Bilateral ankle edema
9-10	10	Type of data	50-51	86	Generalized edema
11-16	010172	Start of survey: day, month, year	52-53	89	Marasmus
17	2	Urban (1) Rural (2)	54-55	90	Marasmic - Kwashiorkor
18	3	Sampling method	56-57	91	Kwashiorkor
19	1	Sampling unit	58-59	92	Undernutrition
20-21	00	Sampling rate	60-61	93	Overnutrition (obesity)
22	2	Recording unit	62-63	--	
23	0	Quality control of data	64-65	--	
24-25	01	Source of information	66-67	--	
26-27	00	No. of cards per recording unit	68-69	--	
28-31	0400	Total No. of data cards	70-71	--	
32-33	--	Data fields per card	72-73	--	
			74-75	--	

Variable Definitions			Connectors		
34-35	51	Thyroid, enlargement III	76	0	Continuation Indicator
36-37	56	Follicular hyperkeratosis (arm)	77-78	24	Record Number
38-39	60	Petechiae	79-80	02	Card Number
40-41	61	Pellagrous dermatitis (neck)	Comments:		

Data recorded by T. N. Lee

Date 30 (day) 11 (month) 72 (year)

FIGURE 4

Sample form for recording clinical findings

(Example for a clinical survey for 35 signs)

I. GENERAL

Col.	Code	Item	Col.	Code	Item
1-2	01	Country	11-16	030230	Case identification
3-4	03	1st. Administrative Division	17-22	111248	Birth date: day, month, year
5-6	10	2nd. Administrative Division	23	3	Age indicator: 1.days, 2.months, 3.years
7-8	20	Locality	24-25	23	Age quantity
910	10	Type of data	26	3	Sex and physical status

II. CLINICAL FINDINGS

(Identify positive findings by recording appropriate codes and sign names)

Col.	Code	Sign Name	Col.	Code	Sign Name
27-28	01	Fever, current	55-56	--	
29-30	03	Diarrhea, current	57-58	--	
31-32	13	1-2 hospitalized in last 5 years	59-60	--	
33-34	35	Cheilosis	61-62	--	
35-36	36	Spongy bleeding gums	63-64	--	
37-38	53	Thyroid enlargement II	65-66	--	
39-40	81	Unilateral ankle edema	67-68	--	
41-42	92	Undernutrition	69-70	--	
43-44	--		71-72	--	
45-46	--		73-75	---	
47-48	--		Connectors		
49-50	--		76	0	Continuation indicator
51-52	--		77-78	24	Record Number
53-54	--		79-80	02	Card Number

Examiner: M Davis

Recorder: T.N. Lee

Date 30 (day) 11 (month) 72 (year)

NOTE: Continuation required only when a case presents 25 or more positive findings. In this example there could be only one continuation card since the 35 signs considered can be accomodated in two cards. Continuation cards would be numbered as card 03

3.4 Tentative codes for clinical examination, data type 10

Medical History

Illnesses:

Fever, current	01
Fever, recurrent	02
Diarrhea, current	03
Diarrhea, recurrent	04
U.R.I., current	05
U.R.I., recurrent	06
Other, current	07
Other, recurrent	08

Immunizations:

Smallpox	09
DPT	10
Polio	11
Measles	12

Number of hospitatlizations in previous (5 years?):

1 - 2	13
3 - 4	14
5 or more	15

Clinical Signs

Hair:

Lack of luster	16
Depigmentation	17
Easy pluckability	18
Thinness and sparseness	19

Eyes:

Conjunctival xerosis	20
Conjunctival pallor	21
Bitot's spots	22
Conjunctival and scleral pigmentation	23
Corneal xerosis	24
Corneal vascularization	25
Corneal scar	26
Keratomalacia	27
Angular palpebritis	28

Face:

Naso-labial seborrhea	29
Other seborrhea	30
Pigmentation (malar)	31
Moon face	32

Lips:

Angular lesions	33
Angular scar	34
Cheilosis	35

Gums:

Spongy bleeding gums	36
Recession of gums	37

Teeth:

1-2 carious teeth	38
3-5 carious teeth	39
5 or more carious teeth	40
Fillings	41
Mottled enamel	42
Enamel hypoplasia	43

