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Annual Report of the Nutrition Evaluation Project for Panama

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Annual Report of the Nutrition Evaluation Project for Panama

I. INTRODUCTION

This document is intended to serve as an annual report and assessment of progress to date on the Nutrition Evaluation Project in Panama. The material should be considered a working draft and comments are welcome regarding any improvements, particularly with respect to improvement of any of the evaluation methods and/or the economic models presented in the report.

This introductory section will discuss the issues and objectives of the Nutrition Evaluation Project and will provide an overview of nutrition conditions in Panama. Subsequent sections of the report will discuss measurement issues encountered in nutrition assessment and will provide recommendations regarding measurements best suited for developing countries. Also discussed are several quasi-experimental evaluation research methodologies. Most of the evaluation techniques will be tested for their effectiveness in discerning nutritional differences among and between district level populations within Panama. The data for this and other studies conducted as part of the project will be taken primarily from the Panama National Nutritional Status Survey of 1980.

In addition to assessing the effectiveness of alternative evaluation methods, the report discusses several aspects of microeconomic models and focuses specifically on applications of new consumer theory to family nutrition and health care utilization patterns. The proposed application of these models is also discussed.

This section is followed by an explanation of the National Nutritional Status Survey and the Research Triangle Institute's activities in preparation and execution of the survey. The usefulness of the survey data in terms of data needs for evaluation is also presented. This section also discusses RTI's site visit activities and objectives while in Panama.

Finally, some preliminary findings based on the survey data are presented. These findings represent only a small sample of the analyses still to be performed on the data, and they are based on unweighted data which limits the national level inferential power of these initial analyses.

A. Project Issues and Objectives

In January 1980 a meeting was held in Panama between the staff of the Ministry of Health and Drs. Jose Obdulio Mora, David L. Franklin, and Stuart Blumenfeld to begin planning the design and implementation of the Nutrition Evaluation Project. At that time it was agreed that the project would be effected jointly between the Research Triangle Institute (RTI) and the Ministry of Health according to the following basic points:

1. The planning, implementation, analysis and publication of results would be developed in a close joint venture between the Ministry of Health (MOH) and RTI.
2. The project will consist of the design, testing and validation of an evaluation methodology--simple, efficient and inexpensive--of the impact of nutrition programs, allowing for short-run application in developing countries, especially in Latin America.
3. Both institutions will be responsible for the project planning, including the design and formulation of evaluation methodology; the elaboration of specific work plans; and the analysis and utilization of the results. The execution of the project operations will be the responsibility of the MOH with the advice and assistance of RTI.
4. The evaluation model will be designed, based on the programs of the Government of Panama, with the implicit and/or explicit objective of improving the nutritional status of the population, especially but not exclusively, through the health sector.
5. A basic project characteristic will be the incorporation of the evaluation methodology as an integral part of the regular public sector information systems.
6. The MOH will put its infrastructure at the disposition of the project, especially that of the General Office of Health, the Office of Nutrition, and the Department of Statistics and Computations, assigning a staff member full-time to the field coordination and supervision.
7. RTI, as project co-participant, will provide the necessary technical assistance and has agreed that, if in the implementation of the project there arises a need for marginal funding in order to assure the smooth running of the project and to keep from placing an extra heavy burden on the MOH budget, they will endeavor to procure special one-time funds to cover these marginal costs.

B. Nutrition and Health Conditions in Panama

A comparative analysis of health indicators and of the standard of living in several countries of Latin America will reveal that Panama has attained a relatively high stage of development. In effect, with a population of less than 2 million, 55 percent of whom live in urban areas, Panama has a national level life expectancy of 70 years, a general mortality rate of 4.4 per 1000 (1977), infant mortality of 28.1 per 1000 (1977), and a preschool mortality rate of 1.4 per 1000 (1977). The birth rate is the lowest in the region (28.5 per 1000 in 1977) and the population growth rate is only 2.4 percent per annum [Parillon, 1979]. In addition, the country provides a relatively high degree of coverage of health care services and fairly extensive provision of portable water and sanitation services.

In regards to nutritional status of its population, statistical data over the last fifteen years indicates that Panama is also relatively well off. For example, the country has a daily per capita consumption of calories in excess of 2500 and 60 grams of protein. These figures reflect national averages, however, and an uneven distribution of food has resulted in some portions of the population receiving significantly less than the national average. Reutlinger and Alderman in a recent study by the World Bank estimate that the income distribution in Panama is such that nearly 50 percent of the population could be suffering from a daily deficit of 300 calories per person [Reutlinger and Alderman, 1980].

Given the unequal distribution of income and food there is justified concern that considerable malnutrition may exist within Panama. Information from previous nutritional surveys of children under five years of age indicates that between 1967 and 1975 the prevalence of malnutrition increased. These trends need further investigation, however, and specific pockets or geographical areas where the problem is most severe need to be clearly identified.

In order to address the need for more accurate and geographically specific data on the prevalence of malnutrition, the National Nutritional Survey of 1980 was proposed. In addition to collecting information on the extent and location of malnutrition, the survey is intended to assist in the development of a permanent nutritional status information and monitoring system, and to assist in the evaluation of nutrition intervention programs.

Some of the nutrition intervention programs which may be subjected to evaluation are the following:

1. The Complementary Food Program (PAC)

The objectives of this program are the prevention of malnutrition in the most vulnerable groups, specifically pregnant and nursing women and children under five years of age; the recuperation of individuals who have suffered from some level of malnutrition; and incorporation of program participants into an active food production process.

2. The Food Production Program

This program involves the development and operation of community garden plots and small animal raising centers. The objectives of the program are the improvement of community nutritional status; to increase the community's agricultural production and productivity for the ongoing subsistence of the community; to diversify production while maintaining traditional crops; to raise the level of family incomes; and to improve community health conditions.

3. The Mother and Child Program

This program is supported by food from CARE. The objectives of the program are to improve the nutritional status of pregnant and nursing mothers and preschool children; and to support child and mother health care services.

Other related nutrition and health programs are programs to improve drinking water and waste disposal, improvement of basic crop and livestock programs, provision of nutrition education in the public school system, a preschool lunch program, and the fortification of flours with vitamins and minerals.

II. ANTHROPOMETRIC IMPACT INDICATORS FOR THE EVALUATION OF NUTRITION PROGRAMS

Since nutrition programs are aimed at improving the nutritional status of groups of persons, indicators of nutritional status must be selected that can be widely used, and that allow comparisons between the impact of different interventions. A causal model specifies that a change in a causal factor should in some finite time period lead to a change in an individual's nutritional status, all other things equal. But, changes in nutritional status are difficult to measure because they cannot be observed directly. According to Habicht et al. (1979) "nutritional status is the expression of nutriture* in a specific variable." Therefore, the variable or variables that reflect nutritional status must always be specified (e.g., nutritional status as reflected in height, or in growth, etc). The difference between nutritional status and its indicator is that the indicator also reflects the influences of nonnutritional factors (e.g. genetics). An indicator is not necessarily a direct measurement of a phenomenon, but rather a practical way of evaluating its magnitude (Behar, 1973).

The following sections are an overview of indicators of nutritional status as they may be used within an evaluation method.

Indicators of Nutritional Status

Attempts to evaluate nutritional status have used a number of methods and measurements, many of which are still subject to criticism, partial acceptance, refinements, and continuous evaluations. No one method has been accepted as an optimum indicator of nutritional status, in particular for mild-moderate cases of malnutrition, and investigators are still searching for indicators which are adequate, simple, precise, and low cost.

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*Nutriture: The state resulting from the balance between supply of nutrition on the one hand and the expenditure of the organism on the other.

Nutrition: The process by which the organism uses food, or anything normally ingested through digestion, absorption, transport, storage metabolism and elimination for purposes of producing and maintaining life, growth, normal functioning of organs and producing energy (Habicht et al., 1979).

Up to now, the measurements most commonly used to evaluate nutritional status have been direct measurements, including anthropometry, clinical signs, and biochemical tests; and indirect measurements, including food intake or food disappearance, food balance sheets, and vital statistics.

Balance sheets and vital statistics are gross estimates of a population's possible nutritional status, and are not useful in determining an individual's nutritional status. As these data are being based on aggregate statistics, they may mask changes in nutritional status of the population. They are important, nevertheless, because they may reveal the overall magnitude of nutritional problems.

Vital statistics most frequently used in nutrition include age-specific and general mortality rates, proportion of low-birthweight babies, population growth rate, life expectancy at birth, and coverage of health services. The interpretation of vital statistics, however, is often complicated by non-nutritional factors. It is further complicated by questions about accuracy of the data and how representative (i.e., how much underreporting is there?). In Panama, for example, one finds relatively low mortality rates, yet past nutritional surveys accuse a level of preschool malnutrition in the range of 50-70 percent. According to Beaton and Bengoa (1976), low mortality rates do not necessarily mean that the survivors are healthy.

Food balance sheets use national data, and do not account for unequal distribution among regions, cities, households and individuals.

Food intake data are also a rough estimate of nutritional status. Even if food intake data were quite accurate in reflecting an individual's intake, they are not an exact measurement of nutritional status because individual requirements vary due to differences in metabolism, level of physical activity, and incidence of infections and diseases. An intake which is adequate for one person may not be adequate for another, and may not be adequate for the same person at all times. According to Wolanski (1974), the same level of nutrient intake for one person can produce more than one nutritional state depending on the ecological situation of the person at different times. In addition, procedures to obtain data on food intake are subject to measurement errors, and thus are recommended mainly for use with groups of people rather than individuals.

Biochemical tests can provide objective information about an individual's nutritional status and can frequently detect deficiencies in the pre-clinic

stages. However, a number of procedural, logistic and cost difficulties are involved in biochemical tests.

First, most tests must be conducted in a sophisticated laboratory. Second, most biochemical tests are done on urine or blood samples and, aside from the problems of transporting samples to the laboratory, variations in the sample collection procedures may affect results of the tests. For example, the concentration of nutrients and metabolites in the urine may vary depending on the time of the day, the last time a meal was eaten, the amount of liquid drunk, etc. In addition, blood levels of nutrients tend to reflect recent food intake rather than actual nutritional status. The presence of infection or other conditions may also confound the results. There is, in addition, a lack of data on the degree to which specific cut-off levels of biochemical variables are related to the prevalence and incidence of health-related conditions (Nichaman, 1980). Lastly, when a deficiency is mainly related to total energy, and is therefore balanced, biochemical changes rarely become apparent (Gurney, 1979).

Eleven clinical signs, suggestive of protein-calorie malnutrition of early childhood have been listed (Jelliffe, 1966):

> Oedema, dyspigmentation of the hair, easy pluckability of the hair, thin sparse hair, straight hair, muscle wasting, depigmentation of the skin, psychomotor change, moon-face, hepatomegaly, flaky-paint dermatosis.

All have the disadvantage of being subjective and difficult to standardize and express quantitatively. Most are not completely specific to protein-calorie malnutrition and may appear only after the malnutrition has reached a certain level of severity. In addition, these signs are not constantly present, especially in mild and moderate protein-calorie malnutrition, and vary in prevalence from one part of the world to another, depending on the interaction of many ecological factors, and whether the kwashiorkor or the marasmus is the main abnormality in the community (Jelliffe, 1966).

Physical signs of nutritional deficiency are often unreliable. Fomon (1976) described an example of the low reliability of specific physical signs of nutritional deficiency: "In Panama in 1967 two well-trained individuals examined 895 adult subjects. Incidence of abnormal hair, filiform papillary atrophy, follicular hyperteratosis, swollen red gums, angular lesions, glossitis

and goiter was noted by each examiner. With respect to subjects classified as having abnormal hair, agreement between the two examiners occurred in only 31 percent of the cases. Agreement between examiners with respect to other clinical signs was generally not better than 50%."

There is widespread belief that the preschool child adapts to an inadequate nutrient intake by slowing his growth, thereby, in the early stages, maintaining normal values for the other measurable characteristics, such as biochemical or physical changes (Wray and Aguirre, 1969). Therefore, anthropometry is considered the most useful indicator of nutritional status in young children, and in certain adult populations as well. Anthropometry as the foundation of nutrition assessment is dependent on the availability of reference population data with which to compare the results in individuals and communities. Such reference values are often misused as norms or as the bases for absolute cut-off points to classify individuals as malnourished. Furthermore, different types of anthropometric measurements and norms have been used by different investigators in several countries without any agreement having been reached on interpretation of the ideal measurement or even the plausibility of the existence of norms. There is controversy among experts with respect to the sensitivity of the indicators used to classify mild or moderate cases of malnutrition, and to detect small changes in nutritional status. Care is needed in the interpretation of data. Although nutritional differences between individuals or populations may lead to anthropometric differences, the existence of anthropometric differences between individuals or populations does not necessarily imply nutritional differences (Goldstein, 1974).

The following sections discuss different anthropometric measurements, their usefulness as indicators of nutritional status, and some considerations in selecting indicators of nutritional status for evaluating the nutritional impact of interventions. For a more detailed discussion of these topics, see Appendix B.

A. Anthropometric Measurements Commonly Used as Indicators of Nutritional Status

1. Weight for Age

The classification of nutritional status based on the adequacy of the child's present weight for the "expected" weight for his age* was suggested

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* The "expected" weight for a specific age is the 50th percentile of the values obtained from a sample of a population in good health whose distribution is assumed to be the normal probability distribution.

by Gomez, (Gomez, et al. 1956). The classification is based on clinical symptoms and the realization that those children with severe malnutrition never had weights above 60 percent of the expected weight for age. Kielmann and McCord (1978) have also observed that in children aged 1-36 months, child mortality doubled with each 10 percent decline below 80 percent of the Harvard weight median.

The Gomez classification groups children into four categories:

a) Normal or obese (weights above 90 percent of the reference for their age);

b) Grade I malnutrition (weights between 90 percent and 76 percent of the reference for that age);

c) Grade II malnutrition (weights between 75 percent and 61 percent of the reference for that age); and

d) Grade III malnutrition (weights fall below 61 percent of the reference for that age).

The advantage of this classification is that it allows one to establish certain priorities, based on the severity of the nutritional problem (which is obtained from the adequacy of the child's weight with respect to the norm for that age). However, the classification also runs into the following problems:

a) It does not distinguish between normal and obese children, a factor of growing interest in recent times. However, this can be readily solved by adding a fifth category, obese or overweight (weights above 110 percent of the reference for their age).

b) It assumes that all children of the same age should weigh the same, no matter what their size. Consequently, those children who weigh less simply because they are shorter (no matter why they are short) are classified as malnourished in some degree (false positives); conversely, those children who weight more because they are taller may be classified as obese.

c) It assumes that all ethnic groups should weigh the same at the same age, regardless of different body builds. However, with wider bony frame and greater proportion of trunk length to leg length will have higher relative body weights for the same stature (Buzina and Uemura, 1974).

d) The daily variation in an individual's weight is large (Dean, 1965). For this reason, some experts argue that weight may be an adequate indicator for extreme cases of malnutrition, but that it is not sensitive enough to detect mild or moderate cases of malnutrition, or small changes in nutritional status.

e) Many times the exact age of the child is not known, particularly in developing countries where registry of birth is still not widely spread.

f) It does not indicate whether the malnutrition is of recent origin (acute), or more long term (chronic). Neither does it indicate whether the child is presently consuming an inadequate diet, or whether the weight loss was due to a severe infection or a previous inadequate diet that has recently been corrected.

g) The limits dividing the different degrees of nutritional status automatically establish that, in a statistically normal population, a certain percentage of the population will be classified as having some degree of malnutrition. More specifically, statistical normality dictates that 75 percent of the norm (that is, of the 50th percentile) is equal to the 3.75th percentile, that is, 3.75 percent of a normal population will have weights below 75 percent of the norm--and consequently, will be classified as either grade II or grade III malnutrition. This means a lot of care should be used in the interpretation of data to avoid false conclusions.

h) Using this classification it might be very difficult to demonstrate statistically significant changes in nutritional status of individuals (or populations)for evaluation purposes.

The Gomez classification has received some slight modifications in recent years: Bengoa, in 1970, suggested that any child with edema should be classified as grade III, no matter what the child's weight; Wellcome and his working party also utilized a combination of percentage of weight for age and presence of edema, as detailed in Table 1. However, none of these modifications have any bearing on the problems discussed above.

Table 1

CLASSIFICATION OF SEVERE PROTEIN-CALORIE MALNUTRITION
ACCORDING TO WELLCOME WORKING PARTY

Weight (% of Reference)	Presence of Edema	
	Yes	No
80-60	Kwashiorkor	Undernourished
<60	Marasmus-Kwashiorkor	Marasmus

SOURCE: Waterlow, 1972.

In recent years, weight-for-age has been receiving increased recognition as an indicator of nutritional status for longitudinal individual evaluations, and losing its roll as an indicator of actual mild to moderate nutritional status in a cross-sectional sample.

2. Height for Age

The classification of nutritional status according to "expected" height for age is based on the concept that socioeconomic and environmental factors have a greater impact on an individual's height than genetic factors, particularly during the preschool period. This is illustrated by the secular trend towards increased heights. For example, comparisons among preschool children who were presumably well-nourished but of different ethnic backgrounds indicated a difference of about 3 percent in height measurements. Comparisons between these children and others, some of whom had similar ethnic backgrounds, but who lived in the poor, urban and rural regions of developing countries indicated differences in height measurements approaching 12 percent (Habicht, et al., 1974). Furthermore, Vahlquist (1979) states that length at birth is poorly correlated to height in adult life (for boys, r = .25), whereas at 2 years of age the correlation is much higher (for boys, r = .79). This must mean that during the first few years of life there is considerable "crossing over" between different growth channels, which subsequently diminishes. Since height, once attained, cannot be lost, height is considered a more stable measurement of growth than weight.

The effect of unfavorable conditions on growth seems to depend upon the duration and the severity of the insult and the age at which it occurs. A child who suffers for a short period of time from an illness or starvation is able to return to, or at least approach, his regular course of growth when conditions improve. In doing this, his initial growth velocity upon recovery is above that normally to be expected for children of his age, or even his skeletal maturity. This higher-than-normal velocity has been named catch-up growth. Catch-up growth may or may not restore the child's condition to normal. When treatment is incomplete or not very effective, the child may resume growth at a normal but not supranormal velocity (Eveleth and Tanner, 1976). Therefore, the magnitude of the deficit of height for age can be considered a measure of the duration of the bout of malnutrition.

However, there are limitations to the practical application of this classification, for the following reasons:

a) Changes in height in periods of less than 6 months are very small, making it difficult to obtain accurate information with respect to reduction in growth.

b) A significant reduction in height (about 10 percent) tends to occur when a child's weight is already 25 percent below the norm.

c) Children's body measurements tend to have a marked resemblance to the parent's body measurements after the age of 2 years, showing more the effect of their own genes than the effect of the uterine environment in which they grew (Eveleth and Tanner, 1976). From 3 to 9 years, correlation coefficients of height between parents and offspring are slightly under 0.5 and have been made the basis of standards for childhood height allowing for height of parents, according to Tanner, Goldstein and Whitehouse, 1970. These authors note that a short child with short parents should be viewed as being less at risk than a child who is short but whose parents are tall. Even though nutritional and environmental factors may be important determinants of growth, the organism may impose its own limits.

d) A child's length at birth also seems to be important. Longitudinal studies on white children have shown that infants who were short at birth remained short (Garn and Shaw, 1977).

e) Often a child's exact age is not known, which makes it difficult to classify the child precisely.

Seasonal variations in the rate of increase in children's height and weight occurs in both temperate and tropical climates and is considerable in some tropical regions. These seasonal differences should be recognized because they are significant in terms of evaluating impact of interventions (Eleveth and Tanner, 1976).

3. Weight for Height

Weight as a percentage of expected weight for height, offers several advantages, such as not requiring knowledge of a child's exact age. Thus this measure offers a good indication of the actual nutritional status of the child. Weight for height seems to be nearly independent of age between 1 and 10 years; at a given height, both median weight and range of weight are

independent of the age of the children concerned. Weight for height also may be relatively independent of ethnic group, particularly between 1 and 5 years. At ages of less than 1 year, an older child tends to be heavier than a younger child of the same height (Waterlow et al. 1977). Nevertheless, classification errors may occur if different body builds are not considered separately, in particular in persons more than 5 years old, since people with longer leg length relative to trunk length will have smaller body weights for the same stature (Buzina and Uemura, 1974).

The fact that two measurements, height and weight, are involved in this classification, each with its own requirements for precise instruments and measuring techniques, slightly reduces the simplicity and reliability of this indicator. Further, this classification does not identify those children who suffered past or chronic malnutrition and, therefore, may have low weight and low height, although proportional.

4. Weight for Height and Height for Age

The comparison between these two indicators may help solve some of the identification problems mentioned previously. For example, the joint use of weight for height and height for age allows children to be classified into several categories that differentiate between past and actual malnutrition:

a) Normal children (or obese).
b) Children who do not presently suffer from malnutrition but who once did (as evidenced by their low height for age, stunted).
c) Children who are presently malnourished, but whose heights are adequate for their age, which indicates a recent onset of malnutrition (acute malnutrition). These children may be classified as underweight.
d) Children who are presently malnourished and have low height for age, which indicates a long duration of malnutrition (acute and chronic)

Table 2 illustrates the four categories identified above. In terms of program evaluation, it should be noted that no matter how successful an intervention is in improving the nutritional status of a population, it will not be able to change stunted children into normal children.

Naturally, the values for normal and low used for the relationship weight/height and height/age should be some percentage of the reference values.

Table 2

CLASSIFICATION OF NUTRITIONAL STATUS

Weight for Height	Height for Age	
	Normal	Low
Normal	Normal	Past Malnutrition (Stunted)
Low	Acute Malnutrition (Underweight)	Acute and Chronic Malnutrition (Stunted and Underweight)

Seoane and Latham, 1971.

For example, 90 percent of the reference value for height for age, and 80 percent of the reference value for weight for height could be the limit between normal and low. Several grades, such as above normal, grade I, grade II, etc., for each of the relationships could also be used, thus creating a multi-cell table as illustrated in Table 3.

The biggest problem with this classification is its reliability. Not only are there two measurements involved, (weight and height), with their respective measurement errors, but there is also the difficulty of obtaining the child's exact age.

5. Weight for Height, Weight for Age, and Height for Age

The World Health Organization and the Pan American Health Organization have recently recommended that a combination of all three indicators be used. They note that there are only 9 meaningful indicators out of the 27 possible combinations (Table 4). However, none of the 9 recommended combinations allows for all low values, that is, a child who is presently underfed or malnourished, in addition to having a past history of malnutrition. Furthermore, the recommendations stress that:

- all children with a normal weight for height are not malnourished whatever the classification of the other two indicators;
- all children with a low weight for height are underfed, some more than others depending on the values of the other two indicators, and
- all children with a high weight for height are overfed in varying degrees depending on the values of the other two indicators.

However, the ultimate shape and size a child attains will be the result of the continuous interaction between environmental and genetic factors. In some instances, genetics and physiological factors place an upper limit on the effects of an optimum environment on the growth of a child, as for example, a child who has two short parents.

For these reasons, a child's absolute position with regards to the reference values of weight for age, height for age, and even weight for height is of secondary importance compared with the magnitude and direction of the child's growth. Only sequential measurements for some months or even years will indicate whether the child is achieving his growth potential. For example,

Table 3

EXAMPLE OF 4x4 CLASSIFICATION ACCORDING TO DEGREES OF MALNUTRITION AND RETARDATION (REDUCTION IN RATE OF GROWTH)

(Number of Children)

	Retardation			
Grade	0	1	2	3
% Expected Height for Age	>95%	95-90%	90-85%	<85%

Grade Malnutrition	% Expected Weight for Height
0	>90
1	90-80
2	80-70
3	<70

SOURCE: Waterlow, 1972.

Table 4

WHO/PAHO RECOMMENDATIONS FOR COMBINATIONS OF ANTHROPOMETRIC INDICATORS

Combinations of indicators	Interpretation of nutritional status
1. Normal wt/ht + low wt/age + low ht/age.	Normally fed with past history of malnutrition.
2. Normal wt/ht + normal wt/age + normal ht/age	Normal.
3. Normal wt/ht + high wt/age + high ht/age	Tall, normally nourished.
4. Low wt/ht + low wt/age + high ht/age	Presently underfed ++
5. Low wt/ht + low wt/age + normal ht/age	Presently underfed +
6. Low wt/ht + normal wt/age + high ht/age	Presently underfed
7. High wt/ht + high wt/age + low ht/age	Obese ++
8. High wt/ht + normal wt/age + low ht/age	Presently overfed with past history of malnutrition
9. High wt/ht + high wt/age + normal ht/age	Overfed but not necessarily obese

SOURCE: World Health Organization/Pan American Health Organization, 1979.

a child below the tenth percentile point in weight for age might be thought of as undernourished, but as many as one in 10 normal children will be below this level (Stuart et al., 1959). A low-birthweight baby will probably always remain small and underweight for his age, and yet have an adequate growth pattern. A child whose weight is well below the mean for his age but who is gaining steadily will not be a cause of concern, while on the other hand, a child whose weight is above the mean but who has been "fattened" for 9 months may require admission to a hospital for incipient kwashiorkor (Morley, 1976).

6. Mid-upper Arm Circumference

There is still a lot of controversy regarding the usefulness of this measurement as an indicator of nutritional status. The measurement is relatively independent of age in children 1-5 years old (i.e., it changes little with age); requires no difficult, heavy, or expensive equipment; and is quite simple to carry out. It has been shown to be useful in the quick screening of those children who are malnourished but whose exact age is not known (Gurney, 1966; Burgess and Burgess, 1969). However, its sensitivity for identifying mild to moderate cases of protein-calorie malnutrition has not been fully established, although Brozek (1974) claims that it is a more dependable criterion than weight in detecting changes in nutritional status. However, because the measurement is so small, the allowable margin of error is also quite small, which reduces its statistical reliability.

The relationship of arm circumference to height has been suggested, because it is also independent of age. It offers, however, the same information as weight/height, although it is less sensitive and less exact (Waterlow, 1972).

7. Head Circumference

This measurement has been suggested by some experts as an indicator of nutritional status, because of the rapid growth of the head during the first year of life, in order to accommodate the rapid growth of the brain.

A variation of this measurement includes the relationship between head and chest circumference: in a well-nourished child under 6 months of age, the chest circumference is usually smaller than the head circumference. At 6 months of age, the relationship changes, and the chest circumference becomes greater than the head circumference. Jelliffe (1966) has suggested that a ratio less than 1 between chest and head circumference could be used as an indicator of malnutrition in children over 6 months of age.

8. Hair Root Morphology

A few of the signs indicative of protein-calorie malnutrition in young children deal with hair, such as:

- dyspigmentation of the hair
- easy pluckability
- thin, sparse hair
- straight hair

Bradfield and Jelliffe (1970) report that changes in hair root morphology that are present in mild to moderate protein-calorie malnutrition, and thus can be standardized and classified, are useful as a "sensitive confirmatory indicator" of early malnutrition in community surveys.

However, other investigators have claimed that the technique is traumatic to the person and possibly to the hair, that it is tedious and time consuming, and that experienced observers are needed since the technique is subjective and only semiquantitative. In addition, Johnson, et al. (1975), did no find the method useful in determining the prevalence of different degrees of protein-calorie malnutrition, differentiating only well-nourished from severely malnourished children. Lastly, Tamphaichitr, et al. (1977), demonstrated that ethnic differences exist, and that standards should be developed for each ethnic group to be studied.

9. Skinfold Thickness

This measurement is most commonly used in determining obesity, although Keet, et al., (1970), suggest that due to their findings of significant correlations between skinfolds, weight and height; and the little variation in skinfold thickness between the ages of 1 and 5 years (which means that knowing the precise age of the child is not necessary); skinfold thickness can be used as a reliable criterion of suboptimal nutrition in young children.

Some investigators (Keet, et al., 1970; Robson, et al., 1971) claim that an ethnic factor may be why triceps skinfolds are lower in Negroes than in Caucasian children and also that skinfolds may be thinner in warmer areas.

Frisancho, et al., 1971, 1971(a), claim that in relatively lean populations, children that are fatter than average for their age, are not also taller. However, children that are more muscular the average are taller indicating that muscle size is a better indicator of nutritional status than fatness.

10. Muscle Size

The amount of subcutaneous fat and degree of muscularity in children reflects the individual calorie and protein reserve. However, measurements of subcutaneous fat among relatively lean populations may not be a sensitive indicator of nutritional status and growth. On the other hand, measurements of muscularity in children do adequately index nutritional status and growth (Frisancho, et al., 1971).

A number of authors (Frisancho, 1974; Jelliffe and Jelliffe, 1969) have claimed that the decrease in muscle mass, determined either through creatinine output or limb measurements, during malnutrition exhibits a greater reduction than body weight, suggesting that if skeletal musculature is well maintained, the protein requirements for growth and body tissues have been met.

Estimates of muscle size may include:

- arm muscle circumference (mm) = arm circumference (cm) $- \frac{\Pi}{10}$ (triceps skinfold)(mm)
- Arm muscle diameter (mm) = $\frac{\text{arm circumference (mm)}}{\Pi}$ $-$ triceps skinfold (mm)
- Arm muscle area (mm^2) = $\frac{\Pi}{4}$ (arm diameter^2)

(Gurney & Jelliffe (1973) have developed an easy nomogram for calculating muscle area from arm circumference and triceps skinfold measurements.)

However, between ages of 1-5 years both boys and girls grow nearly 35 percent in muscle area, but only 16 percent in diameter or circumference. Thus, estimates of muscle diameter and circumference underestimate the magnitude of tissue changes.

11. Height of Children 7 Years of Age as a Community Indicator

Bengoa (1973) stresses the urgency of finding one or more indicators to assess the lasting effects of malnutrition in young children. A single indicator that would reflect, for a given community, the combined effect of a number of factors related to physical, functional, and social development would be preferred. Such an indicator should incorporate objectivity,

feasibility, specificity, and sensitivity. Bengoa suggests using the height of children 7 years old as a community indicator. Such an indicator has the following possible advantages:

a) The height of chilren 7 years old summarizes with objectivity the past history of the community in terms of nutrition (usually associated with other health problems.)

b) Children 7 years old are entering school, which facilitates the task of measurement. The age of 5 or 6 would be equally suitable if this were the age of entrance into school.

c) Height represents a good indicator of physical development and reflects some parameters of functional development. For example, short boys have a significant reduction in average hemoglobin, protein, and albumin levels in comparison with well-nourished boys of the same geographical area.

d) The index is sensitive, as suggested by the great differences among social groups in a given country. In Costa Rica, for example, a country of great homogeneity in racial origins, the 50th percentile of the height of boys 7 years old in urban areas is 118.7 cm. The 10th percentile is 109.2 cm, and the 90th percentile is 126.2 cm. This large range cannot be explained by genetic differences, but can be explained by environmental factors, among which nutrition is the most important in this case. The sensitivity of the index is shown also by a study in Japan, where the height of 7-year-old boys increased from 112.3 cm in 1948 to 116.8 cm in 1963, paralleling improvements in the national diet and general health condition.

e) The heights of children 7 years old are apparently closely correla'ed with the socioeconomic index developed by th U.N. Research Institute for Social Development.

f) Boys, instead of girls, may be selected because they seem more sensitive to environmental influences, at least as reflected in social class.

B. Age Assessment

Exact age assessment is desirable in the anthropometry of young children. Ages of infants and preschool children should be known to the month if possible. However, in many instances the precise age of a child is not known. Aside

from trying to construct a locally relevant calendar in order to get an approximation of the child's age, a number of authors suggest the use of the emergence of the young child's deciduous teeth (dental eruption), as approximate supporting evidence.

The order of eruption of the deciduous teeth is practically fixed and only occasional individual variations occur. Twin studies indicate the importance of genetic control in the age of eruption; opinion is divided as to whether there is a significant environmental influence also. A number of investigators have studied the effects of malnutrition on tooth eruption. Infants who are small for their age have delayed eruption. Eruption is delayed also in triplets and higher order multiple births. Possibly infants with severe protein-calorie malnutrition are delayed, but if so, the effect is considerably less on tooth development than on weight, height, or skeletal development (Eveleth and Tanner).

A method of assessing the approximate age of a child based on average dental eruption is suggested in Table 5. It has been suggested that, as an approximation, the simple addition of 6 to the number of teeth erupted--that is, with the crown of the tooth visible through the gum--gives the rough age in months, and this proposal has the advantage of requiring no memorizing or consulting of tables (Jelliffe, 1966).

C. Values of Reference

Aside from all the discussions and problems related to identifying ideal indicators of nutritional status, experts also disagree about which reference values should be used as a basis for comparison.

Currently, two major points of discussion about reference values for various indicators of nutritional status are:

- Whether the reference values may be international or whether they should be national/local; and
- Whether the reference values should be derived from a representative sample (i.e., cutting across all socioeconomic strata) or whether they should be based on a sample from the more privileged socioeconomic class (assuming this class would provide children in good nutritional status, although there may be a problem of overnutrition).

The use of local rather than international reference values is preferred mainly because reference values derived from the overall population might not take into account genetic differences among local populations. However, the

Table 5

AVERAGE ERUPTION TIME OF DECIDUOUS TEETH

Tooth	Lower Jaw	Upper Jaw
Central Incisor[a]	6 months	7½ months
Lateral Incisor[a]	7 months	9 months
Cuspid	16 months	18 months
First molar[b]	12 months	14 months
Second molar[b]	20 months	24 months

[a] Incisors: range ± 2 months

[b] Molars: range ± 4 months.

SOURCE: Jeliffe, 1966.

use of international reference values are valid when environmental factors are more important and can override the genetic factors affecting a child's growth, particularly during the preschool years. In addition, the use of the same reference values would facilitate the comparison among countries of the prevalence of malnutrition and of results of nutritional projects. Finally, many countries do not have sufficient resources to stablish their own reference values with a strong statistical basis.

Some experts have suggested the use of both reference values, local and international when possible. They also stress the importance of care in the analysis of data, in order not to stigmatize that portion of the population which is below the international reference values. It is important to remember that the reference values should not be considered as norms, or objectives to be reached at all cost, but should be considered as reference values for comparison purposes.

The biggest argument against the use of reference values derived from a privileged socioeconomic class is that a child from a low socioeconomic class has a growth pattern that is related to the envi ment. The adaptation of the child to his surroundings, although resulting in a growth which is less than the maximum potential, may reality be the best under those circumstances, and "it would be absurd to classify an average healthy pygmy as 'growth-retarded' by well-off standards, even if it were believed that pygmies are shorter because of environmental rather than genetic factors" (Goldstein, 1974). Eveleth and Tanner (1976), argue that it should not be uncritically assumed that bigger means better. Just because in temperate industrialized countries the best-off members of the community are larger than the worst-off, and taller women have more successful reproductive histories than short women, it does not follow that the same holds true under other ecological conditions. These authors note that in the harsh environment of the Peruvian Andes, for example, small mothers have more surviving offspring than large mothers. Neumann (1979) cites the higher mortality rate in those toddlers who grew most rapidly and had presumably greater nutritional requirements than average. Thus small body size may be more adaptive under some types of conditions. In addition, the effects of malnutrition on the genetic potential for growth may sometimes take two to three generations to disappear, and the use of reference values derived from the privileged socioeconomic class may not be reachable by the rest of the population in the short run. The use of such reference values

would understate any significant improvements in the nutritional status of the population participating in nutrition programs. Finally, these experts argue, there is still no definite proof that "bigger is better," particularly when one considers the tendency in the last few years towards obesity and all of its related problems. On the other hand, the use of reference values derived from a more representative sample might allow the comparison of an individual child to the existing situation, but would not necessarily provide any information as to what the optimum value might be.

Waterlow et al. (1977) suggest that an arbitrary and perhaps temporary adjustment may be made in the cut-off points derived from the reference population. For example, if in a particular population even well-nourished children are shorter in stature than the children of the reference population, it might be reasonable to set the target for height as 95 percent of the reference height, instead of 100 percent. However, decisions of this kind must to be made at the local level, or by each individual country.

D. Age Groups

Children under 5 years old are often considered a homogeneous group and are referred to as preschool children. However, sensitivity to the influence of ecological factors differs with the stages of development, and is greater in periods of rapid growth (Wolanski, 1974). As a result, the pattern of malnutrition tends to change as children grow older: at 1-2 years of age, the deficit in weight for height is often very marked; by 3-4 years this deficit may be made up, but the child will remain with a deficit in height for age and weight for age. For this reason, Waterlow, et al. (1977) recommend that data be broken down and presented in the age groups shown in Table 6.

E. Conclusion

In the analyses and evaluation to be conducted in Panama, the anthropometric measures of height and weight by age will be the principal tools utilized for assessment of nutritional status. These values will be compared against their mean values, for the most part, instead of compared with Gomez or other standardized criteria, although such criteria will also be employed.

In the evaluation portion of the study these anthropometric measures will be used as dependent variables for the detection of significant differences between treated and nontreated populations. These variables will also be utilized in the regressions of the economic models. For governmental planning purposes these measures of nutritional status will also be broken out by

Table 6

RECOMMENDED AGE GROUPS FOR THE PRESENTATION OF ANTHROPOMETRIC DATA

A Highly Recommended	B Recommended	C Permissible
0 - 2.99 Months		
3.0 - 5.99 Months	0 - 5.99 Months	
6.0 - 8.99 Months		
9.0 - 11.99 Months	6.0 - 11.99 Months	0 - 11.99 Months
1.0 - 1.99 Years	1.0 - 1.99 Years	1.0 - 1.99 Years
2.0 - 2.99 Years		
3.0 - 3.99 Years	2.0 - 3.99 Years	
4.0 - 4.99 Years		
5.0 - 5.99 Years	4.0 - 5.99 Years	2.0 - 5.99 Years
6.0 - 6.99 Years		
7.0 - 7.99 Years	6.0 - 7.99 Years	
8.0 - 8.99 Years		
9.0 - 9.99 Years	8.0 - 9.99 Years	6.0 - 9.99 Years

SOURCE: Waterlow, et al., 1977.

geographical area, i.e., the district level, in order to assist in the identification of pockets of malnutrition and isolation of causes.

In the following section we present a brief discussion of some of the evaluation models to be employed in this study. Based on the results of these tests of evaluation models a recommended set of methodologies will be developed for assessing nutrition programs in developing countries.

III. EVALUATION METHODS

In the following section we will present material on the general aspects of experimental design and some specific recommendations for the work to be conducted in Panama.

A. Conceptual Bases for Nutrition Evaluation

A system of evaluation of multi-sectorial feeding and nutrition programs must comply with a number of requirements, from evaluation at the national to local level, to assessment across different sectors of the country, across different nutrition programs, etc. Such systems of evaluation can become extremely complex and highly specialized to different program needs, and they can be difficult to develop and operate. With this thought in mind, it should be recognized at the outset that no single evaluation methodology is likely to satisfy all aspects of all nutrition programs. It should likewise be recognized that different evaluation methods will have tradeoffs between their strengths and limitations as compared with other methodologies.

Of particular importance, in a general sense, is the issue of internal and external validity of each method of evaluation, or each experimental design. By external validity is meant the capability of the designed situation to relate or transfer to conditions in other populations and/or related conditions. In other words, what occurred in one situation could be assessed to be applicable and valid in other similar situations. By internal validity is meant that a specific factor or cause has been identified within the experimental condition which clearly explains or is responsible for a specified result. No other confounding factor exists such that clarification of causal path(s) is impossible.

Whether the internal factor can explain or be valid outside the specific experimental situation is an issue of external validity as discussed earlier. In the evaluation models to be presented shortly, these isues of internal and external validity have been already assessed prior to their selection. Other issues for selection of evaluation models are presented below.

B. Some General Points on Evaluation Models

In planning and evaluation of projects it is necessary to take into consideration a number of topics, among which are the following:

1. The amplitude of the project to be evaluated in relationship to other governmental programs. In this respect it is best to limit evaluation

activities to those programs in which the most nutritionally vulnerable populations are being served. Both endogenous and exogenous variables should be considered, since the government can not control all factors which affect nutrition.

2. Select specific nutrition programs for inclusion in the evaluation. In Panama the Programa de Alimentacion Complementaria (PAC), the Programa de Produccion de Alimentos, and the Programa Materno-Infantil/Care will be selected for evaluation.

3. Determine whether the evaluation should be impact or process evaluation in nature, or a combination of both. The type of evaluation or areas of emphasis will influence the type of data to be collected as well as the use to which it will be subjected. Care should be taken that the processes of data collection do not disturb the experiment and its evaluation.

4. Select the geographical area for evaluation. This selection process should be done with an eye to design of the evaluation, the ease of data collection, and the likelihood of detecting significant differences in the population's nutritional status. Two possible areas representing rural and urban populations are the Provincia de Veraguas and Panama City, respectively. Other non-covered populations should be selected, when necessary, as control groups.

5. Development of a conceptual model. The model(s) should be selected on the basis of their usefulness to each program or situation. Regardless of the evaluation model selected it is useful to have a conceptual model of nutrition and identification of where in the flow of nutrition operation a program intervention might be established and effectively evaluated. An example of a nutrition model is presented below. (See Figures 1 and 2.) In this example, several general relationships are outlined, as well as identification of some nutrition program operations in Panama.

6. Identification of the target population. Several levels of population aggregates are possible: National, local, family, and individual. It is also possible to study only participants in a program, however, problems of self-selection bias can arise. Whatever the target population, there needs to be concern that the individuals who participated in the nutrition program are adequately represented.

Figure 1

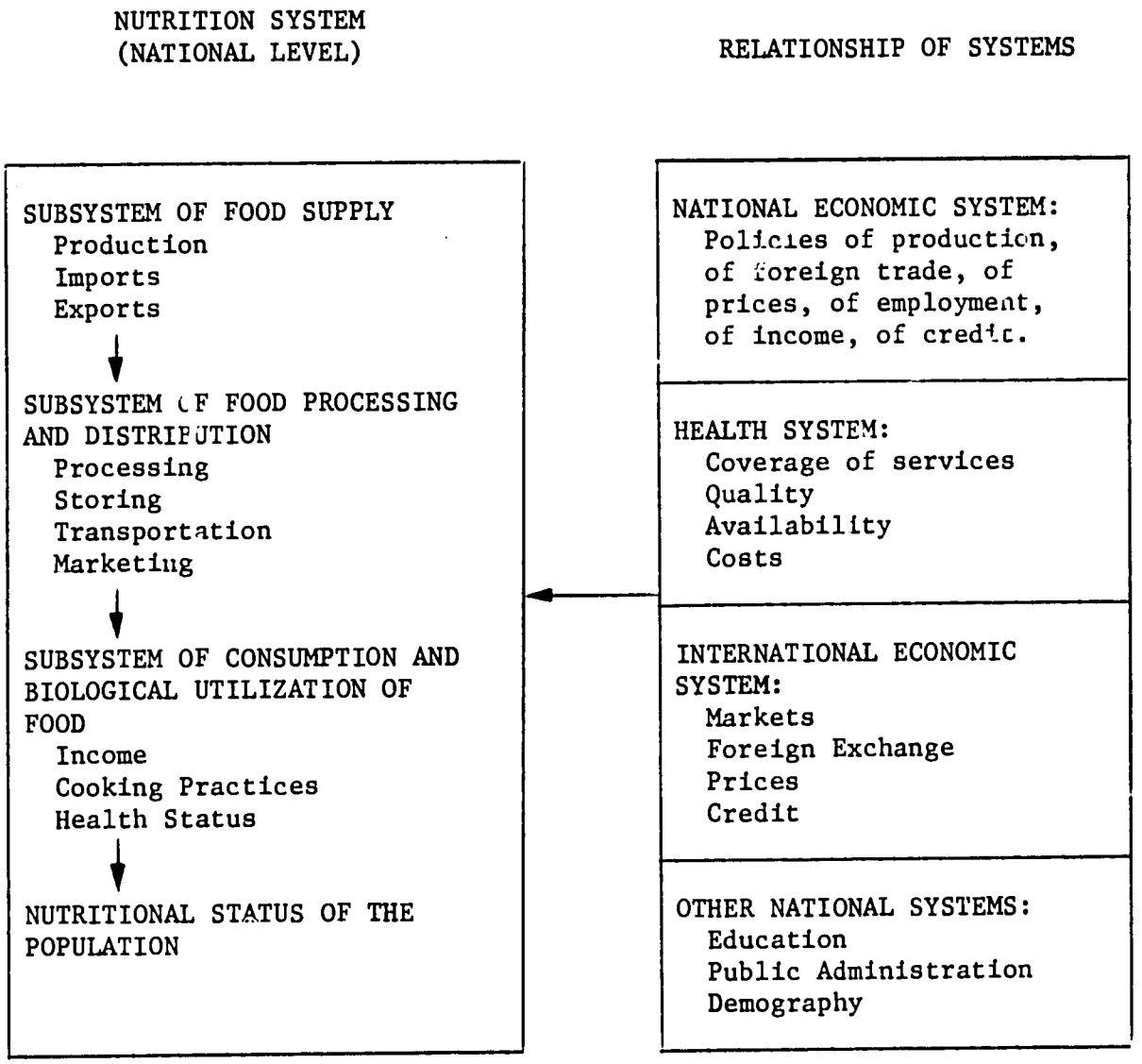
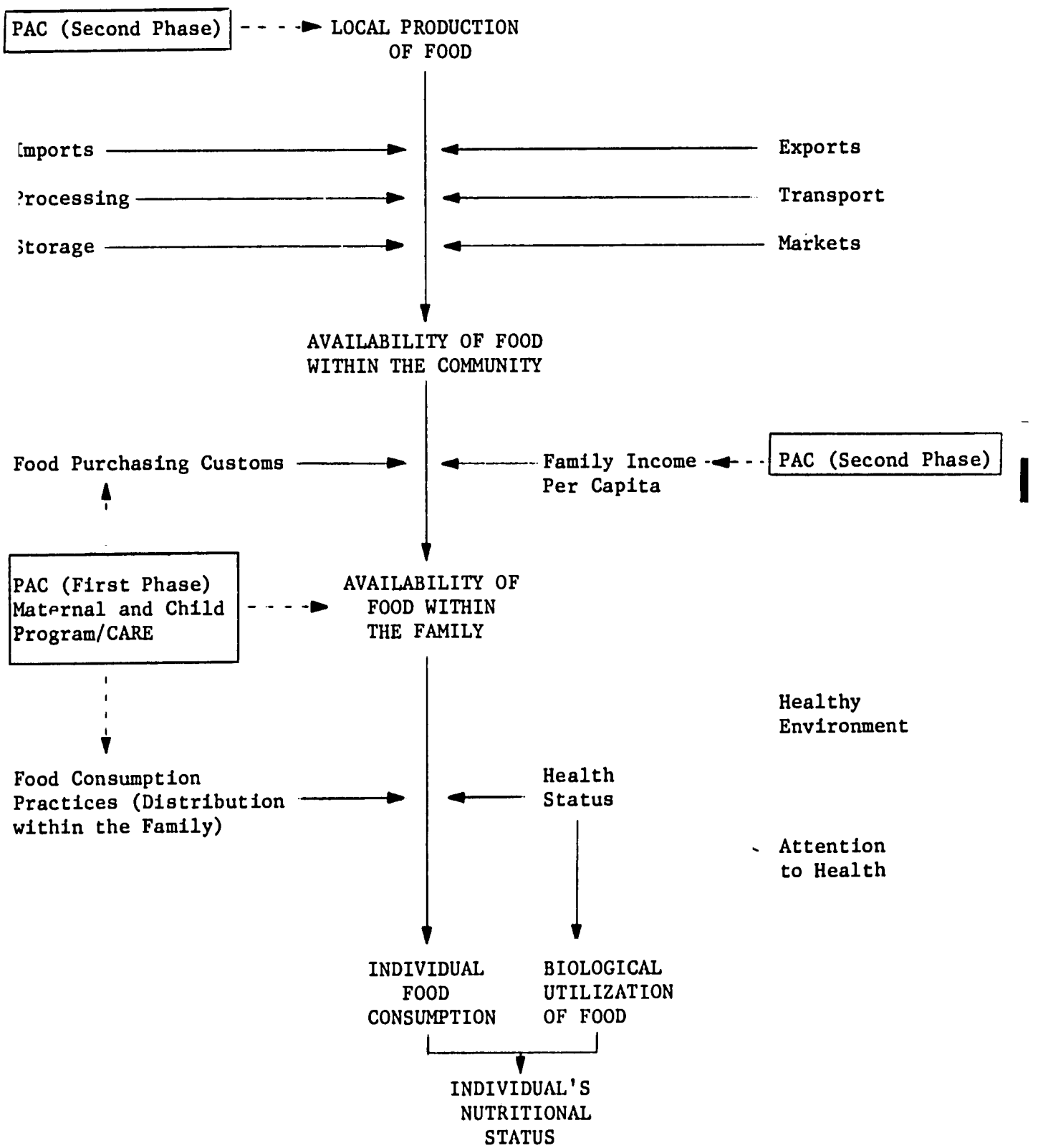

NUTRITION SYSTEM
(NATIONAL LEVEL)
RELATIONSHIP OF SYSTEMS
SUBSYSTEM OF FOOD SUPPLY
Production
Imports
Exports
SUBSYSTEM OF FOOD PROCESSING AND DISTRIBUTION
Processing
Storing
Transportation
Marketing
SUBSYSTEM OF CONSUMPTION AND BIOLOGICAL UTILIZATION OF FOOD
Income
Cooking Practices
Health Status
NUTRITIONAL STATUS OF THE POPULATION
NATIONAL ECONOMIC SYSTEM:
Policies of production, of foreign trade, of prices, of employment, of income, of credit.
HEALTH SYSTEM:
Coverage of services
Quality
Availability
Costs
INTERNATIONAL ECONOMIC SYSTEM:
Markets
Foreign Exchange
Prices
Credit
OTHER NATIONAL SYSTEMS:
Education
Public Administration
Demography

Figure 2

NUTRITION SYSTEM
(LOCAL LEVEL)

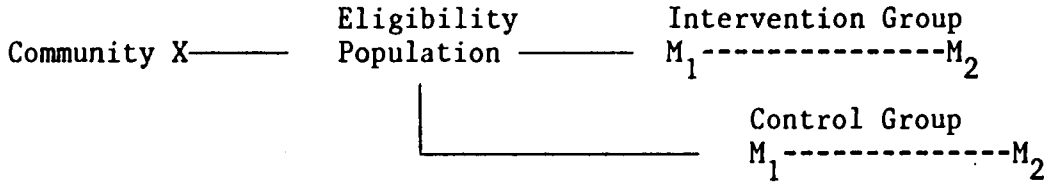


C. Some General Models of Evaluation

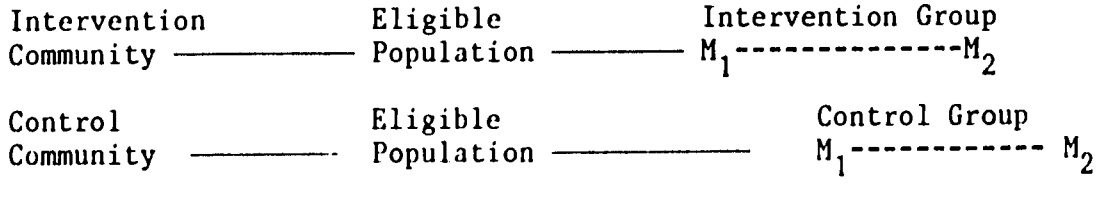
Several quasi-experimental models are available for evaluation of nutrition programs. In this section of the report, five models are presented along with a discussion of the strengths and limitations of each.