Tongue:		
	Edema	44
	Scarlet and raw tongue (glossitis)	45
	Magenta	46
	Atrophic papilae	47
	Geographic	48
Ears:		
	Discharging	49
Glands:		
	Unilateral parotid enlargement	50
	Bilateral parotid enlargement	51
	Thyroid enlargement I	52
	Thyroid enlargement II	53
	Thyroid enlargement III	54
Skin:		
	Dry or scaling (xerosis)	55
	Follicular hyperkeratosis in arms	56
	Follicular hyperkeratosis in back	57
	Follicular hyperkeratosis in chest	58
	Follicular hyperkeratosis in thighs	59
	Petechiae	60
	Pellagrous dermatitis of the neck	61
	Pellagrous dermatitis of the hands	62
	Pellagrous dermatitis (other)	63
	Flaky point dermatitis	64
	Loss of elasticity	65
Nails:		
	Koilonychia	66
Abdomen:		
	Hepatomegaly	67
	Splenomegaly	68
	Pot belly	69

Muscular and skeletal systems:

Muscle wasting	70
Craniotabes	71
Frontal and parietal bossing	72
Epiphyseal enlargement (tender or painless)	73
Costochondrial beading	74
Persistently open anterior fontanelle	75
Bow legs	76
Harrison's sulcus	77
Pigeon chest	78

Nervous system:

Sensory loss	79
Motor weakness	80
Loss of position sense	81
Loss of ankle jerk	82
Calf tenderness	83

Edema:

Unilateral ankle edema	84
Bilateral ankle edema	85
Generalized edema	86

Clinical impressions:

Apathy	87
Irritability	88
Marasmus	89
Marasmic-kwashiorkor	90
Kwashiorkor	91
Undernutrition	92
Overnutrition (obesity)	93

Codes 94 to 00 available for naming special conditions to be investigated.

3.5 Variable identification codes for anthropometric measurements, data type 20

Figures in parenthesis preceeding the variable name indicate priority ratings for preferred measurements

Variable Code	Variable Name	Units	Recording
01	(1) Weight	kg	xxx.x
02	(1) Height	cm	xxx.x
03	Sitting height	cm	bxx.x
04	Leg length	cm	bxx.x
05	(2) Head circumference	cm	bxx.x
06	Chest circumference	cm	bxx.x
07	Abdominal circumference	cm	bxx.x
08	(2) Arm circumference	cm	bxx.x
09	Leg circumference	cm	bxx.x
10	Biacromial diameter	cm	bxx.x
11	Bicrystal diameter	cm	bxx.x
12	Biepicondylar diameter	cm	bbx.x
13	Bistyloid diameter	cm	bxx.x
14	Bicondylar diameter	cm	bxx.x
15	(2) Tricipital skinfold	mm	bxx.x
16	Scapular skinfold	mm	bxx.x
17	Abdominal skinfold	mm	xxx.x

3.6 Variable identification codes for biochemical determinations, data type 30

Figures in parenthesis preceeding the variable indicate priority ratings for preferred measurements, usually on a subsample of the population studied

	Variable Code	Variable Name	Units	Recording
Whole Blood				
	01	(1) Hemoglobin	(gm/100 ml)	xx.x
	02	(1) Hematocrit	(%)	bxx
	03	R.B.C. count	(millions)	x.xx
	04	Riboflavin	(mcg/100 ml)	xx.x
	05	(2) Folate	(ng/ml)	xxx
Serum				
	06	Total proteins	(gm/100 ml)	x.xx
	07	(2) Albumin	(gm/100 ml)	x.xx
	08	Alpha-1-globulin	(gm/100 ml)	x.xx
	09	Alpha-2-globulin	(gm/100 ml)	x.xx
	10	Beta globulin	(gm/100 ml)	x.xx
	11	Gamma globulin	(gm/100 ml)	x.xx
	12	(2) Vitamin A	(mcg/100 ml)	xxx
	13	Carotene	(mcg/100 ml)	xxx
	14	(3) Vitamin C	(mg/100 ml)	x.xx
	15	Riboflavin	(mcg/100 ml)	xx.x
	16	(2) Folate	(ng/ml)	xx.x
	17	(3) Vitamin B_{12}	(pg/ml)	xxx
	18	(2) Iron	(mcg/100 ml)	xxx
	19	(2) Iron binding capacity	(mcg/100 ml)	xxx
	20	Cholesterol	(mg/100 ml)	xxx
Urine	21	(2) or (3) Creatinine	(mg/100 ml)	xx.x
	22	(3) Riboflavin	(mcg/100 ml)	xxx
	23	(3) Thiamine	(mcg/100 ml)	xxx