1. If program coverage does not extent to all eligible people, possibly due to insufficient resources, it is possible to take a sample of individuals or families who did not participate in the program, but who were otherwise eligible. This group could be compared with a sample of program participants. This design does hold the potential for self-selection bias, but could be checked through adequate stratification techniques.

This model can be illustrated as shown below:



2. A second approach consists of selecting communities where nutrition programs have not been implemented, but where the characteristics of the community are similar to those of communities with nutrition programs. In the control communities the sampling process involves setting up the same selection process used in the intervention communities. In other words, the same eligibility criteria used to select individual or family participants in the intervention communities is used to select individuals or families in the control communities. The efficiency of this design depends on the ability to find comparable communities and duplication of the eligibility-selection process. This model is illustrated below:



3. A third alternative, which is more efficient, employs the concept of virgin communities, or communities where there has been no previous intervention. The individual eligibility requirements for program participation are the same for each control community and intervention community. The principal

limitations of the design is the difficulty in identifying and measuring longitudinal impacts on nonparticipants. The design does minimize the likelihood of self-selection bias. Diagnostically, the design can be shown as follows:

Intervention Community ————	Eligible Population ————	Intervention Group M_1----------M_2
Nonintervention Community ————	Eligible Population ————	Control Group M_1----------M_2

4. The fourth design is different from the third only in that those communities which did not initially receive the intervention receive it at a later point in time. In this manner, the ethical issues of treatment versus non-treatment between groups is avoided. The design can be illustrated as follows:

Community A ————	Eligible Population —	Group A M_1 Intervention	M_2 Intervention	M_3
Community B ————	Eligible Population —	Group B M_1 Control	M_2 Intervention	M_3

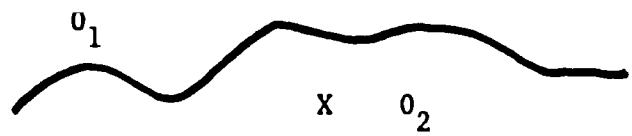
The initial measure M_1 permits a comparison of the two groups so that any exogenous differences can be accounted for. At M_2 a second observation is taken which permits observation of the difference (if any) between the group exposed to treatment and the group with no intervention. Between M_1 and M_2 sufficient time should have lapsed to allow the effect of treatment to reveal itself. The use of three measures or observations M_1, M_2, and M_3 also permits assessment of whether there is further change in group A between M_1 and M_2 and between M_2 and M_3. It also permits comparison across time of one group, i.e., group B. In this case, group B is measured for the effects of no treatment, M_1 to M_2, and then for the effects of treatment, i.e., by comparing the periods M_1-M_2 with M_2-M_3.

5. Finally, there is a cohort approach to institution program evaluation. The term cohort analysis generally refers to any study in which there are several measures of some characteristic(s) or a sample of individuals from one or more cohorts collected at several points in time. The design finds application in the program evaluation context in that it allows one to

capitalize on the routine passage of individuals through formal and informal institutional settings. In the case of Panama, it allows one to capitalize on the passage of people through various nutrition programs. It is this natural succession that provides the potential comparative framework. The design is particularly well suited to situations in which natural maturation results in significant changes in measures taken on individuals, such as is the case for children and infants in nutrition programs. The concept of cohorts allows one to incorporate the maturational component directly into the analysis through the equation of cohorts on age. By controlling for age through the structure of the cohort, any maturational changes indexed by age are adjusted for in the analysis comparing the responses of different birth cohorts exposed to varying lengths of treatment.

The design should be adaptable to Panama's nutritional programs, especially those that focus on pregnant women, infants and young children. Participants enter the program at different maturational stages (e.g., gestational age), experience treatment exposure of varying types and amount, then leave the program. Some queuing may occur and not all participants complete the full treatment period. Overall, however, the client flow, while resembling a trickle flow process, should be fairly continuous. This flow can be exploited to create two independent comparison groups: pretreatment cohorts and post-treatment cohorts. The fact that participants enter the program at different maturational stages, defined here as age (or gestational age for women), can be used to construct birth cohorts that differ with respect to treatment exposure but are at the same age at the point of outcome measurement. The procedure basically involves matching participants entering the program with cohorts either at a later stage of program involvement (e.g., 6 months in the program) or at program exit. The entering cohorts would constitute the pre-treatment cohorts, the participating or existing group would comprise the posttreatment cohort. Thus, one would have a birth cohort partitioned into two groups: those that were exposed to treatment and those that were not. A schemata of the basic design strategy is displayed below.

Selected Cohort Design



where:

0_1 = Pretreatment cohort.

0_2 = Posttreatment cohort.

X = Treatment exposure.

D. <u>An Example of A Data Analysis Strategy Using the Cohort Design</u>

In this section we will describe a data analysis strategy that has been developed to fit a cohort design approach. The analysis will be initiated by generating descriptive profiles on each of the variables. The descriptive statistics will include means, medians, and selected percentiles and estimates of their standard errors. The population of participants below certain predetermined cutoff values with respect to widely used nutritional status measures will be used. Descriptive statistics could be generated for the entire sample and for subgroups of the sample determined by variables such as race, program model characteristics, age, gestational age, and sex (for children).

During the initial stages of the evaluation it will usually be necessary to address several key issues that could impact upon subsequent analyses. First, it will be necessary to examine the selection process underlying the construction of the comparison groups to identify any marked dissimilarities on key mediating variables which could serve to confound later analyses. The magnitude of the differences between the groups must be coupled with information on the measurement reliabilities associated with the variables contributing to the dissimilarities to gain and indication of:

-- the magnitude and direction of potential bias introduced into any subsequent analyses due to comparison group nonequivalences; and

-- the extent to which statistical techniques, such as ANCOVA, will enable unbiased estimates, given the magnitude of measurement error present.

A second major concern would be the problem of attrition from comparison groups, both in terms of the amount and pattern of attrition. The amount of attrition directly relates to the statistical power of the design to detect treatment effects of different sizes. It is necessary to examine the amount of attrition in order to gauge its impact on the sensitivity of the design, with reference to specific outcome measures. The issue of the pattern of attrition relates to the point of comparison group non-equivalence. The extent to which the pattern of attrition is non-random across comparison groups could be directly assessed using a variety of techniques (Rutman, 1977). Those variables affected most by the attrition pattern, in the sense that they reflect non-random attrition by serving to distinguish between the comparison groups, should be incorporated into subsequent analyses.

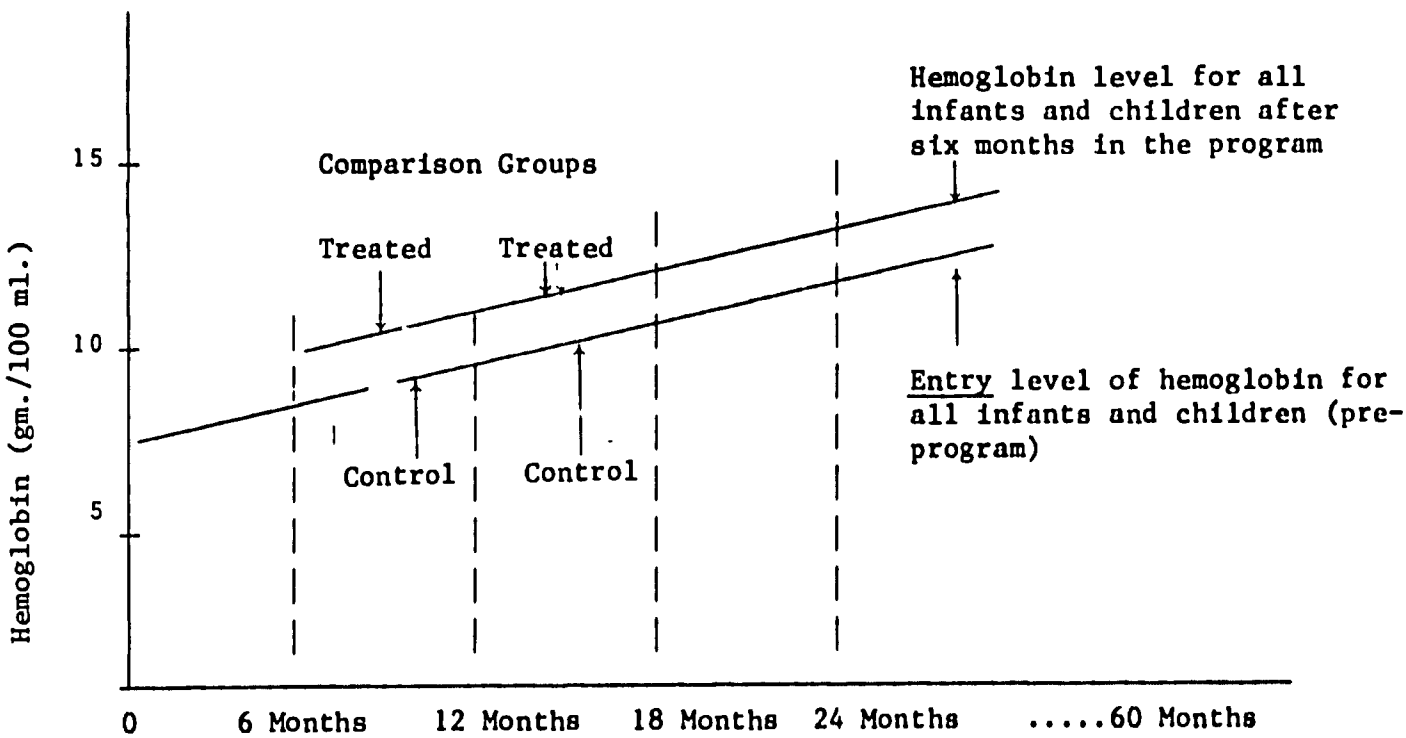
The data analysis strategy should be based on the general linear model (Searle, 1971). The univariate and multivariate analysis of variance and analysis of covariance and regression approaches are included in this framework. In view of the fact that in most instances the number of observations available for analysis will not be equal in all the relevant cells (determined by the combinations of levels of factors included in the specific analysis), the analyses should be carried out using statistical algorithms which are capable of dealing with unbalanced data, for example, the GLM procedure in SAS (1979).

It should be recalled, from the discussion in the last section, that the cohort design is site-specific. It does not require a separate nonprogram comparison group. The data collected at program entry will be used to estimate treatment effects. The manner in which this will be done is illustrated below.

In the case of infants and children, chronological age is a major determinant of outcome measures of interest such as weight, height, nutritional intake, etc. In Figure 3 we present the relations (hypothetical) between an outcome measure and chronological age for the entry and 6-month follow-up hemoglobin. These outcome measures are taken at entry and at the subsequent follow-ups. Assume for discussion purposes that the follow-up visits are 6 months apart. The first follow-up will occur at 6 months, and the second follow-up will occur at 12 months. Note that if the children enrolled are in the 0 to 60 months age group, this group will be in 6-66 months age group at 6

Figure 3

Hemoglobin Levels in Infants and Children
at Entry and at the Six Month Evaluation



months and 12-72 months at the second follow-up. Let us assume that we want to study to program effect on children 24-30 months at the end of the study.

Consider the children who are between 24-30 months when the particular outcome measure was taken. This cohort consists of three subgroups:

-- those who were 24-30 months at the time of entry to the program,

-- those who were 24-30 months and were in the program for 6 months, and

-- those who were 24-30 months and were in the program for 12 months.

Note that these are three different groups of children. The major difference among these groups is the duration of time they were in the program. The differences in the outcome measures of these three groups, after adjusting for other relevant factors in the general linear model framework (ANOVA or ANCOVA), are attributable to the differences in the duration of treatment exposure (i.e., program participation). The group 24-30 months at entry is, in this sense, a control group in the analysis.

As pointed out in the prior section, the strategy followed is to compare children of the same age at the time the particular outcome measures are taken. In the case of pregnant mothers, the strategy will be to compare groups of women who are at the same gestational age (gestational age cohort). Thus the data will be partitioned into several sets according to age at visit for children and gestational age at visit for women. Separate statistical analysis will be carried out for each of the data sets.

The statistical techniques that could be used in estimating treatment effects consist of:

-- Analysis of variance (univariate and multivariate),

-- Regression analysis,

-- Simple t-tests, and

-- Multiple contingency table analysis.

Analysis of variance techniques would be used for assessing the statistical significance of the effect on outcome measures of interest (weight gain during pregnancy, change in intake of specific nutrients, changes in growth parameters, etc.) of several factors jointly and individually. The choice of the effects to be included (main and interactive effects) will be based on statitical and substantive considerations. Suppose that we are interested in the statistical significance of ethnic origin, age group, and

program type on weight gain during pregnancy. Furthermore, we might be interested in testing whether there is an interaction between program type and ethnic origin on maternal weight gain. The data for participants in a specific pregnancy interval group (say, 24-28 weeks) could then be analyzed using the following model:

$$Y_{ijktn} = \mu + R_i + A_j + D_k + M_t + (RM)_{it} + \varepsilon_{ijktn}$$

where

Y_{ijktn} = the weight gain for the nth individual in the cell characterized by the ith ethnic origin, j^{th} age group, k^{th} level of duration in the program, t^{th} program type,

μ = a constant,

R_i = effect of the ith ethnic origin group,

A_j = the effect due to the jth age group,

D_k = the effect due to the kth level of program exposure

M_t = the effect due to the tth program type,

$(RM)_{it}$ = interaction effect due to the ith ethnic origin and the tth program, and

ε_{ijktn} = random error due to unmeasured sources of variation.

A test of the hypothesis that there is no effect of duration in program on weight gain is a test of the equality of the set of parameters D_k. If the situation warrants, some of the analysis could be done based on nested classification (sometimes also referred to as hierarchical classification) instead of a cross classification (Winer, 1962). A situation where such an analysis is appropriate is the following: suppose there are K program sites and there are ℓ_k subcenters (possibly Health Centers) within the kth site. Here the subcenter variable is nested within the center in the sense that there may not be anything in common between subcenter number 1 in sites k and ℓ. This is accounted for in the model by treating subcenter as a variable nested within a site. Thus the effect that will be included in the model will be the effect of a subcenter within a site and not a simple subcenter effect.

The summary statistics presented in the discussions and reports could include adjusted means of outcome measures of interest based on the models used in the analysis for each population group of interest. The adjusted mean

for a subgroup based on a specified model is an estimate of the mean of the group that would be expected had equal number of observations been obtained in each relevant cell. For example, based on the above model the adjusted mean for the kth group according to the duration of the program is given by

$$\mu + D_k + \frac{1}{I} \sum_{i=1}^{I} R_i + \frac{1}{J} \sum_{j=1}^{T} M_t + \frac{1}{I \times T} \sum_{i=1}^{I} \sum_{t1}^{T} (RM)_{it}$$

where I denotes the number of levels of ethnic origin, J the number of levels of age, and so on.

It is worth noting that the parameters are estimated based on all the participant data included in a given analysis. The model implicitly assumes that the relationship between the outcome measure and the effects due to age, program type, and ethnic origin in the groups of participants included in the analysis are parallel (i.e., they differ only with respect to the intercept). If the assumption is reasonably valid with respect to the pattern of attrition observed in the study, the analysis based on the model is relatively free from the biases due to attrition.

Some of the analyses also will probably involve the use of regression techniques which are essentially generalizations of analysis of variance principles. These techniques will be used when the variable of interest is assumed to have some specified functional relationship with the factor or factors which are presumed to have an effect on it. The relationship is usually polynomial in nature and the analysis consists of estimating the parameters in the relationship and testing them for significance. For example, if one wishes to investigate the statistical significance of a linear relationship between birth weights of babies and economic conditions (e.g., income) of families the appropriate model would be

$$B_i = \alpha + \beta W_i + \varepsilon_i$$

where

α = intercept

B_i = birth weight of the ith baby in the sample,

β = the increment in birth weight per unit increment in family income,
W_i = family income of the mother of the ith birth, and
ε_i = random error due to unmeasured sources of variation.

The hypothesis to be tested in this case is that $\beta = 0$ and if this hypothesis is accepted (i.e., not rejected) one concludes that birth weight and family income are not linearly related.

The analysis of variance model and the regression model are often merged into a single model, analysis of covariance. This model is useful in performing analyses like those usually handled through the analysis of variance but where there are mediating variables present which influence the measurement of interest but are of no intrinsic interest itself. Covariance analysis allows one to partial out of the analysis the variation in the variable of interest due to the influence of the covariable.

Techniques of multiple contingency table analyses can be used for analyzing data sets in which all variables are categorical in nature. As an example, consider the impact of Panama's nutritional programs on the prevalence of low weight for age. This can be illustrated by the following example.

Let A = low weight for age (yes, no),
B = race (Black, Indian, other), and
C = duration in program (0, 6 months).

Assume that we are interested in looking at the children aged 12-18 months at visit. We will then have two 2 x 3 tables: 1 for initial visit and 1 for the 6-month visit. Let n_{ijk} denote the number of children in the 12-18-month age group at the kth visit (k = 1 for initial, 2 for 6-month follow-up) with i^{th} status for anemia (1 = low weight, 2 = non-low weight) and j^{th} race (1 = Indian, 2 = Black, and 3 = other). If none of the n_{ijk}'s are zero, then we can analyze the data using the following model:

$$\text{Log } n_{ijk} = U + U_A(i) + U_B(j) + U_C(k) + U_{AB}(ij) + U_{AC}(ik) + U_{BC}(jk)$$

where the U terms involving 1 subscript can be thought of as the main effects and terms involving two variables can be thought of as interaction effects. A test of the hypothesis that the $U_{AC}(ik)$ terms are equal to zero is a test of the hypothesis of no difference in the proportion under weight between those in the initial visit group and those in the 6-month visit group. Notice that

the model includes adjustment for the differences in the race distribution of the two groups. If the two groups differ with respect to variables other than race, these variables can be included in the model.

D. Application of Models to Panama

Any or all of the evaluation models presented above may be used in analysis of the National Nutrition Survey data. In particular, where districts can be located which are otherwise comparable, but where one district received treatment (was participating in one of the nutrition programs) and the other did not, then one or several of the models may be used to conduct impact evaluation. With the survey data presently in hand it appears that it will be possible to breakout the data at the district level, to identify treatment and nontreatment districts, and procede to make comparisons. Whether the cohort model can be utilized remains to be determined. Efforts will be made, however, to test all evaluation models in order to assess their discriminatory power, comparability across models, cost of use, data requirements, etc.

In the next subsection we present information on the sampling schemes utilized to conduct the national survey. Understanding of the sampling frame and procedures is important in terms of understanding the limitations on the data.

E. Sampling Design Used in the Panamanian Nutritional Status Survey

The sampling designs for surveys which are intended to estimate national nutrition status are not necessarily identical to sampling designs intended to estimate the impact of nutrition programs on targeted subpopulations. In Panama the material received by RTI, "Diseño De La Muestra Para Investigar El Estado Nutricional De La Poblacion En La Republica De Panama," produced by Mr. Federico Guerra G and the work by Raul Batista (RMBE) are sampling designs developed for a nationwide survey of nutritional status.

The authors identify ten strata, which correspond to the ten provinces or health regions of Panama, and the number of census segments contained in each stratum. From these strata a sample design is developed which is a stratified, random, clustered sample, where the clustering occurs by segment. The number of segments drawn from each stratum was based on the proportion of population in each coresponding stratum. The actual or absolute number of residences

selected from each stratum, however, included a process of over- and under-sampling in order to assure an adequate sample from each stratum. Once the number of segments within each stratum had been selected, the individual segments were then drawn randomly. From this process it then becomes possible to calculate the weight to be attached to each stratum. For example, Stratum #1 (Bocas del Toro), with a total of 390 segments, had 8 segments selected for the national survey, or 390/8 = 48.7500, the reciprocal of the probability of selection. Similar weights were calculated for all ten strata. In the paper by Mr. Guerra, they are titled, "Factor de Expansión del Estrato." Additional weighting information, "Ponderación del Estrato," is provided and may serve for a post stratification weight adjustment, an average across strata. Based on the author's comment regarding adequate estimates at the national and district level, each stratum can also serve as a self-representing primary sampling unit. The sample design and corresponding sample sizes are intended to facilitate calculation of reliable estimates of population parameters regarding the nurtitional status of the national and district-level populations. At issue in the sample design is the ability to accurately and reliably infer nutritional parameter values from the sampled population to the populatio at large. The large sample size assures this capability. From the perspective of nutritional program evaluation, the sampling design appears to meet both external and internal validity criteria. In addition to parameter estimation and inferential power, evaluation requires that the sampling design permit tests of hypotheses, specifically tests of differences between treated and nontreated populations. Initial analyses suggest that this capability also exists.

F. Process Indicators

Although the methodology to be designed refers to an impact evaluation, it will be necessary to obtain some information about certain process variables, in order to allow the evaluators to determine the extent to which essential linkages between program inputs and outputs (i.e., impact) have been achieved. It is important to determine the extent to which certain service delivery characteristics, which are part of the intervention, and the level of need and exposure of the target population to the services, would allow one to expect any measurable impact on the selected impact indicators. There are a number of examples of impact evaluations which have been carried out with

quite sophisticated methodology, yet producing surprisingly poor results, where an appropriate process evaluation would have allowed one to predict the absence of any impact (Mora, 1980).

In monitoring the extent to which the program implementation is consistent with design specifications, and assessing the extent to which the target population has been reached, the process evaluation should address:

1) The accessibility of services;
2) The availability at the intervention site of the resources needed to provide the services;
3) The adequacy of services as related to population needs with respect to amounts, duration, timing, coverage and possible bias towards subgroups.
4) The accountability of staff in providing project performance data to supervisors and funding agencies.
5) The acceptability of the services to the community.

1. Accessibility to the Services by Population in Need: This theme requires special attention due to its being a critical factor in a process evaluation.

The concept of accessibility is not yet well defined, and even less clear is the concept of how to measure it and how to evaluate it. From the demand side, it is necessary to analyze certain characteristics of the population which might determine demand. Three determining components have been suggested (Andersen, in Santamaria, 1980):

- A "predisposing" component, related to the propensity of the individual to utilize the services. This includes a series of characteristics related to KAP values and attitudes previous to the immediate need of utilizing the service; to be verified through degree of utilization of previous intervention programs;
- A "capacitating" component, related to the means available for the use of services. This includes personal and family resources as well as community and area resources;
- A "need" component, which refers to the immediate problem to be solved through the services, and which is the most immediate cause for the utilization of the services. This need refers to that defined by the intervention itself as well as to that perceived by the individual.

Implicit in the concept of accessibility is also the fact that certain population groups have greater or less access to the services than others, due to not only supply characteristics but also due to biological and social characteristics of a specific group.

2. Availability: Although the concept of availability deals with the evaluation of "inputs" and not necessarily of "process," still, it is important for the process evaluation to know whether the inputs required for carrying out each intervention are really available. Inputs should be quantifiable, and might include indicators of availability such as those described below for health service programs:

- Availability of health service units in operation, complete, incomplete, under construction, being remodeled, etc.
- Staffing for each unit.
- Population to be covered, with coverage goals
- Development of human resources; goals for training of personnel, by program.
- Equipment: food, instruments, vaccines, educational material, vehicles, etc.
- Availability of water system: goals for coverage of water systems, chlorination, plants, pumps, latrines, pipes, etc.

In some cases, it is not sufficient to know amounts only--it might be just as important to obtain information about quality. Take for example, a case where a health post received a shipment of measles vaccine, and administered the vaccine to 97 percent of the children in its area of influence. The following year, however, it was noted that the incidence of measles increased in that area. A careful investigation discovered that the health post did not have refrigeration, and thus the vaccine had been stored unrefrigerated, and had lost its protective ability. Thus, information about the percentage coverage against measles would have provided, in this case, an inaccurate indicator. Another example relates to the vaccination against polio, which requires 3 doses to be effective. Information on the number of children vaccinated against polio, without information on how many of those had been first, second or third dose, would not be an adequate indicator.

It should be kept in mind, however, that the indicators to be developed should be easy to obtain routinely, without increasing the work burden of already over-worked field staff.