Variable Code	Variable Name	Units	Recording
24	(4) N-methyl nicotinamide	(mg/100 ml)	xx.x
25	(2) or (3) Iodine	(mcg/100 ml)	xxx
26	(5) Urea nitrogen	(gm/100 ml)	xx.x
27	(5) Hydroxyproline	(mg/100 ml)	xx.x
Derived Values:			
28	Mean corpuscular volume (MCV)	U^3	xx.x
29	Mean corpuscular hemoglobin (MCH)	ng	xx.x
30	Mean corpuscular hemoglobin concentration (MCHC)	%	xxx
31	Transferrin saturation Index	%	xx.x
32	RBC riboflavin	(mcg/100 ml)	xx.x
33	RBC folates	(ng/ml)	xxx
34	Total globulin	(gm/100 ml)	x.xx
35	A/G ratio (albumin/ globulin ratio)		x.xx
36	Urinary riboflavin mcg/gm creatinine		xxx
37	Urinary thiamine mcg/gm creatinine		xxx
38	Urinary N-methyl nicotinamide mg/gm creatinine		xx.x
39	Urinary iodine mcg/gm creatinine		xxxx
40	Urinary hydroxyproline mcg/gm creatinine		xx.x

CHAPTER IV

Guidelines for interpretation of survey data

4.1 Introduction

The primary purpose of these guides is to permit within the limits of knowledge and methods a realistic interpretation of the data collected during a nutrition survey in terms of characterizing the nutritional status of population groups. In a nutrition survey one is concerned with assessment of nutritional status of population groups, identification of nutrition problems, their variation, severity and with those factors which influence nutrition health and the opportunities for betterment.

The spectrum of nutritional health state extends between two theoretical limits: that of optimal nutrition, when the metabolic needs are amply satisfied and that of extreme deficiency which results in severe metabolic-physiologic alteration interfering with life processes. In between there is a continuous approach of either extreme. On the elaboration of the Guides for interpretation of data which define the two extremes (optimum health and ill health to death), several criteria are employed to assist in describing and identifying that portion of the population that is at a "severe risk" or at a "deficient or near deficient state", and likewise that portion of the population that are candidates for moving into this "deficient or severe risk" state if tissue nutrient levels deteriorate. These are classified as at "risk".

4.2 Limitation of individual methods of appraisal

4.2.1 Anthropometric assessment

Anthropometric data is extremely useful in characterizing the general health status of individuals or of population groups. The direction and magnitude of resulting changes in child growth and adult physique are beyond doubt the simplest index for appraising nutrition status. From a Public Health point of view, the important issue is the definition of the size of the population at nutritional risk and an estimate of the severity of risk. Anthropometric measurements of height and weight are in general sensitive measures of health status of preschool children. One must keep in mind that growth retardation - height and/or weight - may and often is due to a combination of factors such as infectious disease, inborn errors as well as due to malnutrition

Weight for age or weight for height is a measure or index of current nutritional status. The well-known Gómez classification of malnutrition (PCM) in preschool children which is based on weight for age enables one to classify the retardation according to the degree (severity) of malnutrition

Linear growth is a measure of the deviation from growth over an extended period of time reflecting the past history of malnutrition or ill health.

In order to identify the prevalence and severity of malnutrition or growth retardation, the measurements must be compared for interpretation to a so-called "reference population or standard". For preschool children the so-called "Harvard standards"* have been widely used throughout the world. (Jelliffe 1966).**

It must be remembered that although anthropometric data is extremely valuable in characterizing the general health and nutrition status, this data does not identify the type or cause of malnutrition.

Note: Standards for interpretation to be inserted at a later date based on the collaborative anthropometric study for Latin American.***

4.2.2 Physical - medical examination

Physical examinations and anthropometric measurements can usually be extended to cover much larger population groups that can be included in biochemical and dietary appraisal. Physical "indicator lesions" of nutritional deficiencies may come and go unpredictably in mild deficiency states. Few, if any of the physical signs of suboptimal nutrition in mild forms, are specifically diagnostic. Other factors or vectors in the environment may result in similar alterations; the concomitant

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* References: Stuart, H.C., and Stevenson, S.S. (1959), "Textbook of Pediatrics". Ed. W.E. Nelson, 7th Edition, Saunders, Philadelphia.

** "The Assessment of Nutritional Status of the Community", D.B. Jelliffe, WHO, 1966.

*** "Manual of Internationally Comparable Growth Studies in Latin America and the Caribbean." Draft - October 1972, PAHO, Washington, D.C.

presence of several deficiency states may obscure the appearance of clear cut clinical signs. Those characteristics which are dependent upon slight deviation from normal, in cases of suboptimal nutrition, are invariable susceptible to pronounced differences in classification and recording among physicians.

Experience demonstrates that there is less likelihood of divergence of opinion by examiners, for those lesions characteristic of frank overt deficiency disease. In spite of these limitations, the prevalence and severity of physical indicator signs of malnutrition in population groups have value in nutritional assessment, especially when considered collectively with dietary, biochemical and anthropometric data.

4.2.3 Dietary intake studies (see Table 5)

Dietary studies constitute an essential part of any complete nutrition survey. Populations which for extensive periods have subsisted on dietary intakes which are marginal in protective nutrients may fail to reveal any recognized specific nutritional deficiency lesions; however, they may be at "risk" of developing overt malnutrition if subjected to further stress. It must be appreciated that dietary data represent only the situation at a given limited time. Seasonal foods and other variations of dietary intake may often significantly alter nutritional status. Likewise, it must be appreciated that dietary data represent only the situation at a given limited time. Seasonal foods and other variations of dietary intake may often significantly alter nutritional status. Likewise, it must be

appreciated that in convernting food intake into nutrients, the accuracy of nutrient intake is dependent upon the individual nutrient values for the specific food that is given in the current food composition table. In no case should dietary nutrient intake be used by itself, to define nutritional deficiency states in a population. Likewise, it must be appreciated that current food composition tables contain approximate (mean) nutrient values for relatively few foods and few nutrients - Vitamin A, Vitamin C, thiamin, riboflavin, niacin, iron, calcium and crude protein, fat, and carbohydrate levels. Recently, limited aminoacid composition data have become available.

4.2.4 Biochemical assessment (Tables 1 through 4)

A definite sequence of events leads eventually to clinical nutrition deficiency diseases. During the gradual development of a deficiency disease, there first occurs depletion of the body nutrient stores. This is usually accompanied by changes in the nutrient composition of blood and other tissues and/or reduced urinary excretion of the nutrient and/or its metabolites. As restricted nutrient intake or utilization is continued and the state of deficiency progresses, functional impairment occurs, and finally the anatomical lesions characteristic of the clinically manifest deficiency disease appear.

Biochemical assessment (for the specific nutrient analyzed) permits an estimation of the prevalence of those subjects that are in a "risk" category with an estimate as to how severe or how mild they are. Furthermore, it indicates in general terms the percentage of the population that has tissue levels along the scale from deficient ("extreme risk") to acceptable or adequate levels.

The guidelines for interpretation of the biochemical data have regarded "adequacy" or "acceptable levels" as that level above which objective evidence of health improvement does not occur. Likewise, those levels designated as "severe risk" or "deficient" are those levels which may be expected to be associated with definite, although not necessarily severe, physical-physiological impairment due to insufficiency of a nutrient in a measurable proportion of individuals. In these conditions, histological and physiological alterations are clearly evident in a majority of the subjects.

Values intermediate between "acceptable" and "extreme risk" in general are considered indicative of undesirable situations at "potential risk". Subjects in this range can usually be changed from a doubtful

status by increasing the nutrient supply. The closer the values are to the "extreme risk", the greater the risk.

It is recognized that there are often substantial quantitative differences in nutritional requirements of individuals. These differences, combined with the errors of sampling and of the laboratory determinations and the substantial differences among physicians in the appraisal of various physical abnormalities may be expected to prevent a high correlation between the dietary, biochemical, and clinical evaluation of individuals. These guidelines are not intended to be diagnostic of an individual. For those individuals designated in the extreme risk group, additional follow-up work, such as therapeutic trials, saturation tests, and the use of additional, more specific diagnostic tests is imperative.