3. Adequacy: If resources are sufficient, it is desirable that a large percentage of the population in need be served by a program. Problems may arise, however, if services already are overburdened while serving an inadequate percentage of eligibles. It would not seem practical to increase the utilization of services without first reducing the volume of inadequate utilization, perhaps through use of stricter eligibility criteria. If the needy population does not perceive its need, or perceives the services as being inaccessible, inadequate, or unacceptable, the result will be an under utilization of the services available, with consequent waste of resources and inefficiency in solving problems. Comparison between sites may also be useful in determining adequacy through understanding target group differences as well as staff, administrative and other contextual differences. Measures of utilization may be drawn through use of records, surveys of participants or community surveys, although the latter methods might well prove to be prohibitively expensive.

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IV. ECONOMIC MODELS

A. Introduction

In this section of the report we discuss some economic models which will be used in evaluating nutrition programs. The discussion will focus first on general micro-economic models of household behavior and consumer choice. This material will be followed by a discussion of the application of the models to the fields of nutrition and health status.

B. Economic Models

1. Traditional Concepts

Traditional microeconomic theory focuses on human behavior as people make choices, both as consumers of goods and services on the demand side and as producers or input factors in the production process on the supply side. In their demand side activity, people are viewed, either individually or collectively, as demanding or choosing goods and/or services in a manner which maximizes their satisfaction or utility, given their levels of income. In the case of goods, the goods were viewed as providing satisfaction directly. The consumption process is viewed as an individual activity. Aggregations of persons into consuming units, such as families, is not emphasized. Also, there is little emphasis given to the energies and time necessary to undertake the process of comsumption, nor the fact that the household is both a producer of goods and services which produce satisfaction and a consumer of that satisfaction.

On the supply side, individuals are generally seen as inputs in factor markets who contribute their time and skills to firms in return for salaries or wages, which in turn generate money income to purchase retail goods and services.

2. The New Consumer Theories

In the early to mid 1960s, several lines of economic thought were evolving in the field of micro consumer theory. The principal contributors to this work were Gary Becker [Becker, 1965], Kelvin Lancaster [Lancaster, 1966], and Richard Muth [Muth, 1966] in the United States, and Duncan Ironmonger [Ironmonger, 1972] in England. Although similarities exist between the contributions of these authors, there are also different areas and degrees of emphasis. Becker, for example, places emphasis on the allocation of time and

development and use of human capital. Lancaster expanded traditional consumption theory to introduce characteristics or attributes of goods in addition to the goods themselves. Muth, on the other hand, developed the notion of collective consumption and production within a family unit. His work places specific emphasis on the use of a household production function, where family or household members contribute their time and skills to produce collective services consumed by the members. Work activities include both work performed within the household and work performed outside the household, i.e., within the traditional factor markets.

The synthesis of these models has resulted in a new microeconomic theory of consumer behavior. The claims of this new theory include the following:

a) Analyzing consumer behavior in terms of preference patterns of the services which flow from goods <u>and from people</u>. These service flows can be viewed as characteristics or attributes of the goods and they can be defined in terms of attributes which satisfy human wants or needs. Such wants (needs) can be physiological or psychological in nature.

b) The theory acknowledges that not all dimensions of consumer satisfaction are derived from goods and services purchased in the market place. Consumers also obtain utility from goods and especially services which they produce at home. In fact, the household is now viewed as a production-consuming unit where members are involved in using various combinations of inputs, both purchased external to the household and provided by the members themselves, to produce a combination of outputs which are in their most basic form collective satisfaction or utility for the household.

c) One of the major inputs used in the household production model is the time of household members. In order to assess the value of member's time, time prices are usually estimated from salary/wage data or other proxy variables which could serve as indications of society's evaluation of the value of people's time. These estimations usually under-value the worth of people's time to the extent that not all human production activities

enter the market place. In addition, the individuals evaluation of the worth of his/her time may be different (higher or lower) than society's evaluation.

d) An additional component of the evaluation of household time is recognition of the different levels of education, technical training and general experience of people which adds to their human capital. The concept of human capital is essentially an adaptation of the traditional concept of capital, which is that it is an input in the production process which is also an output of some previous production process. In the case of human capital, the inputs used to increase the size or stock of human capital are education (formal and informal), health care, diet and exercise, and whatever other general experience which increases the individual's ability to produce (and one might add consume) more efficiently. An individual with a large stock of human capital will produce (and probably consume) more effectively than a person with a lower stock.

e) The combination of monetary income and household production introduces the concept of full income. This concept basically recognizes that the income available to members of a household is usually greater than the money measures of income earned in factor market places. The value of that income, similar to the value of household labor in the household production process, is determined by the value of the time contributed by the combined individuals in the household to the household production process.

f) Finally, the theory includes concepts of market prices of goods and services and factor prices, as well as internal or shadow prices of resources within the household. In this fashion, the theory is used to analyze the allocating of household resources in terms of their marginal contribution to household satisfaction, as well as within the external pricing system of the market place.

With the expansion of micro consumer theory to address these additional dimensions of human behavior, the explanatory power of economic

analysis was enlarged such that it could more effectively address some heretofore highly subjective areas of human activity. Specifically, economic analysis could now incorporate more of the psychological explanations of consumer buying practices, some of the motives and consequences of intra-family decision making, more of the dimensions of the consumption process, the interaction of household activities with market activities, and specifically, the economic motives behind consumer behavior in such areas as human nutrition and utilization of health care services. In the next two sections of this report we will consider use of the theory in the fields of nutrition and health.

3. An Economic Model of Nutrition Behavior

In this section we will present an example of the use of the new consumer-household production model as it has been applied to the field of human nutrition.* In the particular example to be cited below, the interest of the study was to use economic analysis to determine why families with malnourished children did not increase food consumption by the size of the food transfer they received from government programs. An area of particular interest in the study was the role of the mother in the acquisition and provision of food to the children and how she used her time and other dimensions of human capital to affect the nutritional status of the children.

In order to accomplish these objectives a household production model was developed, from which a calorie demand equation was derived. Utility was assumed to be derived from two household commodities--children's services and parents' consumption. These commodities were viewed as produced within the household according to three production functions--child quality, number of children and the household's nonfood consumption. The elasticity of calorie demand with respect to the value of the mother's time was also derived. This produced an empirically testable hypothesis: that the partial elasticity of substitution between mother's time and calories is negative and substantial.

*For a more thorough discussion of this topic, see David L. Franklin, "Malnutrition and Poverty: The Role of Mother's Time and Abilities." Research Triangle Institute, Research Triangle Park, North Carolina, February, 1979.

The study also endeavored to explain the low market income elasticity in the demand for calories. In addition, mother's time and abilities were hypothesized as complementary resources that combined with food and other inputs to produce children's nutritional health. In the settings of the study (Cali, Columbia), time and abilities were scarce and had few substitutes. Consequently, food transfers alone would not improve children's nutritional status unless more of the mother's time and abilities were made available physically, through skill augmentation, or through the evolution of a market for substitutes such as day care centers.

With regard to the impact of human capital, it was assumed that families make critical decisions regarding a child's nutritional health. These decisions begin with mate choice and conception, and continue with choices regarding prenatal care, nursing, feeding, training and provision of health care, etc. All of these choices are influenced by economic variables, and have economic consequences for a woman and her family. Material resources and human resources enter into these choices. Time is required to deliver the services of the human resources. Time is needed to make allocative decisions regarding mate choice, number and spacing of children, market purchases, production in the market and in the household, and the use of leisure time.

Quality and quantity of foods stuffs are major factors in the production of child nutritional status. Disease, on the other hand, contributes to malnutrition through calorie losses during fever episodes and episodes of diarrhea and through denial of certain foodstuffs to the ill child.

In this application of the economic model, food intake and good health were both treated as factors in the production of nutritional status. Medical services, sanitation, crowding, housing conditions and disease are other factors affecting health status and consequently nutritional status. Mothers' time and the time and abilities of other family members interact with each of these factors in three ways: (1) knowing which factors to use, (2) knowing how to use these factors and (3) the "doing" that complements the factors. These interactions are inextricably linked. It is in this manner that time embodies knowledge and abilities. Action is required to make knowledge and abilities productive and action also requires time. Higher levels of knowledge and ability make time more productive.

As discussed above, traditional microeconomic analysis, when applied to the problem of malnutrition, generally pursued a neoclassical analysis of

food demand, and overlooked, or at best relegated to "taste," the parameters and information about household members' allocative abilities and their allocation of household time. The Becker-Lewis theory of household production [Becker-Lewis, 1973] offered a more useful approach to the problem of the persistence of malnutrition by focusing on the allocation of women's time and abilities.

According to a household production approach, children are a source of current and future satisfaction of affective and material wants. Current theory considers this flow of services emanating from children to be the result of two factors, quality per child and number of children. Indicators of child quality (health, nutrition, cognitive scores, schooling performance, earnings, etc.) and number of children in a household compete for the same time and material resources. Each household must choose between marginal increments to child quality and child number.

The demands for quality and number of children are derived demands for commodities produced internally by the household with time and market goods and services. Each of these commodities has its own internal price determined by the conditions of demand and of production within the household. To acquire the market factors of production, the household must trade goods and services it produces with other households and firms [Willis, 1973].

In order to more rigorously conceptualize the new household production theory to the situation of child nutritional status, a model was developed to derive the demand for calories and children services. The general goal of the model was to provide insights into the use of time and human abilities as factors of production in nutrition.

4. Household Production Model in Health Care

In general, the application of the new micro theory in the field of health care is quite similar to its use in nutrition. Although several approaches are possible, an example will be provided which illustrates the similarities between health and nutrition.

The nature of the relationship between health status and various social and economic conditions is a central focus of research in both the health care sector and social sciences in general. Of primary interest has been the desire to develop a set of strategies that would alter socioeconomic conditions (e.g., income, prices, education, information) such that a higher or better level of health status is achieved by the population. Actions by

various individuals or groups are based on explicit or implicit relationships between health status and socioeconomic conditions. For example, age-sex-race associations with various health conditions are used as a basis for developing health planning strategies to improve the health of these groups. Increases in the supply of health services and resources are undertaken to increase the amount of health care provided which in turn will improve health status. Explicit recognition is given to health care as a predominatly purchased service. Therefore, increased amounts can be purchased through appropriate alteration of prices, incomes, or both, thus raising the level of health status. Other programs promote alterations in individual diets or habits (e.g., smoking) to promote an improved health status. Water fluoridation and reduced pollution (e.g., air and water) programs are often promoted, developed and implemented on the basis of improving the health status of a population.

Grossman [1972] has rather succinctly provided the general basis for a study of the demand for health that starts from the notion that "individuals invest in themselves." The most obvious form of investment people make is in their education. The expected payoff to this investment comes in the form of increased productivity in the market sector of the economy (in production of earnings) and in the nonmarket sector where the individual produces commodities (with his/her own time and resources) that enter directly into the utility function. This approach has been used [Becker, 1965; and Ben-Porath, 1967] to develop models to determine optimum amounts of investment in education and to show how the optimal quantity varies over the life cycle of an individual and among individuals of the same age. Health is also viewed as a form of human capital. Health, however, has been differentiated from education in that the latter focuses on increases in productivity in the market sector while investments in health increase the period of time one can spend in producing earnings and commodities (e.g., see Grossman, 1972; Becker, 1973).

The primary demand is for health rather than health services. Since, however, individuals make use of market goods and services in the production of such commodities, the demand for market goods and services becomes a derived demand not unlike the demand for resources by a business firm in the market sector producing goods and services. In this approach, the level of one's health depends upon the amount of resources (market goods and services, and own time) one is willing and able to devote to the production of

health. Health is demanded as a source of increasing utility, as well as a means by which the time period for market and nonmarket activities can be expanded. The household production model discussed provides a useful framework for considering these effects as it allows for inclusion of the full price of care (both money prices and time costs), the separation of income into work and nonwork related components and a distinction between market produced and home produced health care.

Conceptually, individuals are assumed to desire the services derived from their health. In order to obtain the optimal amount of services, individuals must engage in certain activities of preventative health care and in doing so must expend various amounts of time and resources that could be devoted to alternative uses. Preventive care activities are also undertaken in the home setting. Each of these activities has various substitution and complementary relationships in the household production, may be purchased, and requires the use of time. Changes in factors affecting the decision to produce (e.g., market prices, income, education, prepayment for care, and environmental conditions) will induce changes in the demand for health care.

For purposes of this discussion, it is assumed that individuals* possess an intertemporal utility function of the following general form:

$$U = U(G_t, H_t) \qquad t = 0,\ldots,h \qquad (1)$$

where G_t represents an aggregate of all commodities besides services of good health entering the utility function in period t, and H_t are the services derived from the stock of health in period t, and h is the length of the decisionmaking horizon. Services derived from the stock of health include full use of body functions, productivity, appearance, comfort, etc. The net amount of services derived is affected through decisions to invest in market produced health care and home care practices. H_t represents a flow of services and can be considered to be a random variable.

*The individual is assumed here to be the decision maker regarding the level of services that enter the utility function. In some cases this may not be the direct consumer of care or the individual possessing the stock of health, as is the case of parents who make decisions for their children.

The intertemporal utility function is used here due to several characteristics attributable to health and decisionmaking regarding health production. Due to the chronic nature of some diseases, decisions regarding health extend across time and can be made at different points in time. There are also life cycle effects that influence decisions made about health. The incidence and prevalence of diseases and health conditions are related to age, sex, working conditions, life style, etc.

For each time period, the individual faces a time constraint that requires, for any period t, that the total time available be exhausted by all possible uses. The total time devoted to producing health can be usefully partitioned into T_F (time spent in household produced services) and ΣT_C^i, i=1..., n (time spent in consuming market produced health care) where there are n components of health care that can be delivered. Therefore,

$$T = T_L + T_F + \Sigma T_C^i + T^*, \quad i=1,\ldots n \qquad (2)$$

where T_L is total market labor time, and T^* is all other time.
It is assumed the T_C^i represents the full-time spent including transportation time, waiting time, and service delivery time to receive service i.

For each individual, market goods and services, and own time are scarce resources. Therefore, each individual faces a life time wealth constraint wherein total wealth at death is zero. At the present time, an individual may "inherit" either a positive or negative wealth position:

$$\sum_{t=0}^{h} \left(\frac{1}{1+r}\right)^t \left[P_{Gt}G_t + \sum_{i=1}^{n} \phi_{it}P_iC_{it} + P_{Ft}F_t + E^* - W_tL_t - Y_t\right] \qquad (3)$$

where: P_{Gt} = prices of market goods and services other than market produced health care,

ϕ_i = the fraction of the market price the individual must pay for a unit of market produced health care [this fraction could vary in amount from zero (for free care), $0 < \phi_i < 1$ (for those covered under a prepayment plan with a copayment arrangement) to unity (for those required to pay the full market price); ϕ_i can also vary by component of health care],

P_i = the market price of the ith type of health care,

P_{Ft} = the unit monetary cost to produce units of home produced health care,

E^* = represents the first period net inherited wealth position,

W_t = the individual's market wage rate,

Y_t = unearned income (e.g., property income),

r = the market rate of interest,

C_i = quantity of the ith type of market produced health care, and

F_t = quantity of home produced health care.

All income is after tax income. The individual is assumed to choose levels of the choice variables (G_t and H_t) in order to maximize utility subject to constraints including the time and expenditure constraints discussed above.

The individual implicitly faces a production function for health that has the following general form:

$$H_t = H(\lambda_t N_t) \tag{4}$$

where: H_t = services derived from the individuals stock of health in the t-th time period,

N_t = a measure of the stock of health in time period t,

λ_t = flow of service per unit of stock in time period t.

where N_t offers positive marginal products in the production of health services. The total input of services from the stock of health in period t is $\lambda_t N_t$. Greater amounts of N_t will generate a higher total output of services than lower amounts. The production function (4) is a technological relationship between the amount of input and the output of services.

The measure of services, H_t, is assumed to be an unobservable variable. However, each individual is assumed to have seen a physician and received an accurate diagnosis of the condition of N_t at some previous point in time. The time since this diagnosis will vary greatly over a large group of individuals.

At the time of diagnosis, the individual acquires information and is assumed to know the condition of N_t. This condition includes the current state, past destruction due to injury and disease, ongoing disease processes that were not previously treated, etc. Therefore, at the time of the previous diagnosis the individual is made aware of various conditions for N_t which implies a level of H_t.

With time, the individual faces the risk of disease and injury. For purposes of exposition we will focus here on the disease process as it effects N_t. Consider a variable, D, that measures the extent of disease. Since the individual may not know exactly the extent of disease, D represents a random variable to the individual whose distribution can change over time due to the growth of on-going disease. Between physician visits the individual may not know exactly the extent or condition of the N_t input in the health services production function, but he/she does know that destruction due to disease leads to a reduction in N_t and a lower H_t. Therefore:

$$N_t = N^* - D_t$$

where N^* measures the condition of the stock of health at the time of the previous diagnostic visit and N_t measures a condition of the stock of health at time t (following the previous visit).

The introduction of the variable D and the concept of disease requires a stochastic model and some specification of the statistical distribution of the random variable. The type of distribution will depend on the characterization of the disease, as each illness usually shows different patterns of development, etc.

This discussion has provided an elementary introduction to the use of the new micro theory in health care. The similarities between the two models should be obvious. Stock concepts may have been more explicit in the health application, but they exist in nutrition as well. The role of household decision making is equally important in both cases, as is the use of time and other human capital resources. Inasmuch as health and nutrition are closely interwoven, likewise these two applications of the micro economic theory are closely linked and work together effectively. In the discussion of data sources and estimation processes, the overlap and complementarity of the models will become evident.

5. Application of the Models in Panama

In conjunction with the evaluation methods discussed in the previous section of this report, the economic models presented above will be used to analyze the survey data to determine whether such models can accurately and reliably explain and predict intra-family decision making regarding use of nutritional and health care services. The models will, consequently, help determine the effect of educational programs on child nutritional status. They should also be able to give some indication of useful policy options viz-a-viz the marginal benefit and cost of feeding programs and health care delivery programs. In the analysis of the Panamanian survey data both models can be combined to analyze the combined impacts of nutrition and health care programs. Elasticities of demand for calories, for protein, and for various forms of health care service should be obtainable. Finally, the models can also be utilized to assess the potential impact of family size and family planning programs on child nutritional status.

Some of the hypotheses to be tested through these models are the following. In each of these tests the initial assumption, or null hypothesis, is that the beta coefficient before each selected variable to be tested is not significantly different from zero. Some of these variables, when regressed on measures of nutritional status are family income years of education, the type of person who attends to the care of the children, the birth order of children, the frequency of use of health care services, the availability of mothers time, the age and education of the mother, the quantity of children (as a test of quantity-nutritional quality tradeoffs), etc. Most of these relationships will also be assessed using cross tabulations, and some situations may justify the use of discriminant analysis. Some form of factor and cluster analysis may be used in the identification of vulnerable populations, especially at the district level. This analysis has been called "clasificacion funcional" in previous work by the INCAP organization.

Any additional techniques which seem useful as the analysis is proceeding will, of course, also be tested for their applicability to assessing nutritional status and programs in developing countries. Efforts will be made to discover the most reliable, accurate, dependable, and cost-effective evaluation and economic models, especially in light of the limited resources usually available in the developing world.

V. THE NATIONAL NUTRITIONAL STATUS SURVEY

A. History Behind the Need for a Survey

Initial talks with Panamanian staff clearly demonstrated their interest in carrying out a national survey, multi-sectoral in approach, which would be able to fill in the gaps found in the existing data and provide a complete diagnosis of the nutritional problem in the country. They had already developed a causal model for nutritional status in Panama along with a detailed list of all the information considered necessary for the definition and explanation of the nutritional situation in the country.

Some time was spent trying to determine how best to integrate the nutrition survey efforts with the RTI evaluation project. Sample design and questionnaire content were the two issues of importance to the integration of the two efforts.

The Nutrition Director presented his point, however, that the survey be carried out first, with full cooperation from RTI, so that:

1) Data might be available shortly for incorporation into the national 1981 sectoral plans; and
2) Data might be available to improve the knowledge about the nutrition situation in Panama, and thus provide better foundation to the causal model used for the evaluation project.

It was decided that all present efforts would concentrate on the survey, and smaller surveys would be carried out at a future date to satisfy the needs for the evaluation project.

It was known that much of the information listed was already available from different sutdies and governmental offices, so the next step was to decide which of the items had to be supplemented from the survey data itself. The original plan was to divide the work into two parts: the first part was to obtain a list of all the existing data, and do a quick analysis of it to verify whether it could be used or not (in terms of representativity, reliability, etc.); the second part would be the sample design and the design of the survey questionnaire itself, after completion or near-completion of the first part. For a presentation of the types of data sought in the first part, see Appendix C.

Time pressures, however, dictated that both parts be carried out simultaneously. The representative from the Ministry of Planning also argued that the country did not have good, representative, recent data on socio-economic

factors. In addition, even if good background data were available, most of the data would still have to be collected in the survey so as to permit direct linkages with other characteristics, such as the child's nutritional status. This aspect of being able to link data on individuals is of great importance, and sould not be under-rated. For illustrative purposes, the group discussed the availability of good health statistics, from a recent morbidity survey. However, aggregate data is not useful in this case: it is important to exactly which individual suffered from diarrhea or measles. With respect to immunization, however, health statistics show such a high coverage that the group agreed that it was redundant to verify individual coverage; in this case, it was decided that the simple possession of an immunization card would probably be sufficien information.

Thus, after much discussion, it was finally decided that the survey should cover the following aspects:

1) measurement of nutritional status (anthropometry);
2) food
   a) consumption and habits
   b) production, availability;
3) KAP (including knowledge and participation in other programs)
4) income;
5) health and environmental sanitation;
6) family composition;
7) work
   a) employment
   b) methods
8) other socio-economic factors.

A national census had just been completed (May 11, 1980), which included information on housing, family composition, income, employment, migration, education and literacy levels, etc. It would have been helpful if the data could be crossed with that of the nutrition survey, but there were several factors which made that impossible, at least for the time being:

1) The segments utilized in the 1980 census differ in some instances from those utilized in the 1970 census. Because of some problems with the 1980 segments, the nutrition survey plans to draw its sample utilizing the 1970 segments--thus there might be some difficulties in matching the information by segment.

2) Even had it been possible to match the information, by segment, the census, because of confidentiality clauses, would not be able to provide the Nutrition Division with information on specific households--the minimum would have to be an aggregate of at least three households.

3) Even had it been possible to obtain information on individual households, it probably would not be available before 1981--yet the Nutrition Division needs the information for the analysis of the survey data, which it plans to have completed by September 1980.

So, unfortunately, it was decided that those questions would have to be repeated again, as part of the nutrition survey, in order to be available for analysis. The identification part of the questionnaires, however, would be done as closely as possible to that of the census, in order to permit further cross tabulations, in the aggregate, in the future.

B. The Questionnaire

The questionnaire was divided into parts, trying to match the division of aspects to be included, inasmuch as possible:

I. Housing Characteristics
II. Household Composition
III. Health Services Utilization
IV. Education and Schooling
V. Migration
VI. Occupation and Employment
VII. Food Production (including animal production/hunting)
VIII. Participation in Other Programs
IX. Information on Women of Child-Bearing Age
X. Information on Children Under 5 Years of Age
XI. Food Consumption.

Parts II through IV include information on all household members, irrespective of age, Parts V and VI include information only for those members who are older than 5 years of age; Parts I, VII and VIII are to be completed for each household; Parts IX and X are to be completed accordingly, and Part XI includes information from only a subsample of the survey sample. Details on each of the parts of the questionnaire follow below. An example of the Questionnaire is provided in Appendix A.

Part I: Housing Characteristics

Some of the information desired here was to be used as indication of income or socio-economic status (i.e., type of housing, ownership, materials used in the construction, possession of household equipment, lighting); other questions were aimed mainly at verifying the existence of problems such as crowding, inadequate sanitary conditions (lack of indoor water connection, absence of bathroom, dumping of garbage), or difficulties in food preparation (indicated by the use of wood as a cooking fuel, for example).

It was suggested that perhaps some information might be obtained from the analysis of similar data collected from previous studies, in order to determine which questions or factors might have a greater indicator potential. However, it was argued that the data available were not representative, and thus could not be used, but maybe an index could be constructed from the data of the nutrition survey for future use. In addition, since the questionnaire was also interested in obtaining information on household expenditures, it was decided that it might be useful to leave in some of the questions, so as to be able to ask about expenditures (previous surveys in other countries seem to show expenditure as a better indicator than income, since respondents seem not to mind as much giving out information about expenses).

Most of the questions were copied from those on the census form.

Part II: Household Composition

Initial discussions about this part resulted in the thought that people's names would be asked for identification purposes and for possible follow-up (i.e., to obtain the anthropometric data, or to verify a questionable answer). Later on it was also decided that for humanistic purposes the names of those children with nutritional problems should be forwarded from the data analysis center in Panama City to the appropriate health center, for follow-up action.

The topic of age also brought forth some discussion, resulting in the addition of a question on exact birth date, so as to minimize problems in the analysis of the anthropometric data. However, since older people might not remember their exact birth date, age was also asked.

The sex of the person was of interest for purposes of anthropometry; relationship to the head of the household distinguished between children of the couple from children of the mother or the father only, since a study in Colombia showed that to be a very good indicator of nutritional status (the mother would pay more attention to the child of the actual spouse).

In order to avoid possible confusion and measuring errors, anthropometry was also included in this part, so as to be close to the age information. An entire morning was spent discussing anthropometry: who, how, when, where... The Nutrition Division wanted to take height and weight measurements of all household members, so as to get a feel for the prevalence of obesity too, presently considered to be an increasing problem in Panama. The RTI team argued against the practicality of that, for several reasons:

1) Validity: in order to obtain good information on the prevalence of obesity, the measurements should also include skinfold measurements, so as to separate musculr people (who might weigh a lot) from obese people. However, because of time constraints which would not allow for adequate training, this measurement was not to be included in the survey. In addition, the weight measurements were to be obtained from bathroom scales, which are known to provide large reading and sensitivity errors.

2) Logistics: a house-to-house survey is not likely to find school-age children or working adults at home; it is much more likely to find only the pre-school child at home, wih a caretaker. The losistic problems of follow-up were considered to be greater than the data was worth, in the opinion of the RTI team. However, the Division of Nutrition thought it could solve the logistic difficulties without too much problem.

With respect to the anthropometric measurements, only weight and height were selected. A suggestion was made to include arm circumference, mainly in a research context, to verify if it could eventually be used as an indicator of nutritional status, but the motion was over-ruled, as it would increase the time of the interview. It was noted, however, as a possible measurement to be included in the evaluation study.

Weight measurements were to be obtained from bathroom scales; the weight of a small child was to be calculated by weighing the mother holding the child and then subtracting the weight of the mother alone.

Since the anthropometry of the pre-school child is the most important data being obtained in this survey, RTI suggested that at least for their weights appropriate scales be used. Some information was sought about the possibility of utilizing a digital bathroom scale--which would eliminate some of the errors--but it was found that the digital mechanism was very fragile,

and thus it would not do for field use. The following suggestion was to obtain Salter scales, and information from AID/W DS/Nutrition reported no scales were available on a loan basis, but that they could be purchased from UNICEF in New York. Delivery was possible in a period of 5-10 days. RTI offered to put out the initial funds for prompt acquisition of the scales in order to avoid delaying the survey and assure that adequate measurements would be obtained for children's weights.

With respect to height measurements, the infantometer presently being utilized at the health centers for measuring children below 2 years of age was examined, and found to contain a number of defects (i.e., the moving scale ran down the middle of the board, so that once the child was stretched out on the board, any movement of the scale would pinch the child's skin). Drawings of several models tested by CDC were reviewed (Figures 1-3) and an adaptation of one of the models was ordered made by the Ministry's carpenter, for trial and evaluation by the Division of Nutrition (Figure 4). However, the model was not available by the time we left Panama.

For children older than 2 years of age, and adults, it was decided to use a tape measure attached to a smooth wall, using a T-square for reading the measurement. Although known to contain several elements of error (tape measure not perpendicular to floor, small gap between floor and tape, wall not completely even, etc.), the constraints imposed by having to carry other equipment from house to house made it difficult to consider the possibilities of such instruments. One factor which was overlooked at the time was the stretchability of the tape to be used--a fiberglass tape might be more recommended than the normally available measuring tapes.

It was suggested that the infantometer could be adapted for use in measuring the height of children under 5 years of age, but it was argued that as long as the tape would have to be set up for measuring the adults, the child might as well be measured the same way. Adapting the infantometer to measure adult height was considered to increase the weight of the infantometer too much. However, Figure 5 illustrates a relatively light way of adapting an infantometer so that it could also be used for measuring adult heights. Another suggestion was also made that all pre-school children be measured in length (for long-term follow-up purposes this would be better since there are differences between length and height measurements). However, since the norms being pushed by WHO for international use utilize height measurements for children

older than 2-3 years old, it was decided that the issue of measuring length for all preschool children might be better addressed in the evaluation process.

Further research and discussions back in the U.S. about the anthropometry issue brought forth the following observations:

1) That the height data obtained with a tape measure may not be very reliable, and may lead to poor data;
2) That the WHO is soon to publish its recommendations on instruments for field surveys, and their recommendation is to use a non-flexible tape measure (i.e., plexiglas) for obtaining height measurements for children older than 2 years of age; and
3) That it might be easy to design an extension to the infantometer which would not weigh too much and yet would allow for its use in measuring the height of any individual over 2 years of age.

The main advantage of utilizing an adapted infantometer for measuring heights relates to the precision of the reading itself and to the time-saving aspects, since the time-consuming process of adequately attaching a tape measure to the wall would be eliminated.

However, Panama decided it did not have the time to order the adaptations made, and to go ahead with the use of the tape measure.

Part III: Utilization of Health Services

Initial question design dealt with the notion of whether the household was aware of the existence of a health service nearby, whether it used it, and reasons for not using it. Further discussions led to the notion that the questions were too vague, i.e., a household might use a health center for one purpose, and a nearby hospital for a different purpose, and a local curandero for still different purposes. Finally, since health statistics could provide information on whether there were services available, it was concluded that there was no purpose in asking such questions.

At this point, Dr. Alfonso Santamaría presented an illustration of his perception of the problem of utilization of health services (see Figure 6). Based on this approach, the questions were made more specific, asking if anyone in the household had been sick in a specific period of time, if that person had seen any one concerning the sickness, and if not, why not. The last question was to detect differences in non-utilization due to non-severity of sickness (perceived as not needed), as opposed to perceived need of the service but not using it (lack of time, lack of money, etc.).

Group discussions of the entire questionnaire a few days later demonstrated that the question, "Why did you not see anybody?" should be expanded to include, "Why did you not see someone from the health service?"

Part IV: Education and Schooling (for all household members)

The informtion provided here will allow for some determination of socio-economic status, expenditures, level of human capital, and problems which might affect nutrition (i.e., illiteracy).

Highest educational level approved (including vocational schools) and the qustion, "Do you know how to read?" were purposely placed in this order so as to avoid the embarrassment of asking someone with a university career if she knew how to read. If the answer to the first question indicates a level above the primary school, the answer to the second one is automatically, "Yes," without the question having to be asked.

The question on literacy was the subject of much discussion, since it has usually been asked in the form, "Do you know how to read and write?"

Subsequent discussion centered on whether people who knew how to read also knew how to write, and on what would happen if someone knew how to read and not write. In terms of nutrition, it was felt by some that reading was more important for educational purposes. No decision was made at the time, however, and the topic was left for further discussion by the Panamanians at a later time.

Further reading and thought, once back in the U.S., brought forth the possibility that literacy might not be a sufficiently discriminating indicator and that writing, which is more difficult and which assumes knowledge of reading, might be more discriminating. The suggestion was made, over the phone, to try to include in the pretest a question on ability to write, for comparison with the question on knowledge of reading. Depending on the results of the pre-test, only one or both questions might be asked in the survey.

Current attendance at a school (including vocational training, literacy classes, and day care centers) was asked to obtain information on possible short-term improvements in human capital and socio-economic status, aside from leading into the information on household expenditures.

Costs related to education were initially only to include monthly payments; further discussions with people from the Ministry of Education showed there were additional costs incurred by attending school or classes, such as uniforms, books and supplies, occasional donations requested, transportation, lunch/dinner

and snack money, etc. After detailing the items, it was decided it sounded too inquisitive and complicated, and that more work was needed on the question.

Part V. Migration (for people over 5 years of age)

Serious debate arose as to the importance or need to obtain migration information. It was decided that the highest prevalence of malnutrition seemed to be in the peri-urban area of Panama City, due to migrants from other parts of the country, and that the information was important, in order to verify this phenomenon. Time of residence in a place (not necessarily in the same house, but in the same area) was also considered important, to verify if after a certain period of time there was greater knowledge and utilization of services available. Both questions were left open-ended, so that the analysis could do whatever aggregation was needed. With respect to the question, "Where did you live before," it was debated whether it should be precoded, but it was argued that the categories "urban," "rural," "from small city," "from capital of a Department," etc., did not differentiate sufficiently, since the capital city of one Department could be much worse off than the rural area of another Department. So the question was left to be coded after the survey, by names of districts (66 districts in the country).

An item that was not covered, and which might be considered in future surveys, relates to seasonal migration by the head of household or the family as a unit.

Part VI. Occupation and Employment (for people over 5 years of age)

Since the ILO norms refer to the past week, it was decided to follow that norm. However, to obtain a better idea about the work history of the individuals (and thus get some idea of income), a question was asked about the number of months each person worked during the previous 6-months. It was also decided to include children younger than the customary 10 years of age, since in some areas the 7-8 year old child also contributes towards the household income.

Questions related to type of occupation, place of occupation, permanent or temporary, and number of hours worked were included as indicators of income, time availability (in particular with respect to mothers), and social status. Income earned during the week was asked directly, along with a question detailing other possible sources of funds.

Part VII. Food Production (per household)

This part tried to take into account not only food production per se, but the availability of fruit trees, the utilization of hunting and fishing resources, the costs associated with food production and the income derived from these activities. It also onsidered the proprietorship of the land and size of land holding. Review of the questionnaire by the Ministry of Agriculture led to the inclusion of questions on service utilization (technical assistance, credit) and logistics (where are inputs purchased and the harvest sold), and how much of the production was for self-consumption, sale, seeds, or was lost.

Part VIII. Participation in Other Programs

This information was considered to be important for two reasons: first, in terms of utilization of available resources, which might also increase the household's resources; secondly, because earlier studies seem to show that those families which participate in projects are also those with better nourished children. With respect to the second point, it is not certain whether participation in projects improves the nutritional status of the children or if there occurs a self-selection process, whereby only the families with well-nourished children choose to participate in the projects.

Part IX. Information about Women of Child-Bearing Age

The definition of "child-bearing age" was discussed. A question arose as to whether to include women under the customary 15 years of age. The upper limit of 49 years was found acceptable. No decision was reached at the time, however, with regard to the lower age limit.

The information in this part included the name of each woman, her pregnancy history (number of pegnancies, abortions, live deaths, stillborns, children alive today), and child mortality history (for children who died under the age of 5, age of death, approximate date of death, and causes). This last piece of information, causes of death, is still under debate, since it is uncertain whether mothers will know the cause of death. The final decision was left in the hands of Lic. Batista, due to his knowledge of previous studies which have collected similar data. The interest in the approximate date of death refers mainly to the season of the year, in order to ascertain whether there are seasonal factors which might induce greater danger of death (i.e., rainy season, due to higher probability of parasitic infections).

Questions were also asked about the utilization of specific health services for pre-natal care and with delivery, but these questions were later transferred

to Part X, which deals specifically with children under 5 years of age. In this way, the information could be directly linked to the child's nutritional history.

The last two pieces of information on women of child-bearing age relate to marital status (as an emotional stability factor which might affect her treatment of the children) and number of hours spent away from home (as an indicator of her time availability at home, for food preparation, child care, etc.).

One piece of information which was not considered, but which should be included in future surveys, includes the utilization of birth control methods by the women, and type of method utilized. Due to the potential relationship of child spacing to nutritional status of both the mother and the child, nutrition programs should consider the impact of birth control and child spacing programs.

Part X. Information about Children Under 5 Years of Age

For purposes of cross-tabulation, it is very important to be able to link each child to his/her mother, so it was decided that the name of the mother be asked for each child.

Areas of interest here included maternal pregnancy care and place of delivery (transferred from IX, above), birthweight (if possible), feeding habits (including breastfeeding, reasons for not breastfeeding or for stopping, age of weaning, replacement foods, and age at which specific foods were introduced). Since the ideal was to have pre-coded answers, the final selection of responses was also left to Lic. Batista's discretion. In addition, it was considered important to include information on possible causes of low weight reading, such as a recent episode of diarrhea, measles or some other disease.

There was considerable discussion regarding the information to be collected with respect to vaccinations. Ministry of Health people affirmed that vaccination coverage was quite good, and that it seemed redundant to ask mothers if the child had been vaccinated against measles, polio, DPT, BCG, etc. The group's decision was to formulate a question as to whether the child had a vaccination card (and to show it), assuming that the existence of the card meant that some contact had already been made with the health system.

There was also discussion as to what information should be asked regarding the utilization of well-child care programs. The decision was reached to only ask if the child had attended such a program in the last 6 months. A decision

was also made that other factors have a greater weight in the determination of malnutrition than the attendance to well-child clinics. Thus, it was not very important to distinguish, for example, between children who are 4 years old and who attended a well-child care program for the first 2 years of life, and those children who never attended such a program.

A final piece of information which was thought to be important was who attended the child when the mother was absent.

Part XI. Food Consumption

Because of the difficulties in administering a food consumption interview, this part was separated from the main questionnaire and will only be administered to a sub-sample of the survey population.

The food consumption questionnaire is aimed at obtaining the following information:

a) a 24-hour food recall for the household;

b) whether the food consumed at home was self-produced, a gift or purchased;

c) the price of each purchased food item (so as to determine the average cost of the daily diet);

d) the frequency of consumption of certain foods;

e) who consumes certain food items (young children, adults, entire household, or sick children).

The 24-hour recall page was left blank, for individual listing of foods, after deciding that in many areas the foods mentioned would be so few that it would not be worth precoding an entire page or two of foods. The initial thought behind the 24-hour recall was to try to obtain information on individual consumption, so as to get some idea regarding intrafamily food distribution. However, the presentation of a different analytical approach by Dr. Franklin eliminated the need to obtain individual consumption. The analytical approach described included the selection of DQIs (Dietary Quality Indices): if the family as a whole meets the DQI's, yet the preschool child is found to have a nutritional problem, then it can be stated that the problem is one of intra-family distribution, and not one of general lack of food.

C. The Research Triangle Institute's Role in the National Survey

As can be deduced from above, it was decided, due to the time constraint, that it would be a better utilization of the RTI team's abilities to finish up an outline for the national nutrition survey questionnaire and not worry about

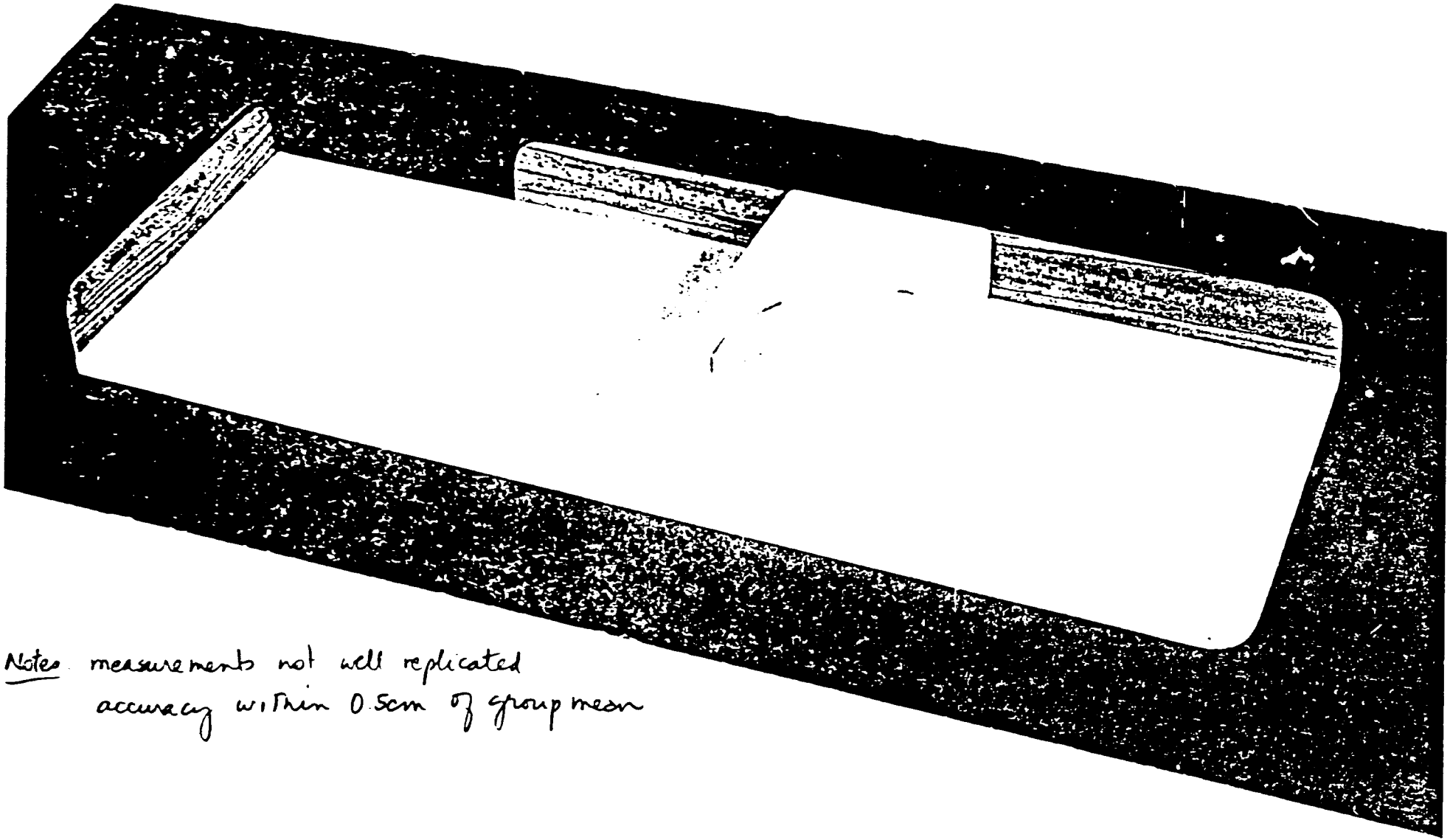
the polishing up of specific questions, leaving that to a group of Panamanians specializing in questionnaire design. Thus, details such as the exact wording of a question, or the exact answers for close-ended questions, or the way by which family members' data could be matched up, were not considered by the RTI team.

As it turned out, however, the "polishing up" which did get done was mainly one of format, and did not get at the minute details which, later, allow for easy analysis and interpretation of the data. Consequently, the final format of the questionnaire cannot be considered "optimum."

The major difficulty arising from the incomplete job of polishing the questionnaire has to do with the issues of identification and linkage. For instance, a household with more than seven members ended up having the eighth person with an identical identification number as the first person, the ninth person as the second, and so on. In addition, it will take an extra coding step to link mothers to children younger than 5 years of age.

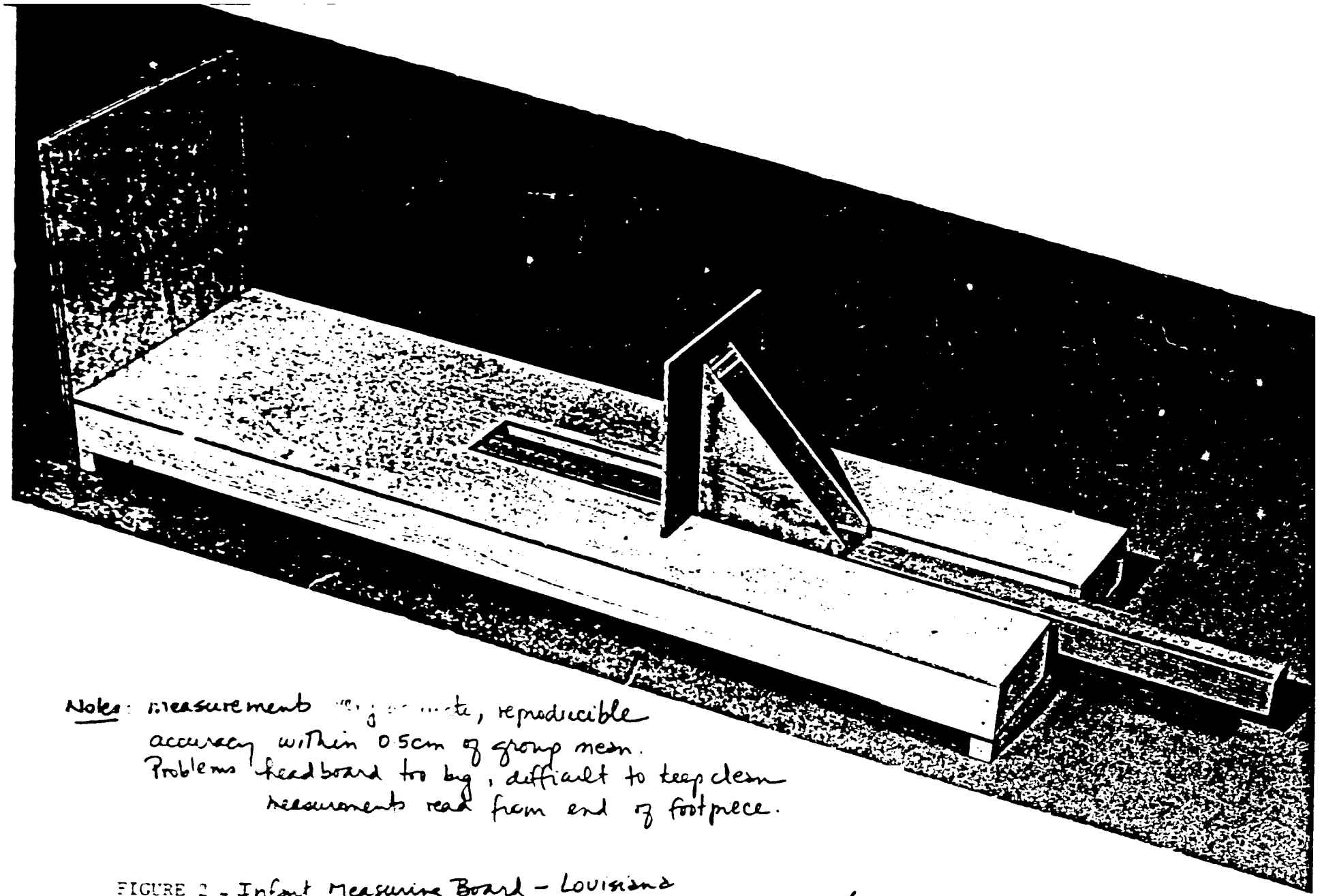
Other examples of polishing problems include:

- Relationship to the head of household: Unless the child is the son or daughter of the head of household, there is no way of knowing which child belongs to which adult. Eventually, it might be possible to at least link mothers to children.
- Literacy: The question was asked, "Do you know how to read and/or write." In this format the question does not allow distinction between people who can read but cannot write, and those who can do both.
- Enrollment in school: The answers were supposed to provide the grade within each level, but the final format just provided the appropriate level.
- Education costs: No polishing was done on this question, so it remained inquisitive and complicated.
- Reasons for not breastfeeding or for weaning: Originally there was one question with a long list of alternative answers. Presently, there are two questions, and some of the alternative answers have been eliminated. Unfortunately, a large proportion (30 percent) of the answers have been coded as "other."



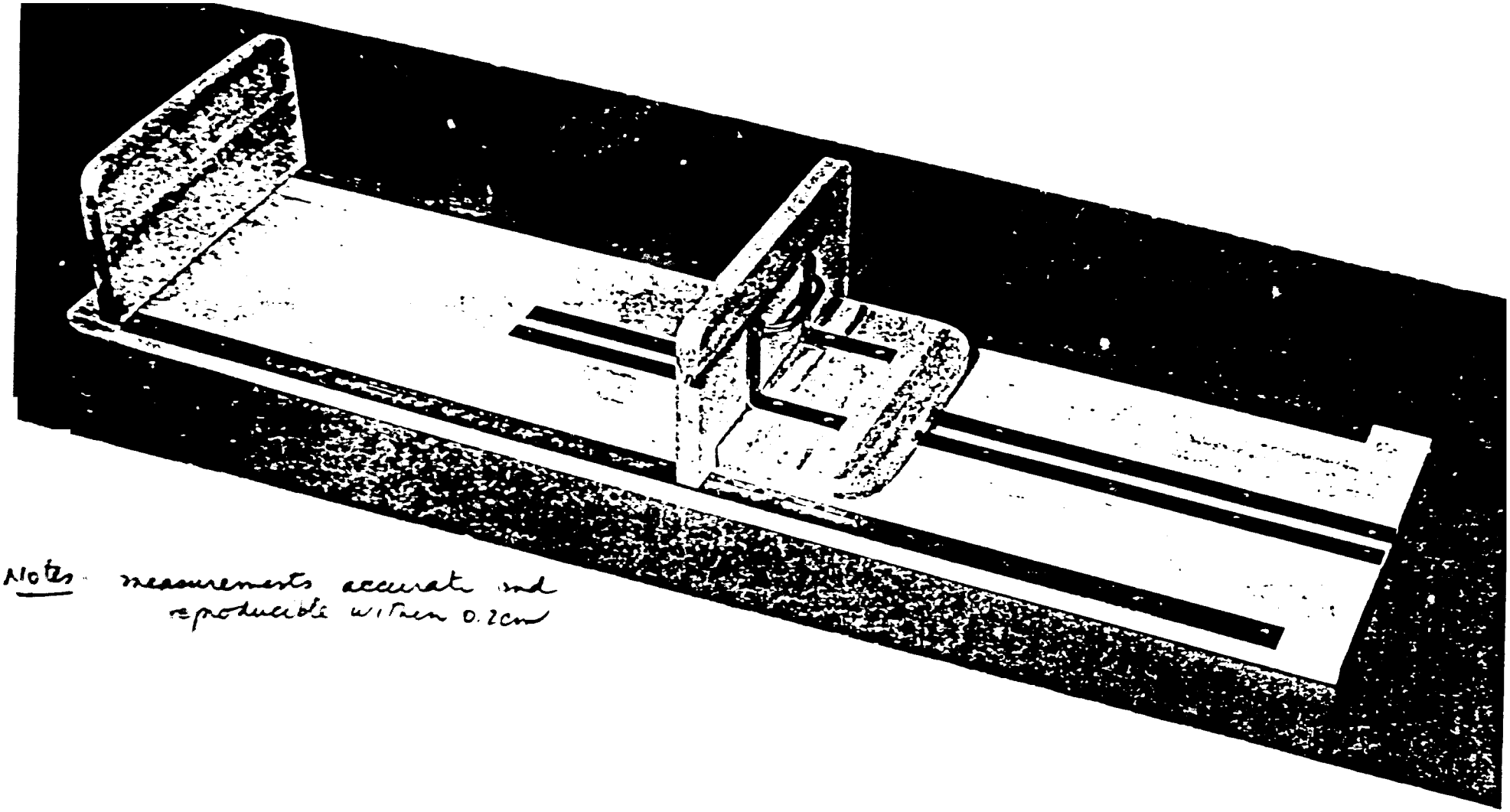
Notes: measurements not well replicated
accuracy within 0.5cm of group mean

FIGURE 1 - Infant Measuring Board - Tennessee.
Cecil Ward, 114 Maureen Drive, Hendersonville, Tennessee 37075 (approx. cost: $25)



Notes: measurements [illegible], reproducible
accuracy within 0.5cm of group mean.
Problems headboard too big, difficult to keep clean
measurements read from end of footpiece.