The guidelines for interpretation of the biochemical findings are fundamentally those developed by the ICNND* and expanded by the surveys of Central America and Panama by INCAP.** The specific biochemical methods and procedures for blood and urine sampling, processing, storage, shipment and laboratory control for reproducibility are given those specified by the above workers.

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* "Manual for Nutrition Surveys" - 2nd. Edition 1963, ICNND. National Institutes of Health, Bethesda, Md., US Government Printing Office.

** "Nutritional Evaluation of the Populations of Central American and Panama" (1965-1967). Regional Summary, 1971, INCAP and ICNND.

TABLE I

GUIDES FOR INTERPRETATION OF BLOOD DATA

		Extreme Risk	Low Risk	Probably Normal
Total Plasma Protein: gms. per 100 ml	(1)	<6.00	6.00 - 6.49	6.50 +
Serum Albumin (Electrophometric Method) gms/100 ml	(1)	<2.80	2.80 - 3.49	3.50 +
Serum Globulin (per cent of serum protein):				
Alpha 1	(1)			4-7
Alpha 2				9-11
Beta				11-15
Gamma				12-16
Plasma Ascorbic Acid: mg/100 ml	(1)	<0.10	0.10 - 0.19	0.20 +
Plasma Vitamin A: mcg/100 ml	(1)	<10	10- 19	20 +
Plasma Carotene: mcg/100 ml	(1)	-	20- 39	40 +
Serum Folacin: ng/ml	(2)(3)	<3.0	3.0 - 5.9	6.0 +
Serum Vitamin B_{12}: pg/ml	(2)(3)	<100	100 - 149	150 +
Red Blood Cell Folacin: ng/ml	(2)(3)	<140	140 - 159	160 +
Red Blood Cell Riboflavin: mcg/100 ml Rbc	(1)	<10	10.0 - 14.9	15.0 +
Transferrin Saturation Index, Percent	(1)(3)	<15	15.0 - 19.9	20.0 +

(1) Manual for Nutrition Surveys, 2nd. Edition, Interdepartamental Committee on Nutrition for National Defense, 1963.

(2) R. M. O. Neal et al, "Guideline for Classification and Interpretation of Group Blood and Urine Data Collected as Part of the National Nutrition Survey." Ped. Res. 4: 103-106,1970.

(3) As used in the Central America and Panama Surveys by INCAP. "Evaluación Nutricional de la Población."

TABLE II

GUIDES FOR INTERPRETATION OF HEMATOLOGY DATA

0-750 Meters Altitude

Age - Years	Sex	Hemoglobin gms %			Hematocrit %			Serum Iron mcg/100 ml	
		(1) Extreme Risk	(1) Low Risk	WHO (2) Anemia	(1) Extreme Risk	(1) Low Risk	WHO (2) Anemia	Extreme Risk	Low Risk
1 - 4		11.3	11.8	11	32.6	34.3	33	< 30	< 50
5 - 8		10.9	11.5	12	33.0	34.6	36		
9 - 12		11.8	12.3		35.3	36.6		< 30	< 50
13 - 16	M	12.4	12.9	13	36.9	38.2	39	< 30	< 60
	F	12.7	13.0	12	38.0	39.0	36	< 30	< 60
17 - 20	M	13.4	13.8		40.8	41.9		< 30	< 60
	F	12.9	13.4		38.5	39.6		< 30	< 60
21 - 49	M	13.3	14.0		40.2	42.1		< 30	< 60
	F	11.8	12.4		35.2	36.9		< 30	< 60
50	M	12.2	13.0	13	35.0	37.7	39	< 30	< 50
	F	12.1	12.7	12	36.5	38.2	36	< 30	< 50
Pregnant 1st. half				11			33	< 30	< 60
Pregnant 2nd. half				11			33	< 45	< 60
Lactation								< 30	< 60

(1) Viteri, F.E., de Tuna, V., and Guzman, M.A. (1972)
Normal Hematological values in the Central American population, British Journal of Hematology 23,189.
(2) WHO, Technical Report Series No.405, Nutritional Anemias, Geneva 1968.