FIGURE 2 - Infant Measuring Board - Louisiana
Williams Cabinet shop, 2664 Iroquois St, Baton Rouge, La. 70805 (approx. cost $82.00)



Notes: measurements accurate and reproducible within 0.2cm

FIGURE 1 - Recumbent infant length Board
TEAM Total Engineering and Marketing, Inc., 938 Michigan National Tower, Lansing, MI 48933
(approx cost $490)

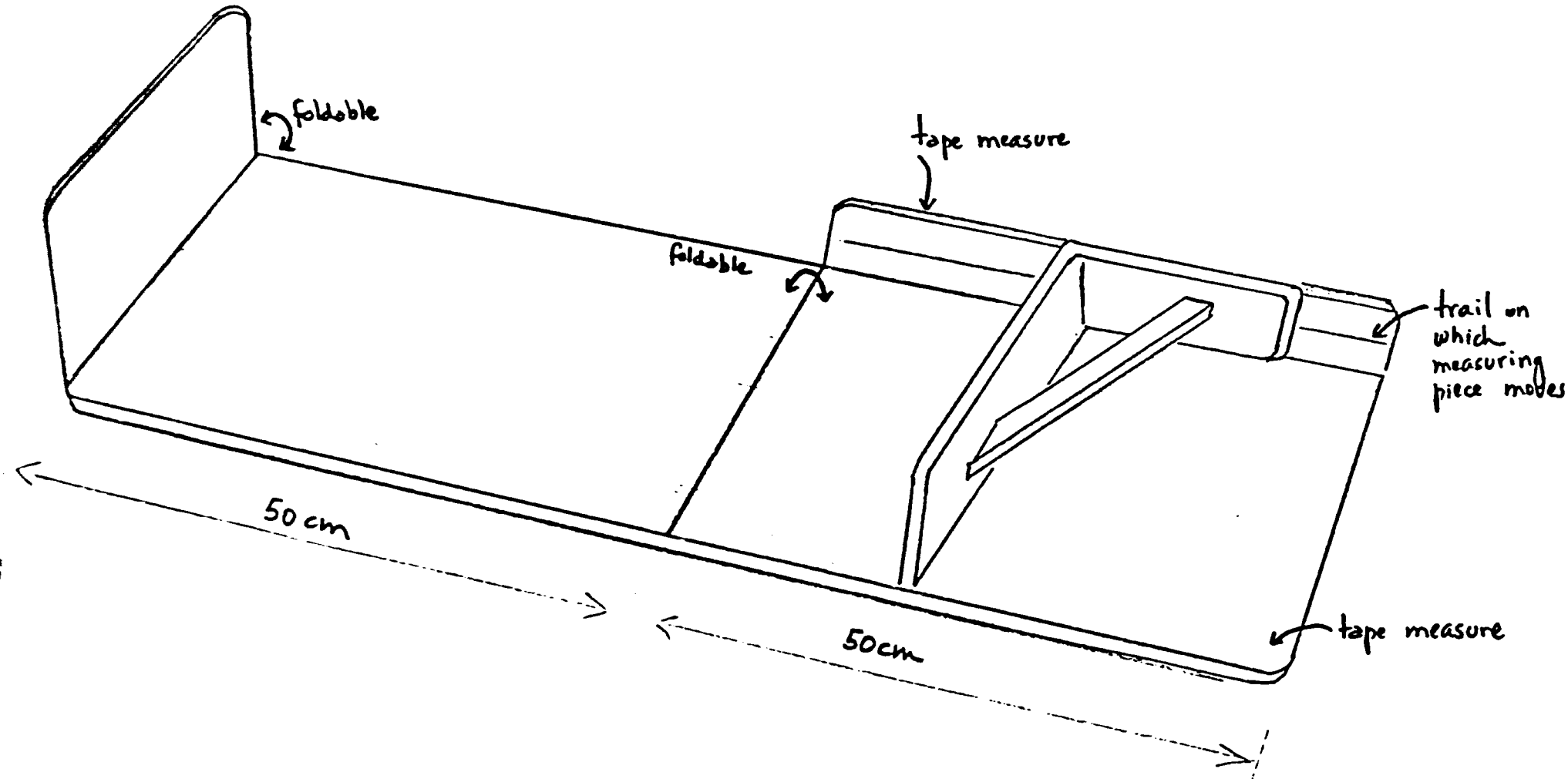
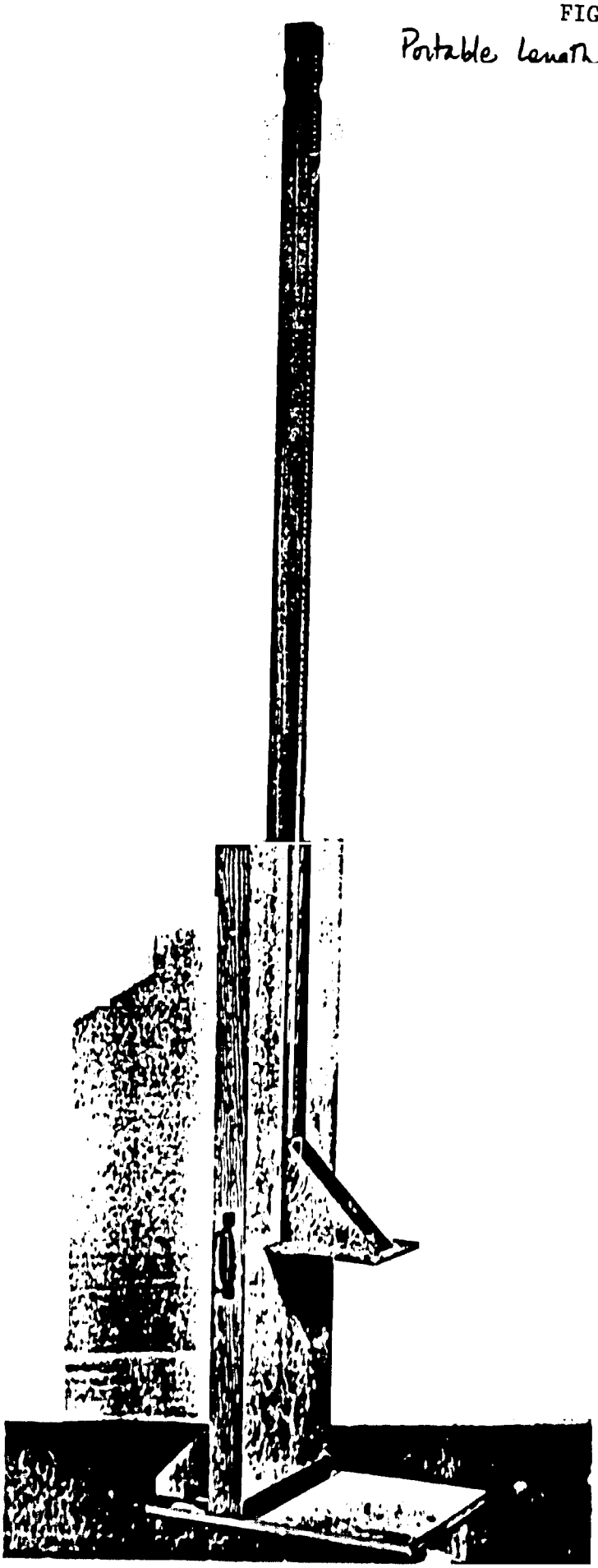


FIGURE 4 - Adaptation of Infant Measuring Board, Tennessee (fig. 1) to field conditions in Panama.

FIGURE 5

Portable Length/Stature Measuring Board (not commercially available, although plans available from Nutrition Division, CDC. Approx. cost $75.00.



Notes: · measurements were accurate and reproducible

accuracy within 0.2cm of group mean

measurements read at upper end of sliding headpiece

extension can be used to measure individuals up to 190cms.

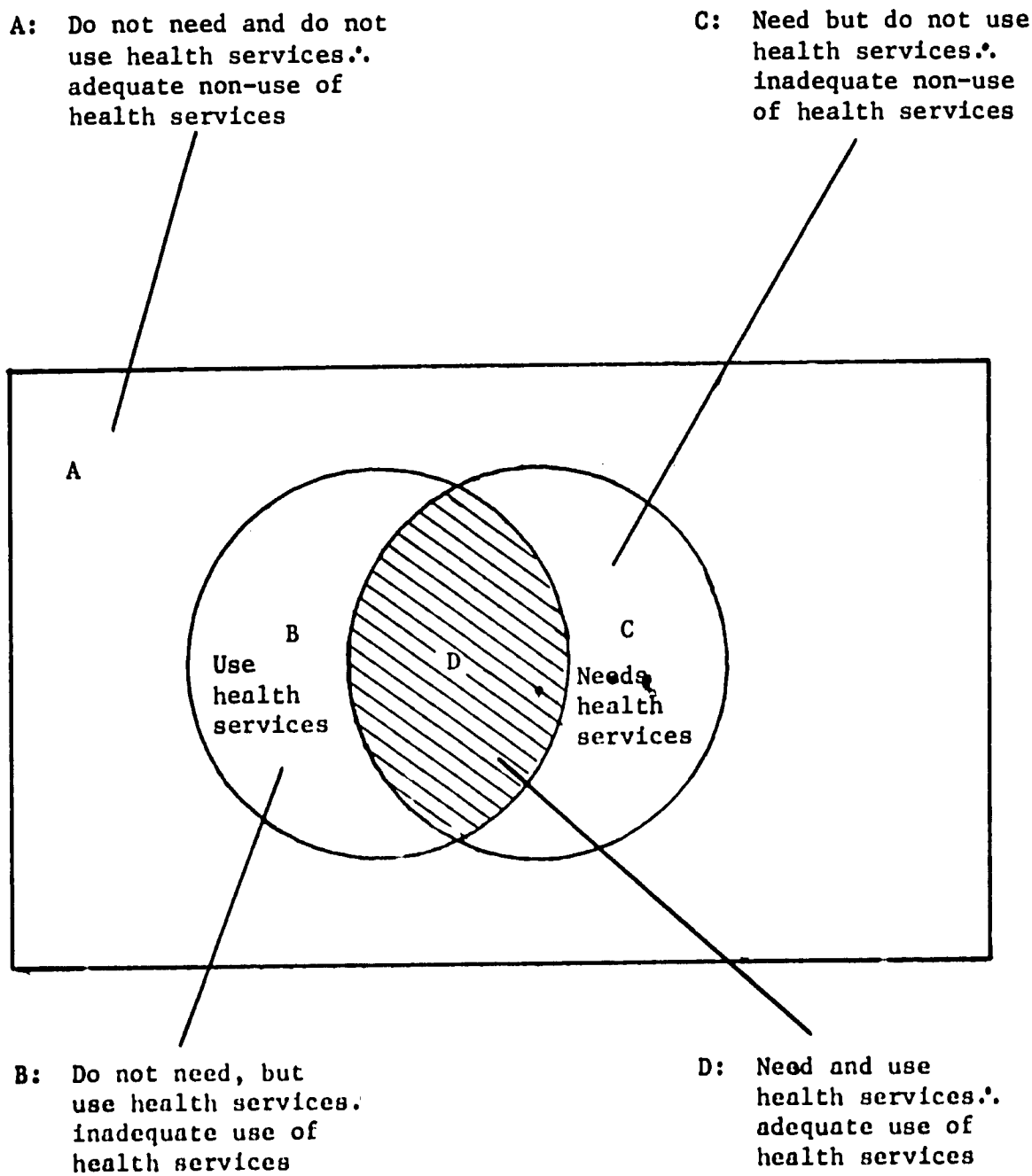


Figure 6. Dr. Santamaria's model regarding the utilization of health services.

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VI. PRELIMINARY DATA

In this section of the report we present some of the preliminary results from analysis of some of the data obtained from the Panamanian National Nutrition Survey. The material presented has not been weighted so that strictly rigorous national-level inferential power is not possible. Furthermore, much of the data is still in the process of data cleaning, adjustment for missing cell values, and other initial steps of data preparation. In the subsections that follow material will be presented on the preliminary results of data analysis of health care, breastfeeding, education and housing conditions as they are correlated with child nutritional status.

A. Health Care and Nutritional Status

Initial analysis of health utilization data and nutritional status revealed some rather unexpected results, and may reflect the relatively raw nature of the data. For example, for children under 5 years of age, the following results were obtained:

1. In comparison of those children who suffered from any degree of malnutrition and those children who had no signs of malnutrition, the well nourished children suffered less diarrhea. Specifically, 34 percent of the well nourished reported diarrhea versus 40 percent of the malnourished. (No statistical tests of significance have been conducted on this or any of the other results.)

2. Between well nourished and malnourished children, the well nourished reported a slightly higher incidence of measles. In both groups, however, the incidence was low, i.e., 3 percent for the well nourished and 2.6 percent for the malnourished.

3. Between the well nourished and malnourished children the well nourished suffered slightly more skin infections: 9 percent versus 7 percent.

4. Between the two groups, malnourished children suffered a slightly higher incidence of respiratory disease, viz. 31 percent to 28 percent for the well nourished.

5. Between the well nourished and malnourished children, the well nourished have a slightly lower frequency of measles vaccination: 28 percent versus 31 percent for the malnourished.

6. Between the two groups of children, the well nourished and malnourished utilized health care services about equally, viz 34.8 percent and 34.1 percent.

One very important point to bear in mind when interpreting these preliminary results is the fact that malnourished children who died may not be adequately represented in the survey data, and hence under-reporting could mean that the impact of malnutrition on children is not accurately revealed in the data since one consequence, death, is not fully included. Further work on this topic is anticipated.

B. Selection of Anthropometric Indicators for Panama

Based on the previous descriptions of anthropometric indicators, the following indicators were selected for use in Panama, for the analysis of the National Nutrition survey and for impact evaluations: weight for height, weight for age, height for age, and combinations thereof. The values on dependability, precision and reliability were not used since the values are applicable to a very specific population and for young children (under 3 years of age), possibly varying under other circumstances.

Runs were carried out with preliminary data from the 1980 National Nutrition survey to compare malnutrition rates as indicated by the individual indicators and by 2-way and 3-way combinations (Waterlow and WHO/PAHO, respectively). The results of these test runs, on an aggregated, national level, are shown in Tables 1-5. It should be noted that the tests were run grouping all grades of malnutrition under the classification "low," with cut-off-points for "low," "normal," and "high" values being as follows:

weight for height and weight for age	low:	< 90% of reference value
	normal:	90 - 110% of reference value
	high:	>110% of reference value
height for age:	low:	< 95% of reference value
	normal:	95 - 105% of reference value
	high:	> 105% of reference value

A comparison between Tables 1 and 2 shows that weight for age tends to over-classify children as being malnourished. As can be seen from the interpretations on the tables, low weight for age could be due to actual low weight or due to a child being short although having adequate weight for height. Because of the inability of the Gomez classification to distinguish between the two causes this indicator seems to be of less value than weight for height, and for this reason it will be eliminated from the analysis as an individual indicator.

Table 1

NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE IN PANAMA, ACCORDING TO THE GOMEZ CLASSIFICATION (WEIGHT FOR AGE)

Weight for Age	Interpretation of Nutritional Status	% Children
Low	Actual malnutrition or child with adequate weight for height	50.08
Normal	Normal child, or underweight tall child, or overweight short child	38.68
High	Overweight child or tall child with adequate weight for height	11.26

Table 2

NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE IN PANAMA ACCORDING TO WEIGHT FOR HEIGHT

Weight for Height	Interpretation of Nutritional Status	% Children
Low	Actual malnutrition	25.23
Normal	Normal	60.53
High	Overweight	14.23

A comparison between Tables 2 and 3 shows that although over 70 percent of the children are classified as being normal or above normal with respect to weight for height, only about 55 percent are normal or above with respect to height for age. This leads to the hypothesis that a number of children might have suffered from malnutrition in some earlier time, and although their height has not been able to reach the "normal" range, they have recuperated from the attack of malnutrition, as indicated by their presently adequate weight for height.

A look at Table 4 confirms that hypothesis by showing that 31.77 percent of the children, although being classified as presently "normal" or "overweight", have low height for age, thus reflecting some past history of malnutrition.

Table 5 illustrates the 9 combinations of indicators recommended by WHO, and which, unfortunately, does not classify 30 percent of the children in the survey. In trying to determine where these children could have fallen, classification-wise, Table 6 was prepared, listing all 27 possible combinations of the three indicators. The data shows us, however, that 8 of the 27 possible combinations resulted in zero children being classified in these positions; further analysis led to the conclusion that these 8 combinations are physically impossible. The remaining 19 combinations can be regrouped into the 6 categories defined in Table 7. Interestingly, these are exactly the same 6 categories obtained in the modified Waterlow classification, which seems to show that the use of weight for age does not contribute much new information to that obtained from utilizing weight for height and height for age. Thus, further analysis will be done using only weight for height and height for age data.

We then proceeded to look at the indicators by age group (Table 8), which demonstrated an interesting pattern and further confirmed our hypothesis that malnutrition seems to hit the strongest during the second year of life, that is, between the ages of 1-2 years. This can be seen by the biggest rate of low weight/height during that time period, and also by the doubling of low height for age rates from 1-12 months of age to 13-24 months of age, with similarly high rates thereafter. This could be interpreted as children doing relatively well during the first year of life--actually, there is a somewhat higher rate of overweight infants than at any other age group--with malnutrition occurring sometime during the second year of life, affecting both indicators, weight for height and height for age. Those children who survive, eventually recuperate in weight for height, although the effect of the malnutrition episode leaves its mark on reduced height measurements.

Table 3

NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE IN PANAMA ACCORDING TO HEIGHT FOR AGE

Height for Age	Interpretation of Nutritional Status	% Children
Low	Past history of malnutrition	44.92
Normal	Normal	47.56
High	Tall	7.51

Table 4

NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE IN PANAMA ACCORDING TO A MODIFIED WATERLOW CLASSIFICATION

	Weight/Height		
Height/Age	Low	Normal	High
Low	11.81	30.29	6.88
Normal	11.88	28.78	4.27
High	2.24	3.10	.76

Actual malnutrition and past malnutrition: 11.81 percent
Actual malnutrition: 14.12 percent

Normal: 31.88 percent
Normal with past history of malnutrition: 30.29 percent

Overweight: 5.03 percent
Overweight, with past history of malnutrition: 6.88 percent

Table 5

NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE IN PANAMA ACCORDING TO WHO CLASSIFICATION

Combinations of Indicators	Interpretation of Nutritional Status	% Children
Normal wt/ht + low wt/age + low ht/age	Normally fed with past history of malnutrition	21.15
Normal wt/ht + normal wt/age + normal ht/age	Normal	23.11
Normal wt/ht + high wt/age + high ht/age	Tall, normally nourished	2.73
Low wt/ht + low wt/age + high ht/age	Presently underfed++	.88
Low wt/ht + low wt/age + normal ht/age	Presently underfed +	10.51
Low wt/ht + normal wt/age + high ht/age	Presently underfed	1.79
High wt/ht + high wt/age + low ht/age	Obese ++	1.10
High wt/ht + normal wt/age + low ht/age	Presently overfed with past history malnutrition	4.16
High wt/ht + high wt/age + normal ht/age	Overfed but not necessarily obese	4.52
Other		30.03

Table 6

NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE IN PANAMA, ACCORDING TO ALL POSSIBLE COMBINATIONS OF WEIGHT FOR HEIGHT, WEIGHT FOR AGE, AND HEIGHT FOR AGE

Combinations of Indicators		Interpretation of Nutritional Status	% Children
Weight for Height: Low			
Wt/Age	Ht/Age		
Low	Low	Acute on chronic malnutrition	11.81
Low	Normal	Presently underfed (†)	10.50
Low	High	Presently underfed (††), tall	0.79
Normal	Low	N.P.[1]	0.00
Normal	Normal	M.A.[2]	1.38
Normal	High	Presently underfed, tall	1.34
High	Low	N.P.	0.00
High	Normal	N.P.	0.00
High	High	Presently underfed, tall	0.10
Weight for Height: Normal			
Wt/Age	Ht/Age		
Low	Low	Past malnutrition	24.23
Low	Normal	M.A.	5.16
Low	High	N.P.	0.00
Normal	Low	M.A.	6.06
Normal	Normal	Normal	22.75
Normal	High	M.A.	1.14
High	Low	N.P.	0.00
High	Normal	M.A.	0.86
High	High	Tall, normal	1.96
Weight for Height: High			
Wt/Age	Ht/Age		
Low	Low	Overweight, with past malnutrition	2.17
Low	Normal	N.P.	0.00
Low	High	N.P.	0.00
Normal	Low	Presently overfed, with past malnutrition	3.79
Normal	Normal	M.A.	1.10
Normal	High	N.P.	0.00
High	Low	Obese (††), with past malnutrition	0.93
High	Normal	Overfed, not necessarily obese	1.17
High	High	Obese, tall	0.76

[1]M.A. = Mathematical Artifact
Although theoretically not logical, it is mathematically possible. Consider, for example, the following limits for:
Low wt/age: below 90% of norm
Normal wt/ht: 90-110% of norm
Normal ht/age: 95-105% of norm
If: Wt/Age = (Wt/Ht) · (Ht/Age), then
Wt/Age = (.90) (.95) = 8.55, or Low Wt/Age.

[2]N.P. = Not Possible.
Aside from being theoretically not possible, none of the children from the survey fell under these categories.

Table 7

REGROUPED CATEGORIES OF NUTRITIONAL STATUS OF CHILDREN

UNDER 5 YEARS OF AGE IN PANAMA

Combinations of Indicators		Interpretation of Nutritional Status	% Children
Weight for Height: Low			
Wt/Age	Ht/Age		
Low	Low	Acute on chronic malnutrition	11.81
Low	Normal	Presently underfed	14.11
Low	High	Presently underfed	14.11
Normal	Normal	Presently underfed	14.11
Normal	High	Presently underfed	14.11
High	High	Presently underfed	14.11
Weight for Height: Normal			
Wt/Age	Ht/Age		
Low	Low	Past malnutrition	30.29
Normal	Low	Past malnutrition	30.29
Low	Normal	Normal	31.87
Normal	Normal	Normal	31.87
Normal	High	Normal	31.87
High	Normal	Normal	31.87
High	High	Normal	31.87
Weight for Height: High			
Wt/Age	Ht/Age		
Low	Low	Overweight, with past malnutrition	6.89
Normal	Low	Overweight, with past malnutrition	6.89
High	Low	Overweight, with past malnutrition	6.89
Normal	Normal	Overweight	5.03
High	Normal	Overweight	5.03
High	High	Overweight	5.03

Table 8

NUTRITIONAL STATUS OF CHILDREN UNDER 5 YEARS OF AGE

IN PANAMA, BY AGE GROUP

	Weight for Height			Height for Age		
	Low	Normal	High	Low	Normal	High
1 - 12	22.30	53.79	23.91	25.58	61.99	12.43
13 - 24	30.85	55.52	13.63	51.49	41.84	6.67
25 - 36	23.89	63.84	12.27	46.12	47.42	6.46
37 - 48	23.73	63.39	12.88	48.52	45.15	6.33
49 - 60	25.40	65.[illegible]	9.18	51.83	42.15	6.02

For purposes of program planning, the anthropometric data has been broken down by provinces and districts. Although these data are not shown in this report, it should be noted that the same types of analysis should be carried out, by age groups, with province- and district-level data.

C. Knowledge, Attitudes and Practices (KAP)

Nutrition intervention programs attempt to impact on a child's nutritional status by changing certain characteristics of the surrounding environment. In many instances, these changes are moderated by attempts to influence knowledge and attitudes of the child's guardians. Education, then--particularly nutrition and health education--becomes an important intervention, or an important requirement in other interventions.

The KAP model, inherited from family planners, has been widely used in explaining the sequence necessary to bring about a change in practices or behavior. It assumes that changes in K (knowledge) will lead to changes in A (attitudes), which will eventually lead to changes in P (practices or behavior). Evidence from the field, however, seems to suggest that, in some instances, practices may change first, leading to changes in knowledge and attitude, or that attitudes may change first. However, no matter what the initial sequence, knowledge and attitudes must change if the new practice is to be sustained for a significant period of time.

Thus, indicators of changes in knowledge and attitudes may be just as valuable in an evaluation as indicators related to practices, and may, in fact, help explain why a particular intervention shows no improvement in the nutritional status of its target population.

With respect to foods, the practice indicators would be food consumption and infant feeding practices (described below); indicators for knowledge and attitudes have not yet been considered, since there are no tested indicators, and although they might be considered in the future, it is not within the scope of this report to identify any.

Indicators for knowledge, attitudes and practices related to health follow the same subdivision as above: practice indicators will be described in the "health" section; knowledge and attitudes indicators might be considered in the future, although their selection and discussion is not part of this report.

1. Food Consumption

Although the 24-hour recall method for eliciting information about food consumption has been shown to be not very accurate for individual estimates, it is considered to provide a fair estimate of intake for large samples.

Because of INCAP's long history in conducting and evaluating food consumption surveys, most of the tabulation of food adequacy data will be carried out by them. At this time, the tabulations are being revised, and it is not possible to make any statements concerning food consumption in Panama.

A word of caution is needed with respect to the analysis of any food intake data. Although the food intake is compared to the USRDAs, there is still much discussion as to what the RDAs mean. It is known that individuals vary tremendously in their requirements, due to differences in metabolism, level of physical activity, and presence or absence of infections and diseases. Thus, an intake which is adequate for one individual may not be adequate for another; and may not even be adequate for the same individual at all times. According to Wolanski (1974), "the same level of nutrient intake can produce more than one nutritional status depending on the whole ecological situation of the individual." The National Academy of Sciences emphasizes that "RDAs are recommendations established for healthy populations"; with the exception of energy, the RDA are "estimated to exceed the requirements of most individuals and thereby to ensure that the needs of nearly all in the population are met. Intakes below the recommended allowance for a nutrient are not necessarily inadequate, but the risk of having an inadequate intake increases to the extent that intake is less than the level recommended as safe." With respect to energy, The National Academy of Sciences states:

> The allowance for energy is treated differently from allowances for specific nutrients. Because a surplus of energy from any source is stored as fat, the continued excessive intake of energy leads to obesity and may be detrimental to health. Recommended allowances for energy are estimates of the average needs of population groups, not recommended intakes for individuals. These needs vary from person to person and are not easily predictable without detailed information about physical characteristics and activity of the individual. Hence, average energy needs for each age and sex group are provided only as guidelines and are not intended as recommended allowances.

D. Feeding Practices

Because of the discernible pattern of malnutrition in children under 5 years of age, with greater proportions of low weight-for-age in younger children and increased proportion of low height-for-age but adequate weight for height in the later years, and without an obvious relationship between nutritional status of the child and household food intake, it seems likely that malnutrition occurs early in childhood--around the second year of life--and is later corrected--as evidenced by the adequate weight-for-height ratios in older children.

It becomes likely, then, to suggest the hypothesis that feeding practices during the first year or two of life might be responsible for the early cases of malnutrition.

Feeding practices encompass both breastfeeding patterns and the introduction of other foods. Preliminary information from Panama on both subjects is provided in Tables 9-14, although it should be stressed that, due to the high proportion of missing values, this information cannot be taken as final. It would be useful, later on, to have information on the ages of the children who were still being breastfed at the time of the survey, to determine whether those might be added, theoretically, to the older age groups. It would also be interesting to have information on the income and urban/rural distribution of breastfeeding.

The information presently available shows that, of the respondents, 15 percent of the children under 5 years of age were never breastfed (which is a relatively low figure); 22 percent were breastfed for less than 6 months and 27 percent were breastfed for at least one year. Future tabulations, to provide information on nutritional status of each child according to the length of breastfeeding might provide further insight into the causes of malnutrition.

The reasons most often mentioned by the survey respondent for not breastfeeding the child (Table 13) were: lack of milk (30.5%), illness of the mother (21 percent), and not wanting to (21 percent). Interestingly, most of these reasons (with the exception of maybe some severe illness of the mother), which accounted for 72.5 percent of the responses, could probably be improved by education about breastfeeding. The inability to breastfeed due to having to work was not a separate category, and might be included among the "other" reasons (16 percent), and thus its relative importance is difficult to judge.

The main reasons for stopping to breastfeed related to lack of milk (25 percent) and other (34 percent). Having to go to work represented 9 percent of the responses.

Information on the age at which specific foods were introduced seems to show that most of the foods specified were introduced between 2 and 6 months of age. Milk was the one exception, with close to 50 percent of the respondents stating it had been introduced by 1 month of age; beans and meats were the other exception, being introduced by most respondents after 6 months of age.

The information on age of introduction of milk provides some insights into breastfeeding patterns. For example, the number of children who were never breastfed or were breastfed for less than one month was smaller than the number of children who received milk by 1 month of age, probably meaning that breastfeeding for certain children was not total, which could result in an earlier introduction of a source of contamination and infection than would be expected from the information on breastfeeding alone. The same holds true for those children who were introduced to other foods during the earlier months of life. This information, then, warns us of the possibility of early supplementation to breastfeeding, with consequent contamination and food allergy problems. It might be worthwhile to run a table, at a future date, looking at nutritional status by age of introduction of other foods.

E. Education

Any consideration of education as a variable in a nutrition intervention model must recognize the interaction of education with other factors in affecting nutritional status of the child. Specifically, the number of years of primary or secondary school completed by the parent may have a distinct bearing on the nutritional status of children in several ways.

The level of educational attainment of parents affects practices in the home, perhaps encouraging participation of the mother in the labor market, altering her employment status and consequently her time availability in the home. As income determinants, both vocational and formal education may contribute to higher returns to the household, with subsequent increased food expenditures.

Indicators other than income are affected by education. Years of school attended can be used as a proxy for literacy, which is thought to be a positive determinant of nutritional status, again in terms of returns to the household as well as increasing exposure to nutrition or child care information, although

it may have as a consequence increased bottle feeding as well. The usefulness of certain nutrition intervention programs would be limited by the presence of illiteracy.

Most importantly, the knowledge, attitudes and perceptions of the target population are affected through alterations of food taboos, food beliefs and feeding practices. Some permanence is implied through KAP change that might not be achieved in an intervention program.

UNESCO defines as literate a person who has completed four years of primary education, the premise being that it is at this stage that the reading and writing process are firmly established. It may be worth nothing, however, that this standard would not classify as literate people who have used vocational education, literacy classes or other informal education that might further reading skills. It would be useful to break the UNESCO test into finer categories to analyze effects of differential educational attainment of mothers on the nutritional status of the child. Data in Panama will allow examination of attainment level in formal and vocational schooling as well as information as to whether the respondent considers himself able to read and write. This will facilitate validation of various hypotheses establishing positive or negative correlations between education and nutritional status of the child. For example, preliminary data would seem to suggest that formal education beyond a certain point makes little additional contribution to knowledge on child care--that information comes mainly from contact with health personnel or accessibility of information.

The educational attainment of other family members may have an effect on the nutritional status of the child as well. Level of education of the person who "keeps" the child is important when the mother's time is not available for child care. Educational attainment of the father could be important in determining the KAP in the household and thus have an influence on the nutritional status of the child.

F. Housing and Nutrition

No individuals exist in total isolation, and few remain uninfluenced by variables relating to family and household characteristics. Individual nutritional status can be as much a factor of family economic and housing conditions as of individual earning power or health. Variables both internal and external to households will effect the actual and potential health status of individuals living in the households. External variables relevant to nutritional status

include housing construction, access to sanitary and health services, ownership of labor-saving devices, etc. The length of time of residence will naturally affect access to information and should be considered when examining each household's relationship to these external factors. Internal factors, such as family size, composition and hierarchy, also impact upon individual nutritional status. Family composition plays a particularly crucial role in nutrition for preschool children, since interventions designed to alleviate malnutrition usually depend on the cooperation of adults within the household of targeted children. The following sections present a preliminary analysis of several relevant household characteristics--such as housing conditions, family composition, and migration patterns--and suggestions for integrating such information into the design of nutrition programs in Panama.

Family Composition

The survey covered a total o 5,775 families. We define a household as all persons sleeping under one roof. The head of household is self-designated in most households. For later analysis, we will be able to make distinctions between "economic" head (i.e., the individual who takes responsibility for allocating the household's resources; us ılly the chief generator of income) and "cultural" head (i.e., in many cultures, the senior male in the household, regardless of his power to make binding economic decisions for the household). Table 15 is a breakdown of several household characteristics, by the sex and marital status of the head of household.

The sex of the head of household is particularly important in cases where a mother of pre-schoolers is the economic head. As a rational individual, these women can and do consider the opportunity cost of time spent in the home versus time spent in income generating activities outside the home, particularly when they are the chief income generator and/or household income is at or below the poverty level. Programs designed to alleviate malnutrition among preschoolers which will require inputs of mother's time should be assessed accordingly. Since there is probably a negative correlation between income and malnutrition, nutrition programs should emphasize children in women-headed households since women's average individual income was $90 Balboas monthly. This compares very unfavorably with the average individual income of male-heads of households of $190 Balboas monthly. Income from other members of the household does not apparently help the female headed households--as shown in Table 15. All categories of female headed households have a lower income per

capita than male-headed households.

Analyzing family composition may enable us to track the role played by other adults or more mature siblings in the care and feeding of preschoolers. The data will require further work before inferences for Panamanian households may be drawn.

Preliminary analysis shows the average household consists of an adult couple and two of their children. Half of the households include one child from a previous union and almost all households include at least one additional family member.

Housing Data

Due to broad-based government housing programs over the last few years, a very high percentage (77 percent) of families in Panama own their own homes. The quality of housing is reflected in the number of people per room, as well as in the construction, access to water, sewage and lights. Table 16 contains a number of key housing quality indicators, broken down by ownership and urban or rural location.

Migration

Access to both public services and quality housing improve with length of residence in an area, as migrants move along the learning curve and become familiar with the full range of opportunities available to them. Thirty-four percent of all persons surveyed had migrated at some point during their lives. The data does not permit us to distinguish circular migration, nor to identify trends in sectoral migration, i.e., rural to urban. However, relevant analysis can be made with respect to length of residence and occupation, education and other socio-economic variables. Further work should include an investigation of the percent of migrants who move with young children, to determine the need to improve the accessibility of nutritional programs to immigrants.

G. Conclusion

The analyses to date of the survey data have served to test the data, reveal further cleaning requirements on the files, the nature of additional data needs, and have suggested future approaches for analysis. During the next year of the project a major investment of time will be devoted to analysis of the data, especially testing evaluation models and "fleshing out" the economic models. The data will be analyzed from any conceivable perspective in order to identify cost-effective and reliable means of nutrition program evaluation.

Table 9

CALORIC ADEQUACY OF HOUSEHOLD DIET AND NUTRITIONAL STATUS
OF CHILDREN UNDER 5 YEARS OF AGE

Nutritional Status (wt/ht)	Caloric Adequacy				
	<60%	60-75%	75-90%	90-110%	>110%
Low	11.67	11.67	20.00	21.67	35.00
Normal	12.89	12.89	18.04	14.95	41.24
High	11.43	20.00	17.14	14.29	37.14

Table 10

PROTEIN ADEQUACY OF HOUSEHOLD DIET AND NUTRITIONAL STATUS
OF CHILDREN UNDER 5 YEARS OF AGE

Nutritional Status (wt/ht)	Protein Adequacy				
	<60%	60-75%	75-90%	90-110%	>110%
Low	73.33	10.00	3.33	8.33	5.00
Normal	72.16	4.12	5.67	7.73	10.31
High	62.86	5.71	20.00	2.86	8.57

Table 11

BREASTFEEDING PATTERNS

	Percentage of Children
Never breastfed	15.592
less than 1 month	6.678
1-3 months	15.186
4-6 months	9.117
7-11 months	8.914
1-2 years	25.581
less than 2 years	2.816
still breastfeeding	15.679
does not remember	0.348

Table 12

PATTERN OF INTRODUCTION OF FOODS

Food	Age of Introduction (months)	Percentage of Childre
Fruit Juices	0-1 month	25.26
	[illegible]	20.90
	[illegible]onths	25.07
	4 months	8.45
	5 months	3.97
	6 months	9.34
	7-12 months	5.65
	13-60 months	1.36
Mashed Fruit	0-1 month	9.62
	2 months	20.72
	3 months	28.98
	4 months	13.18
	5 months	6.50
	6 months	11.51
	7-12 months	8.62
	13-60 months	0.86
Mashed Vegetables	0-1 month	2.81
	2 months	7.51
	3 months	23.24
	4 months	17.91
	5 months	11.19
	6 months	19.72
	7-12 months	17.00
	13-60 months	0.63
Soups	0-1 month	3.66
	2 months	5.60
	3 months	19.49
	4 months	16.69
	5 months	11.63
	6 months	24.72
	7-12 months	17.45
	13-60 months	0.77

Table 12 (cont.)

Food	Age of Introduction (months)	Percentage of Children
Cream of Cereals	0-1 month	9.07
	2 months	10.02
	3 months	22.94
	4 months	14.54
	5 months	8.26
	6 months	18.65
	7-12 months	15.35
	13-60 months	1.17
Milk	0-1 month	49.92
	2 months	9.08
	3 months	7.98
	4 months	5.04
	5 months	2.73
	6 months	11.29
	7-12 months	11.29
	13-60 months	2.68
	0-1 month	2.73
	2 months	11.19
	3 months	23.68
	4 months	13.45
	5 months	6.97
	6 months	18.66
	7-12 months	16.91
	13-60 months	1.41
Eggs	0-1 month	3.83
	2 months	3.58
	3 months	12.87
	4 months	18.52
	5 months	9.15
	6 months	24.05
	7-12 months	26.12
	13-60 months	1.88

Table 12 (cont.)

Food	Age of Introduction (months)	Percentage of Children
Beans	0-1 month	
	2 months	
	3 months	
	4 months	
	5 months	
	6 months	
	7-12 months	
	13-60 months	
Meats	0-1 month	5.26
	2 months	1.05
	3 months	3.84
	4 months	3.92
	5 months	4.42
	6 months	17.91
	7-12 months	59.39
	13-60 months	4.21

Table 13

REASONS FOR NOT BREASTFEEDING

Reason	Percentage of Respondents
Lack of milk	30.51
Mother's illness	21.08
Child's illness	7.35
Did not want to	21.08
Lack of nipple	4.16
Other	15.67

Table 14

REASONS FOR ENDING BREASTFEEDING

Reason	Percentage of Respondents
Lack of milk	25.20
Mother's illness	12.87
Child's illness	5.21
New pregnancy	12.72
Work	9.53
Other	34.14

To this point in time, considerable staff time and resources have been devoted to assisting the Panamanian Ministry of Health in the development and completion of the National Nutritional Status Survey. The objective of RTI staff and consultants in assisting the Ministry in this fashion has been the beneficial cooperation gained, as well as the greater familiarity with Panamanian operations, methods of government management, and other potential influences on nutrition programs.

The project has now arrived, however, to the point where analysis of the survey data can more directly meet the objectives of the project, i.e., the development of nutrition evaluation methodologies. Subsequent analyses will be conducted with weighted data, where appropriate, and with fully cleaned and edited data files. The results presented in this section of the report are strictly preliminary and should not be quoted as fully documented and analyzed data from the National Survey.

TABLE 15

Household & Head of Household Characteristics

	MALE	FEMALE			Total = 1024		
		Single	Married	Commonlaw	Separated	Widowed	Other (no response to marital status questions)
ber	4496	189(18%)	60(6%)	48(5%)	127(12%)	29(3%)	571(55.[illegible])
ge	43.33	42.76	45.15	42.00	41.94	51.89	55.73
rs of school	5.9	7.0	8.0	5.6	6.5	4.5	5.4
iteracy	73%	79%	82%	67%	80%	72%	62[illegible]
or force participation	82%	49%	35%	41%	51%	24%	33%
e of employment							
ermanent	73%	64%	58%	48%	63%	57%	60%
art-time	21%	23%	23%	44%	21%	29%	19
ther	6%	13%	19%	8%	16%	14%	21[illegible]
loyment sector							
griculture	41%	9%	0	19%	7%	29%	16%
ublic	15%	41%	58%	14%	38%	43%	26%
ther	44%	50%	42%	67%	55%	28%	58%
kly hours of work	43.5	37.1	46.5	41.5	38.1	35.1	42.68
ividual income	191.29	100.99	146.90	85.08	95.27	72.00	83.24
ousehold income	300-400	150-200	250-300	300-400	200-250	150-200	150-200
ncome/household member	70-80	50-60	60-70	50-60	60-70	30-40	50-60
f persons in household	5.08	4.42	4.37	5.31	4.80	4.24	4.05
ancy							
wned	71%	54%	42%	63%	71%	83%	73%
ther	29%	46%	•58%	37%	29%	17%	27%

Table 16

Housing Characteristics

	Rural	Urban	Combined
Tenant Status	76%	24%	
owned	82%	51%	74%
rented	10%	35%	16%
Other	8%	14%	9%
Rooms/person	.47	.56	.49
Bedrooms/person	.29	.33	.30
Access to potable water			
no risk	43%	67%	48%
low risk	22%	23%	22%
high risk	35%	10%	29%

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Appendix A

REPUBLICA DE PANAMA
ANALYSIS MULTISECTORIAL DE LA SITUACION
ALIMENTARIA Y NUTRICIONAL DE PANAMA

PAGE

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REPUBLICA DE PANAMA

ANALISIS MULTISECTORIAL DE LA SITUACION ALIMENTARIA Y NUTRICIONAL DE PANAMA

No. de la Boleta ID1 94 080

No. de Segmento ID2

Provincia

Distrito

Corregimiento

Regiduría

Comunidad

OBSERVACIONES:

RESULTADO DE LA ENTREVISTA ID4

- Completa ☐ 1
- Ausencia de Informantes Competentes ☐ 2
- Rechazada ☐ 3
- Parcialmente Completa ☐ 4
- Vivienda Cerrada ☐ 5
- Vivienda Desocupada ☐ 6
- Otro _____ ☐ 7
  ESPECIFIQUE

Nombre del Empadronador ID5 ☐☐

Nombre del Supervisor

Fecha ID6 ID7

DIA MES AÑO

No. de Boleta _____
No. de Hoja _____

CARACTERISTICAS GENENERALES

	1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
1.- CUAL ES SU NOMBRE Y APELLIDO							
2 FECHA DE NACIMIENTO	MES AÑO	MES AÑO	MES AÑO	MES AÑO	MES AÑO	MES AÑO	MES AÑO
3. E AD (EN AÑOS CUMPLIDOS)	AÑOS MESES IM12	AÑOS MESES	AÑOS MESES	AÑOS MESES	AÑOS MESES	AÑOS MESES	AÑOS MESES
4. SEXO	HOMBRE ☐1 MUJER ☐2 I10	HOMBRE ☐1 MUJER ☐2	HOMBRE ☐1 MUJER ☐2	HOMBRE ☐1 MUJER ☐2	HOMBRE ☐1 MUJER ☐2	HOMBRE ☐1 MUJER ☐2	HOMBRE ☐1 MUJER ☐2
5 PESO ACTUAL EN KILOS	KILOS I D14	KILOS	KILOS	KILOS	KILOS	KILOS	KILOS
6 TALLA ACTUAL EN CENTIMETROS	CENTIMETROS I D15	CENTIMETROS	CENTIMETROS	CENTIMETROS	CENTIMETROS	CENTIMETROS	CENTIMETROS
QUE RELACION O PARENTESCO TIENE CON EL JEFE DE LA FAMILIA	JEFE I D16 ☐1	JEFE ☐1	JEFE ☐1	JEFE ☐1	JEFE ☐1	JEFE ☐1	JEFE ☐1
	CONYUGE ☐2	CONYUGE ☐2	CONYUGE ☐2	CONYUGE ☐2	CONYUGE ☐2	CONYUGE ☐2	CONYUGE ☐2
	HIJO DE LA PAREJA ☐3	HIJO DE LA PAREJA ☐3	HIJO DE LA PAREJA ☐3	HIJO DE LA PAREJA ☐3	HIJO DE LA PAREJA ☐3	HIJO DE LA PAREJA ☐3	HIJO DE LA PAREJA ☐3
	HIJO DEL PADRE ☐4	HIJO DEL PADRE ☐4	HIJO DEL PADRE ☐4	HIJO DEL PADRE ☐4	HIJO DEL PADRE ☐4	HIJO DEL PADRE ☐4	HIJO DEL PADRE ☐4
	HIJO DE LA MADRE ☐5	HIJO DE LA MADRE ☐5	HIJO DE LA MADRE ☐5	HIJO DE LA MADRE ☐5	HIJO DE LA MADRE ☐5	HIJO DE LA MADRE ☐5	HIJO DE LA MADRE ☐5
	OTRO FAMILIAR ☐6	OTRO FAMILIAR ☐6	OTRO FAMILIAR ☐6	OTRO FAMILIAR ☐6	OTRO FAMILIAR ☐6	OTRO FAMILIAR ☐6	OTRO FAMILIAR ☐6
	OTRO ☐7	OTRO ☐7	OTRO ☐7	OTRO ☐7	OTRO ☐7	OTRO ☐7	OTRO ☐7

EDUCACION

8.- CUAL ES EL GRADO O AÑO ESCOLAR MAS ALTO APROBADO?	PRIMARIA 1 ☐ E1	PRIMARIA 1 ☐ E13	PRIMARIA 1 ☐	PRIMARIA 1 ☐	PRIMARIA 1 ☐	PRIMARIA 1 ☐	PRIMARIA 1 ☐
	SECUNDARIA 2 ☐	SECUNDARIA 2 ☐	SECUNDARIA 2 ☐	SECUNDARIA 2 ☐	SECUNDARIA 2 ☐	SECUNDARIA 2 ☐	SECUNDARIA 2 ☐
	UNIV. O SUPERIOR 3 ☐	UNIV. O SUPERIOR 3 ☐	UNIV. O SUPERIOR 3 ☐	UNIV. O SUPERIOR 3 ☐	UNIV. O SUPERIOR 3 ☐	UNIV. O SUPERIOR 3 ☐	UNIV. O SUPERIOR 3 ☐
	VOCACIONAL 4 ☐	VOCACIONAL 4 ☐	VOCACIONAL 4 ☐	VOCACIONAL 4 ☐	VOCACIONAL 4 ☐	VOCACIONAL 4 ☐	VOCACIONAL 4 ☐
9.- SABE LEER Y O ESCRIBIR?	SI ☐1 NO ☐2 E2	SI ☐1 NO ☐2	SI ☐1 NO ☐2	SI ☐1 NO ☐2	SI ☐1 NO ☐2	SI ☐1 NO ☐2	SI ☐1 NO ☐2

	1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	5ª PERSONA	7ª PERSONA
10.- ASISTE ACTUALMENTE A LA ESCUELA? (A QUE NIVEL)							
PRE PRIMARIA	☐ 1	PRE PRIMARIA ☐ 1	PRE PRIMARIA ☐ 1	PRE PRIMARIA ☐ 1	PRE PRIMARIA ☐ 1	PRE PRIMARIA ☐ 1	PRE-PRIMARIA ☐ 1
PRIMARIA	☐ 2	PRIMARIA ☐ 2	PRIMARIA ☐ 2	PRIMARIA ☐ 2	PRIMARIA ☐ 2	PRIMARIA ☐ 2	PRIMARIA ☐ 2
SECUNDARIA E3	☐ 3	SECUNDARIA ☐ 3	SECUNDARIA ☐ 3	SECUNDARIA ☐ 3	SECUNDARIA ☐ 3	SECUNDARIA ☐ 3	SECUNDARIA ☐ 3
SUPERIOR	☐ 4	SUPERIOR ☐ 4	SUPERIOR ☐ 4	SUPERIOR ☐ 4	SUPERIOR ☐ 4	SUPERIOR ☐ 4	SUPERIOR ☐ 4
VOCACIONAL	☐ 5	VOCACIONAL ☐ 5	VOCACIONAL ☐ 5	VOCACIONAL ☐ 5	VOCACIONAL ☐ 5	VOCACIONAL ☐ 5	VOCACIONAL ☐ 5
ESPECIAL U OTRO	☐ 6	ESPECIAL U OTRO ☐ 6	ESPECIAL U OTRO ☐ 6	ESPECIAL U OTRO ☐ 6	ESPECIAL U OTRO ☐ 6	ESPECIAL U OTRO ☐ 6	ESPECIAL U OTRO ☐ 6
C. ALFABETIZACION	☐ 7	C. ALFABETIZACION ☐ 7	C. ALFABETIZACION ☐ 7	C. ALFABETIZACION ☐ 7	C. ALFABETIZACION ☐ 7	C. ALFABETIZACION ☐ 7	C. ALFABETIZACION ☐ 7
NO ASISTE	☐ 8	NO ASISTE ☐ 8	NO ASISTE ☐ 8	NO ASISTE ☐ 8	NO ASISTE ☐ 8	NO ASISTE ☐ 8	NO ASISTE ☐ 8
11.- GASTOS EN EDUCACION							
MATRICULA	B/. E4	MATRICULA B/.	MATRICULA B/.	MATRICULA B/.	MATRICULA B/.	MATRICULA B/.	MATRICULA B/.
LABORATORIO	E5	LABORATORIO	LABORATORIO	LABORATORIO	LABORATORIO	LABORATORIO	LABORATORIO
MENSUALIDAD	E6	MENSUALIDAD	MENSUALIDAD	MENSUALIDAD	MENSUALIDAD	MENSUALIDAD	MENSUALIDAD
UNIFORME Y ZAPATOS	E7	UNIFORME Y ZAPATOS	UNIFORME Y ZAPATOS	UNIFORME Y ZAPATOS	UNIFORME Y ZAPATOS	UNIFORME Y ZAPATOS	UNIFORME Y ZAPATOS
UNIFORME DE GIMNASIA	E8	UNIFORME DE GIMNASIA	UNIFORME DE GIMNASIA	UNIFORME DE GIMNASIA	UNIFORME DE GIMNASIA	UNIFORME DE GIMNASIA	UNIFORME DE GIMNASIA
UTILES ESCOLARES	E9	UTILES ESCOLARES	UTILES ESCOLARES	UTILES ESCOLARES	UTILES ESCOLARES	UTILES ESCOLARES	UTILES ESCOLARES
TRANSPORTE	E10	TRANSPORTE	TRANSPORTE	TRANSPORTE	TRANSPORTE	TRANSPORTE	TRANSPORTE
MERIENDA	E11	MERIENDA	MERIENDA	MERIENDA	MERIENDA	MERIENDA	MERIENDA
OTROS	E12	OTROS	OTROS	OTROS	OTROS	OTROS	OTROS