TABLE III

GUIDES FOR INTERPRETATION OF BLOOD DATA IN PREGNANT FEMALES

	First Half Gestation			Second Half Gestation		
	"Extreme Risk"	"Low Risk"	Probably Normal	"Extreme Risk"	"Low Risk"	Probably Normal
Hemoglobin gm/100 ml	< 9.5	9.5 - 10.9	11.0 +	< 9.0	9.0 - 10.4	10.5 +
Hematocrit %	< 30	30 - 34	35 +	< 30	30 - 32	33 +
Serum protein gm/100 ml	< 5.5	5.5 - 5.9	6.0 +	Same as first half		
Serum albumin gm/100 ml	< 3.0	3.0 - 3.9	4.0 +	< 3.0	3.0 - 3.4	3.5 +

TABLE IV

GUIDES FOR INTERPRETATION OF URINARY DATA *

	Severe Risk	Low Risk	Probably Normal
Thiamine: mcg per gm. creatinine			
1 - 3 years	<120	120 - 175	176 +
4 - 6 "	<85	85 - 120	121 +
7 - 9 "	<70	70 - 180	181 +
10 - 12 "	<60	60 - 180	181 +
13 - 15 "	<50	50 - 150	151 +
16 +	<27	27 - 65	66 +
Pregnant 1st half	<23	23 - 54	55 +
Pregnant 2nd half	<21	21 - 49	50 +
Riboflavin: mcg per gm creatinine			
1 - 3 years	<150	150 - 499	500 +
4 - 6 "	<100	100 - 299	300 +
7 - 9 "	< 85	85 - 269	270 +
10 - 15 "	<70	70 - 199	200 +
16 +	<27	27 - 79	80 +
Pregnant 1st half	<39	39 - 119	120 +
Pregnant 2nd half	<30	30 - 89	90 +
N - Methylnicotinamide: mg/gm creatinine	<0.50	0.50- 1.59	1.60 +
Pregnant 1st half	<0.60	0.60- 1.99	2.00 +
Pregnant 2nd half	<0.80	0.80- 2.49	2.50 +
Iodine, mcg./gm. of creatinine	25	25 - 49	50 +

* Manual for Nutrition Surveys. 2nd. Edition, ICNND - 1963. U.S. Government Printing Office, Washington, D.C.

TABLE V

GUIDELINES FOR EVALUATION OF NUTRIENT INTAKE

(Part 1)

Age yrs.	Sex (2)	Body Weight (1) Kg.	Calories K.Cal.per day	Calories K.Cal. per Kg. per Day	Protein (1) Gms. per Kg. Body Weight	Protein Save Levels Total Grams per Person per Day (Different Protein Scores 100 (3)	80 (3)	70 (3)	60 (3)	Calcium (4) mg.
1/2-1		9.0	1,000	112	1.53	14	17	20	23	550
1-3		13.4	1,360	101	1.19	16	20	23	27	450
4-6		20.0	1,830	91	1.01	20	26	29	34	450
7-9		28.1	2,190	78	0.88	25	31	35	41	450
10-12		37.4	2,470	66	0.84	30	37	42	49	650
13-15	M	51.3	2,900	57	0.72	37	46	53	62	650
16-18	M	62.9	3,070	49	0.60	38	47	54	63	550
Adult	M	65.0	3,000	46	0.57	37	46	53	62	450
13-15	F	49.9	2,490	50	0.63	31	39	45	52	650
16-18	F	54.4	2,310	43	0.55	30	37	43	50	550
Adult	F	55.0	2,200	40	0.52	29	36	41	48	450
Pregnancy			+ 350			+ 9	+ 11	+ 13	+ 15	1,100
Lactation			+ 550			+ 17	+ 21	+ 24	+ 28	1,100

TABLE V

GUIDELINES FOR EVALUATION OF NUTRIENT INTAKE

(Part 2)

Age yrs.	Sex (2)	Iron - mg. % Animal Food (5) 10	10-25	25	Vitamin A (6) mcg.Retinol	Vitamin D (5) mcg.	Vitamin C (5) mg.	Vitamin B_{12} (5) mcg.	Folate (5) mcg.	Thiamin (6) mg.	Riboflavin (6) mg.	Niacin Equivalent (6) mg.
1/2-1		10	7	5	300	10	20	0.3	60	0.4 mg. per 1,000 calories	0.6 mg. per 1,000 calories	6.6 mg. per 1,000 calories
1-3					300	10	"	0.9	100			
4-6			"		300	10	"	1.5	100			
7-9			"		400	2.5	"	1.5	100			
10-12					600	"		2.0	100			
13-15	M	18	12	9	750	"	30	"	200			
16-18	M	18	12	9	750	"	30	"	"			
Adult	M	9	6	5	750	"	30	"	"			
13-15	F	24	16	12	750	"	30	"	"			
16-18	F	24 (7)	16 (7)	12 (7)	750	"	30	"	"			
Adult	F	28	19	14	750	"	30	"	"			
Pregnancy		30	20	15		10	50	3.0	400			
Lactation		24	16	12		10	50	2.5	300			

GUIDELINES FOR EVALUATION OF NUTRIENT INTAKE

(Part 3)

R E F E R E N C E S

(1) Adopted after WHO/FAO Report Ad-hoc Expert Committee on "Energy and Protein Requirements", Rome, 22 March / 2 April, 1971.

(2) M: male - F: female.

(3) Scores are estimates of protein quality relative to egg milk protein taken as 100. Corrected protein requirements for 80-70-60 score may over-estimate safe level needs for both adult males and females.

(4) Calcium - adapted from INCAP (Institute of Nutrition for Central America and Panama) "Regional Summary - Nutritional Evaluation of the Population of Central America and Panama", 1971.

(5) Report of a joint FAO/WHO Expert Group - FAO Report No. 47, 1970 - "Requirements of Ascorbic Acid, Vitamin D, Vitamin B_{12}, Folate and Iron - (Adjustments made for age groups).

(6) Report of joint FAO/WHO Expert Group - FAO Report No. 41, 1961 - "Requirements of Vitamin A, Thiamine, Riboflavine and Niacin".

(7) Iron requirement for a menstruating female.

CHAPTER V

List of Tables for Data Analysis

1. Age, sex, distribution of the population group being surveyed
2. Age-specific death rate for preschool-age children

   1-6 months
   7-12 months
   1-2 years
   2-3 years
   3-4 years
   4-5 years
   5-12 years
3. Mean length (cm) by age and sex:

   Mean, per cent of a standard for each age
4. Mean weight (kg) by age and sex:

   Per cent of the standard for each age and sex
5. Mean arm circumference (cm) by age and sex

   Per cent of the standard for each age and sex
6. Mean triceps skinfold (mm) by age and sex

   Per cent of the standard for each age and sex

   (Plot individually on percentile graphs)
7. Mean arm circumferences (cm) by age and sex

   Per cent of the standard for each age and sex

   Calculate muscle circumference = arm circumference (cm) - triceps (cm)
8. Mean weight x length by age
9. Percentage of children falling in 10%, fractions of standard values, mean percentages of standard values, and ranges in % of standard values.

Standard value	Weight	Height	H.C. (1)	T.S. (2)	S.S. (3)
Over 100%					
100-90					
90-80					
80-70					
60					
Mean %					
Range in %					

10. Proportion of children in each age group according to their present variation:

    Weight for age standard
    Weight for length standard
    Length for age standard
    Arm circumference for age standard

11. Proportion of children with chest smaller than head by age:

    _____% with chest below head cir.; _____% with chest over head cir.

12. Mean Hb (gm%) by age and sex

    _____% of standard _____% below standard by age

13. Prevalence of parasites in the stool by type and age

    _____% positive (specify type)

14. Packed cell volume: PCV % by age

    Per cent of standard for each age group

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(1) Head circumference
(2) Triceps skinfold
(3) Subscapular skinfold

15. Proportion of persons in each age group according to their per cent variation from specified weight and height standard and standard arm circumference for age
16. Prevalence of menstruation by age
17. Mean age at first pregnancy
18. Mean age at marriage
19. Interpregnancy interval
20. Prevalence of dental caries and gingivities by age
21. Prevalence of thyroid enlargement by age and sex
    - Grade I; II; III (WHO classification)
    - Per cent in each grade of enlargement
22. Incidence of clinical signs by age and sex
23. PCM relationship to mean hemoglobin
24. PCM relationship to mean birth rank
25. PCM relationship to mean interpregnancy interval
26. PCM relationship to stool parasites
27. PCM related to father's occupation/income/schooling/mother's schooling/age/child guardian/to the time lived in an area/to father's or mother's marital status
28. Prevalence of PCM by age and sex (WHO classification)
29. Children with grade III PCM (WT 60% standard) (WHO classification) by age and sex
30. Parotid enlargement by age
    - per cent of parotid enlarged
    - per cent of parotid not enlarged
31. Mean MCH; MCHC by age and sex
    - per cent below standard

32. Distribution of women by details of children:

-Live birth alive under 5 _____ alive over 5 _____

died under 5 _____ died over 5 _____

33. Distribution of mothers by nutritional status and children born alive and died below 5 years

34. Distribution of individual HB, PCV and other biochemical tests in relation to specified standards.

CHAPTER VI

Topics for Research

1. Evaluation of methods for estimating food intake on the basis of unit cost and accuracy.
2. Evaluation of different methodologies comparing results obtained using different sampling units (household, family, individual, mealtime, etc.).
3. Development of indices which measure different aspects of nutritional status. For example, expressing selected results on a 1,000 calorie basis, or on basis of calorie unit cost.
4. Exploration of procedures which would allow the determination of risk factors in association with levels used as reference guidelines.
5. Search for indicators of functional and mental development.
6. Indicators of sudden deterioration in nutritional status. Development of early warning systems.
7. Development of models which would permit the estimation of the cost-effect relations in different action programs.
8. Development of models for evaluating the effect of changes in the offer-demand structure for selected foods with provision for estimating elasticity patterns.
9. Explorations in the usefulness of systems analyses (linear programming), factor analysis, multivariate analysis, etc.
10. Application of simultation techniques.
11. Development of simple and feasible indices for nutritional surveillance.
12. Development of simple indicators of socioeconomic status.
13. Evaluation of economic value of a food supplement in terms of

changes in the structure of purchasing power. What does the supplement substitute economically and nutritionally?

14. Age-independent indicators of nutritional status.

15. Effect of family structure and population dynamics on nutritional status and vice versa.

CHAPTER VII

Recommendations

In general, nutrition surveys require substantial investments in terms of money, personnel, and time. In the past, however, the information collected locally was not analyzed extensively and exhaustively. Furthermore, after partial descriptive analyses are completed, the basic information collected is not systematically integrated with similar information available from other sources, to permit diagnosis and quantification of nutritional problems on a broader basis.

Numerous problems associated with the quality of the data and lack of adequate facilities for data processing generally contribute to establishing the conditions of limited use of the information collected. At present, there are facilities and instruments which under proper technological considerations could bring to nutrition surveys the benefits that can be derived from the sensible use of electronic data processing systems.

The considerations enumerated indicate that there is a need for establishing a facility which can operate and serve as a basic general-purpose information system for nutrition and related disciplines.

In order to be able to do this, the group recommended:

1. That nutrition research take advantage of the opportunities available in using automated computer systems for the processing of data collected in the course of extensive surveys.

2. That the data collected in recent coordinated nutrition surveys (INCAP, CFNI, U.S. National, etc.) be used in exploring the feasibility of methods for the uniform handling, proper indexing, storage, and retrieval of the information commonly used in the evaluation of nutritional problems.
3. That once the feasibility of methods is determined, proper locations be designated to implement procedures conducive to the establishment of a nutrition information system.
4. Recognizing that computer operations can be inefficient because of either inadequate facilities or suboptimal utilization of facilities, site visits (by qualified experts) should be made to likely locations prior to designating the center(s) that will take charge of implementing the information system.
5. That the data contained in the nutrition information system be edited for internal consistency and validity and then be continuously used in the search for more sensitive indicators of nutritional status.
6. That, in the search for indicators of nutritional status, priority be given in identifying those useful for continuous surveillance and, in particular, to those which as a group could serve as a basis for establishing an early warning system in forecasting possible nutritional problems.
7. That particular attention be given to the integration of the nutrition information system with similar systems that

may exist for agriculture, education, and production. This would make possible a better integration and coordination of efforts, since real advances in nutrition are commonly dependent on factors belonging to these three related areas.