MIGRACION (Para Mayores de 5 Años)

12.- DESDE CUANDO VIVE EN ESTA COMUNIDAD?						
SIEMPRE ☐ 1 (01)	SIEMPRE ☐ 1	SIEMPRE ☐ 1	SIEMPRE ☐ 1	SIEMPRE ☐ 1	SIEMPRE ☐ 1	SIEMPRE ☐ 1
DESDE: 02 (MES) 03 (AÑO)	DESDE: MES AÑO	DESDE: MES AÑO	DESDE: MES AÑO	DESDE: MES AÑO	DESDE: MES AÑO	DESDE: MES AÑO
13.- DONDE VIVIA ANTES DE ESTABLECERSE EN ESTE LUGAR?						
04 DISTRITO	DISTRITO	DISTRITO	DISTRITO	DISTRITO	DISTRITO	DISTRITO
OTRO PAIS	OTRO PAIS	OTRO PAIS	OTRO PAIS	OTRO PAIS	OTRO PAIS	OTRO PAIS

OCUPACION (Para Mayores de 5 Años)

14.- DURANTE LA SEMANA PASADA TUVO ALGUN TRABAJO O EMPLEO?						
SI ☐ 1 (01)	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1
NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2
15.- ESTUVO BUSCANDO TRABAJO LA SEMANA PASADA?						
02 SI ☐ 1 PASE A PREG. 17	SI ☐ 1 PASE A PREG. 17	SI ☐ 1 PASE A PREG. 17	SI ☐ 1 PASE A PREG. 17	SI ☐ 1 PASE A PREG. 17	SI ☐ 1 PASE A PREG. 17	SI ☐ 1 PASE A PREG. 17
NO ☐ 2 CONTINUE	NO ☐ 2 CONTINUE	NO ☐ 2 CONTINUE	NO ☐ 2 CONTINUE	NO ☐ 2 CONTINUE	NO ☐ 2 CONTINUE	NO ☐ 2 CONTINUE

A-5

O C U P A C I O N (Continuación)

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
16 - POR QUE MOTIVO NO ESTUVO BUSCANDO TRABAJO LA SEMANA PASADA?						
HACE TRABAJOS OCASIONALES 03 ☐ 1	HACE TRABAJOS OCASIONALES ☐ 1	HACE TRABAJOS OCASIONALES ☐ 1	HACE TRABAJOS OCASIONALES ☐ 1	HACE TRABAJOS OCASIONALES ☐ 1	HACE TRABAJOS OCASIONALES ☐ 1	HACE TRABAJOS OCASIONALES ☐ 1
HA BUSCADO ANTES Y ESTA ESPERANDO NOTICIAS AHORA ☐ 2	HA BUSCADO ANTES Y ESTA ESPERANDO NOTICIAS AHORA ☐ 2	HA BUSCADO ANTES Y ESTA ESPERANDO NOTICIAS AHORA ☐ 2	HA BUSCADO ANTES Y ESTA ESPERANDO NOTICIAS AHORA ☐ 2	HA BUSCADO ANTES Y ESTA ESPERANDO NOTICIAS AHORA ☐ 2	HA BUSCADO ANTES Y ESTA ESPERANDO NOTICIAS AHORA ☐ 2	HA BUSCADO ANTES Y ESTA ESPERANDO NOTICIAS AHORA ☐ 2
IMPOSIBLE ENCONTRAR TRABAJO ☐ 3	IMPOSIBLE ENCONTRAR TRABAJO ☐ 3	IMPOSIBLE ENCONTRAR TRABAJO ☐ 3	IMPOSIBLE ENCONTRAR TRABAJO ☐ 3	IMPOSIBLE ENCONTRAR TRABAJO ☐ 3	IMPOSIBLE ENCONTRAR TRABAJO ☐ 3	IMPOSIBLE ENCONTRAR TRABAJO ☐ 3
AMA DE CASA ☐ 4	AMA DE CASA ☐ 4	AMA DE CASA ☐ 4	AMA DE CASA ☐ 4	AMA DE CASA ☐ 4	AMA DE CASA ☐ 4	AMA DE CASA ☐ 4
ESTUDIANTE ☐ 5	ESTUDIANTE ☐ 5	ESTUDIANTE ☐ 5	ESTUDIANTE ☐ 5	ESTUDIANTE ☐ 5	ESTUDIANTE ☐ 5	ESTUDIANTE ☐ 5
ESTA INVALIDO ☐ 6	ESTA INVALIDO ☐ 6	ESTA INVALIDO ☐ 6	ESTA INVALIDO ☐ 6	ESTA INVALIDO ☐ 6	ESTA INVALIDO ☐ 6	ESTA INVALIDO ☐ 6
JUBILADO ☐ 7	JUBILADO ☐ 7	JUBILADO ☐ 7	JUBILADO ☐ 7	JUBILADO ☐ 7	JUBILADO ☐ 7	JUBILADO ☐ 7
PENSIONADO ☐ 8	PENSIONADO ☐ 8	PENSIONADO ☐ 8	PENSIONADO ☐ 8	PENSIONADO ☐ 8	PENSIONADO ☐ 8	PENSIONADO ☐ 8
RETIRADO ☐ 9	RETIRADO ☐ 9	RETIRADO ☐ 9	RETIRADO ☐ 9	RETIRADO ☐ 9	RETIRADO ☐ 9	RETIRADO ☐ 9
OTRA CONDICION ☐ 10	OTRA CONDICION ☐ 10	OTRA CONDICION ☐ 10	OTRA CONDICION ☐ 10	OTRA CONDICION ☐ 10	OTRA CONDICION ☐ 10	OTRA CONDICION ☐ 10
17 - EN LOS ULTIMOS 6 MESES CUANTOS MESES HA TRABAJADO?						
MESES ☐ 04	MESES ☐	MESES ☐	MESES ☐	MESES ☐	MESES ☐	MESES ☐
18 - CUAL ES SU OCUPACION PRINCIPAL Y CUANTO GANA?						
05 OCUP. PRINCIPAL — B/. 06 SALARIO	OCUP. PRINCIPAL — B/. SALARIO	OCUP. PRINCIPAL — B/. SALARIO	OCUP. PRINCIPAL — B/. SALARIO	OCUP. PRINCIPAL — B/. SALARIO	OCUP. PRINCIPAL — B/. SALARIO	OCUP. PRINCIPAL — B/. SALARIO
19 - CUAL ES SU OCUPACION SECUNDARIA Y CUANTO GANA?						
07 OCUPACION — B/. 08 SALARIO	OCUPACION — B/. SALARIO	OCUPACION — B/. SALARIO	OCUPACION — B/. SALARIO	OCUPACION — B/. SALARIO	OCUPACION — B/. SALARIO	OCUPACION — B/. SALARIO
20 - TRABAJA O TRABAJO LA ULTIMA VES COMO:						
EMPL. PERMANENTE EMPRESA PRIV. 09 ☐ 1	EMPL. PERMANENTE EMPRESA PRIV. ☐ 1	EMPL. PERMANENTE EMPRESA PRIV. ☐ 1	EMPL. PERMANENTE EMPRESA PRIV. ☐ 1	EMPL. PERMANENTE EMPRESA PRIV. ☐ 1	EMPL. PERMANENTE EMPRESA PRIV. ☐ 1	EMPL. PERMANENTE EMPRESA PRIV. ☐ 1
EMPL. EVENTUAL EMPRESA PRIVADA. ☐ 2	EMPL. EVENTUAL EMPRESA PRIVADA. ☐ 2	EMPL. EVENTUAL EMPRESA PRIVADA. ☐ 2	EMPL. EVENTUAL EMPRESA PRIVADA. ☐ 2	EMPL. EVENTUAL EMPRESA PRIVADA. ☐ 2	EMPL. EVENTUAL EMPRESA PRIVADA. ☐ 2	EMPL. EVENTUAL EMPRESA PRIVADA. ☐ 2
EMPLEADO DEL GOBIERNO PERMANENTE. ☐ 3	EMPLEADO DEL GOBIERNO PERMANENTE. ☐ 3	EMPLEADO DEL GOBIERNO PERMANENTE. ☐ 3	EMPLEADO DEL GOBIERNO PERMANENTE. ☐ 3	EMPLEADO DEL GOBIERNO PERMANENTE. ☐ 3	EMPLEADO DEL GOBIERNO PERMANENTE. ☐ 3	EMPLEADO DEL GOBIERNO PERMANENTE. ☐ 3
EMPLEADO DEL GOBIERNO EVENTUAL. ☐ 4	EMPLEADO DEL GOBIERNO EVENTUAL. ☐ 4	EMPLEADO DEL GOBIERNO EVENTUAL. ☐ 4	EMPLEADO DEL GOBIERNO EVENTUAL. ☐ 4	EMPLEADO DEL GOBIERNO EVENTUAL. ☐ 4	EMPLEADO DEL GOBIERNO EVENTUAL. ☐ 4	EMPLEADO DEL GOBIERNO EVENTUAL. ☐ 4
TRABAJO CUENTA PROPIA PERMANENTE. ☐ 5	TRABAJO CUENTA PROPIA PERMANENTE. ☐ 5	TRABAJO CUENTA PROPIA PERMANENTE. ☐ 5	TRABAJO CUENTA PROPIA PERMANENTE. ☐ 5	TRABAJO CUENTA PROPIA PERMANENTE. ☐ 5	TRABAJO CUENTA PROPIA PERMANENTE. ☐ 5	TRABAJO CUENTA PROPIA PERMANENTE. ☐ 5
TRABAJO CUENTA PROPIA EVENTUAL. ☐ 6	TRABAJO CUENTA PROPIA EVENTUAL. ☐ 6	TRABAJO CUENTA PROPIA EVENTUAL. ☐ 6	TRABAJO CUENTA PROPIA EVENTUAL. ☐ 6	TRABAJO CUENTA PROPIA EVENTUAL. ☐ 6	TRABAJO CUENTA PROPIA EVENTUAL. ☐ 6	TRABAJO CUENTA PROPIA EVENTUAL. ☐ 6
PATRON. ☐ 7	PATRON. ☐ 7	PATRON. ☐ 7	PATRON. ☐ 7	PATRON. ☐ 7	PATRON. ☐ 7	PATRON. ☐ 7
TRABAJO FAMILIAR. ☐ 8	TRABAJO FAMILIAR. ☐ 8	TRABAJO FAMILIAR. ☐ 8	TRABAJO FAMILIAR. ☐ 8	TRABAJO FAMILIAR. ☐ 8	TRABAJO FAMILIAR. ☐ 8	TRABAJO FAMILIAR. ☐ 8

O C U P A C I O N (Cont.)

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
21.- A QUE SE DEDICA LA EMPRESA O ESTABLECIMIENTO PARA LA CUAL USTED TRABAJO?						
CONSTRUCCION ☐ 1	CONSTRUCCION ☐ 1	CONSTRUCCION ☐ 1	CONSTRUCCION ☐ 1	CONSTRUCCION ☐ 1	CONSTRUCCION ☐ 1	CONSTRUCCION ☐ 1
TRANSPORTE ☐ 2	TRANSPORTE ☐ 2	TRANSPORTE ☐ 2	TRANSPORTE ☐ 2	TRANSPORTE ☐ 2	TRANSPORTE ☐ 2	TRANSPORTE ☐ 2
COMERCIAL 010 ☐ 3	COMERCIAL ☐ 3	COMERCIAL ☐ 3	COMERCIAL ☐ 3	COMERCIAL ☐ 3	COMERCIAL ☐ 3	COMERCIAL ☐ 3
INDUSTRIAL ☐ 4	INDUSTRIAL ☐ 4	INDUSTRIAL ☐ 4	INDUSTRIAL ☐ 4	INDUSTRIAL ☐ 4	INDUSTRIAL ☐ 4	INDUSTRIAL ☐ 4
AGROPECUARIO ☐ 5	AGROPECUARIO ☐ 5	AGROPECUARIO ☐ 5	AGROPECUARIO ☐ 5	AGROPECUARIO ☐ 5	AGROPECUARIO ☐ 5	AGROPECUARIO ☐ 5
PUBLICO ☐ 6	PUBLICO ☐ 6	PUBLICO ☐ 6	PUBLICO ☐ 6	PUBLICO ☐ 6	PUBLICO ☐ 6	PUBLICO ☐ 6
SERVICIOS ☐ 7	SERVICIOS ☐ 7	SERVICIOS ☐ 7	SERVICIOS ☐ 7	SERVICIOS ☐ 7	SERVICIOS ☐ 7	SERVICIOS ☐ 7
COMUNICACIONES ☐ 8	COMUNICACIONES ☐ 8	COMUNICACIONES ☐ 8	COMUNICACIONES ☐ 8	COMUNICACIONES ☐ 8	COMUNICACIONES ☐ 8	COMUNICACIONES ☐ 8
BANCARIO O FINANCIERO ☐ 9	BANCARIO O FINANCIERO ☐ 9	BANCARIO O FINANCIERO ☐ 9	BANCARIO O FINANCIERO ☐ 9	BANCARIO O FINANCIERO ☐ 9	BANCARIO O FINANCIERO ☐ 9	BANCARIO O FINANCIERO ☐ 9
NO TRABAJO ☐ 10	NO TRABAJO ☐ 10	NO TRABAJO ☐ 10	NO TRABAJO ☐ 10	NO TRABAJO ☐ 10	NO TRABAJO ☐ 10	NO TRABAJO ☐ 10
22.- CUANTAS HORAS TRABAJO LA SEMANA PASADA?						
HORAS ☐☐ 011	HORAS ☐☐	HORAS ☐☐	HORAS ☐☐	HORAS ☐☐	HORAS ☐☐	HORAS ☐☐
23.- SI ES EMPLEADO ASALARIADO (Temporal o Permanente) QUE SUELDO O SALARIO GANA ACTUALMENTE EN SU OCUPACION PRINCIPAL?						
(ANOTE EL SUELDO BRUTO) 012						
1 DIARIO B/. 013	DIARIO B/. ____	DIARIO B/. ____	DIARIO B/. ____	DIARIO B/. ____	DIARIO B/. ____	DIARIO B/. ____
2 SEMANAL ____	SEMANAL ____	SEMANAL ____	SEMANAL ____	SEMANAL ____	SEMANAL ____	SEMANAL ____
3 QUINCENAL ____	QUINCENAL ____	QUINCENAL ____	QUINCENAL ____	QUINCENAL ____	QUINCENAL ____	QUINCENAL ____
4 MENSUAL ____	MENSUAL ____	MENSUAL ____	MENSUAL ____	MENSUAL ____	MENSUAL ____	MENSUAL ____
24.- EL MES PASADO CUANTO DINERO RECIBIO POR LO SIGUIENTE:						
SALARIO Y JORNALES: 014	SALARIO Y JORNALES:	SALARIO Y JORNALES:	SALARIO Y JORNALES:	SALARIO Y JORNALES:	SALARIO Y JORNALES:	SALARIO Y JORNALES:
VENTA DE PRODUCTOS: 015	VENTA DE PRODUCTOS: ____	VENTA DE PRODUCTOS: ____	VENTA DE PRODUCTOS: ____	VENTA DE PRODUCTOS: ____	VENTA DE PRODUCTOS: ____	VENTA DE PRODUCTOS: ____
VENTA DE SERVICIOS: 016	VENTA DE SERVICIOS: ____	VENTA DE SERVICIOS: ____	VENTA DE SERVICIOS: ____	VENTA DE SERVICIOS: ____	VENTA DE SERVICIOS: ____	VENTA DE SERVICIOS: ____
GANANCIA DE NEGOCIO: 017	GANANCIA DE NEGOCIO: ____	GANANCIA DE NEGOCIO: ____	GANANCIA DE NEGOCIO: ____	GANANCIA DE NEGOCIO: ____	GANANCIA DE NEGOCIO: ____	GANANCIA DE NEGOCIO: ____
COMISION: 018	COMISION: ____	COMISION: ____	COMISION: ____	COMISION: ____	COMISION: ____	COMISION: ____
DIVIDENDO, INTERESES: 019	DIVIDENDO, INTERESES: ____	DIVIDENDO INTERESES: ____	DIVIDENDO INTERESES: ____	DIVIDENDO INTERESES: ____	DIVIDENDO, INTERESES: ____	DIVIDENDO, INTERESES: ____
PENSION Y JUBILACION: 020	PENSION Y JUBILACION: ____	PENSION Y JUBILACION: ____	PENSION Y JUBILACION: ____	PENSION Y JUBILACION: ____	PENSION Y JUBILACION: ____	PENSION Y JUBILACION: ____
LOTERIA, CABALLOS, GALLOS Y OTROS JUEGOS DE AZAR: 021	LOTERIA, CABALLOS, GALLOS Y OTROS JUEGOS DE AZAR: ____	LOTERIA, CABALLOS, GALLOS Y OTROS JUEGOS DE AZAR: ____	LOTERIA, CABALLOS, GALLOS Y OTROS JUEGOS DE AZAR: ____	LOTERIA, CABALLOS, GALLOS Y OTROS JUEGOS DE AZAR: ____	LOTERIA, CABALLOS, GALLOS Y OTROS JUEGOS DE AZAR: ____	LOTERIA, CABALLOS, GALLOS Y OTROS JUEGOS DE AZAR: ____
ALQUILER DE CASA, TERRENO, ETC.: 022	ALQUILER DE CASA, TERRENO, ETC.: ____	ALQUILER DE CASA, TERRENO, ETC.: ____	ALQUILER DE CASA, TERRENO, ETC.: ____	ALQUILER DE CASA, TERRENO, ETC.: ____	ALQUILER DE CASA, TERRENO, ETC.: ____	ALQUILER DE CASA, TERRENO, ETC.: ____
INDEMNIZACIONES DE 023	INDEMNIZACIONES DE	INDEMNIZACIONES DE	INDEMNIZACIONES DE	INDEMNIZACIONES DE	INDEMNIZACIONES DE	INDEMNIZACIONES DE

OCUPACION (Cont.)

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
(CONTINUACION)						
AYUDA DE FAMILIARES Y AMIGOS C24	AYUDA DE FAMILIARES Y AMIGOS. _____	AYUDA DE FAMILIARES Y AMIGOS. _____	AYUDA DE FAMILIARES Y AMIGOS. _____	AYUDA DE FAMILIARES Y AMIGOS. _____	AYUDA DE FAMILIARES Y AMIGOS. _____	AYUDA DE FAMILIARES Y AMIGOS. _____
REGALOS, DONACIONES Y BECAS 025	REGALOS, DONACIONES Y BECAS. _____	REGALOS, DONACIONES Y BECAS. _____	REGALOS, DONACIONES Y BECAS. _____	REGALOS, DONACIONES Y BECAS. _____	REGALOS, DONACIONES Y BECAS. _____	REGALOS, DONACIONES Y BECAS. _____
PAGOS Y REGALIAS EN ESPECIE (SEA BIENES, ROPA, COMIDA) VALOR APROXIMADO 026	PAGOS Y REGALIAS EN ESPECIE (SEA BIENES, ROPA, COMIDA) VALOR APROXIMADO. _____	PAGOS Y REGALIAS EN ESPECIE (SEA BIENES, ROPA, COMIDA) VALOR APROXIMADO. _____	PAGOS Y REGALIAS EN ESPECIE (SEA BIENES, ROPA, COMIDA) VALOR APROXIMADO. _____	PAGOS Y REGALIAS EN ESPECIE (SEA BIENES, ROPA, COMIDA) VALOR APROXIMADO. _____	PAGOS Y REGALIAS EN ESPECIE (SEA BIENES, ROPA, COMIDA) VALOR APROXIMADO. _____	PAGOS Y REGALIAS EN ESPECIE (SEA BIENES, ROPA, COMIDA) VALOR APROXIMADO. _____

SALUD (Datos de Morbilidad, para todos los Miembros de la Familia)

25.- ESTUVO ENFERMO LOS ULTIMOS 15 DIAS?						
SI ☐ 1 NO ☐ 2 S7	SI ☐ 1 NO ☐ 2	SI ☐ 1 NO ☐ 2	SI ☐ 1 NO ☐ 2	SI ☐ 1 NO ☐ 2	SI ☐ 1 NO ☐ 2	SI ☐ 1 NO ☐ 2
26.- QUIEN LO HA VISTO/ATENDIDO O RECETADO POR ESTA ENFERMEDAD?						
MEDICO/ENFERMERA ☐ 1	MEDICO/ENFERMERA ☐ 1	MEDICO/ENFERMERA ☐ 1	MEDICO/ENFERMERA ☐ 1	MEDICO/ENFERMERA ☐ 1	MEDICO/ENFERMERA ☐ 1	MEDICO/ENFERMERA ☐ 1
AUXILIAR DE SALUD ☐ 2	AUXILIAR DE SALUD ☐ 2	AUXILIAR DE SALUD ☐ 2	AUXILIAR DE SALUD ☐ 2	AUXILIAR DE SALUD ☐ 2	AUXILIAR DE SALUD ☐ 2	AUXILIAR DE SALUD ☐ 2
FARMACEUTA ☐ 3	FARMACEUTA ☐ 3	FARMACEUTA ☐ 3	FARMACEUTA ☐ 3	FARMACEUTA ☐ 3	FARMACEUTA ☐ 3	FARMACEUTA ☐ 3
CURANDERO ☐ 4	CURANDERO ☐ 4	CURANDERO ☐ 4	CURANDERO ☐ 4	CURANDERO ☐ 4	CURANDERO ☐ 4	CURANDERO ☐ 4
FAMILIAR, AMIGO O VECINO S2 ☐ 5	FAMILIAR, AMIGO O VECINO ☐ 5	FAMILIAR, AMIGO O VECINO ☐ 5	FAMILIAR, AMIGO O VECINO ☐ 5	FAMILIAR, AMIGO O VECINO ☐ 5	FAMILIAR, AMIGO O VECINO ☐ 5	FAMILIAR, AMIGO O VECINO ☐ 5
NADIE ☐ 6	NADIE ☐ 6	NADIE ☐ 6	NADIE ☐ 6	NADIE ☐ 6	NADIE ☐ 6	NADIE ☐ 6
27.- POR QUE NO CONSULTO A ALGUN SERVICIO DE SALUD O A ALGUIEN?						
PORQUE NO NECESITO ☐ 1	PORQUE NO NECESITO ☐ 1	PORQUE NO NECESITO ☐ 1	PORQUE NO NECESITO ☐ 1	PORQUE NO NECESITO ☐ 1	PORQUE NO NECESITO ☐ 1	PORQUE NO NECESITO ☐ 1
POR FALTA DE TIEMPO ☐ 2	POR FALTA DE TIEMPO ☐ 2	POR FALTA DE TIEMPO ☐ 2	POR FALTA DE TIEMPO ☐ 2	POR FALTA DE TIEMPO ☐ 2	POR FALTA DE TIEMPO ☐ 2	POR FALTA DE TIEMPO ☐ 2
POR FALTA DE DINERO ☐ 3	POR FALTA DE DINERO ☐ 3	POR FALTA DE DINERO ☐ 3	POR FALTA DE DINERO ☐ 3	POR FALTA DE DINERO ☐ 3	POR FALTA DE DINERO ☐ 3	POR FALTA DE DINERO ☐ 3
POR DIFICULTADES PARA LLEGAR ☐ 4	POR DIFICULTADES PARA LLEGAR ☐ 4	POR DIFICULTADES PARA LLEGAR ☐ 4	POR DIFICULTADES PARA LLEGAR ☐ 4	POR DIFICULTADES PARA LLEGAR ☐ 4	POR DIFICULTADES PARA LLEGAR ☐ 4	POR DIFICULTADES PARA LLEGAR ☐ 4
OTRO S3 ☐ 5	OTRO ☐ 5	OTRO ☐ 5	OTRO ☐ 5	OTRO ☐ 5	OTRO ☐ 5	OTRO ☐ 5

SOLO PARA MENORES DE 5 AÑOS

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
NOMBRE DE LA MADRE						
28.- HASTA QUE EDAD LE DIO PECHO AL NIÑO? (Mensione el nombre correspondiente)						
NUNCA LE DIO ☐ 1	NUNCA LE DIO ☐ 1	NUNCA LE DIO ☐ 1	NUNCA LE DIO ☐ 1	NUNCA LE DIO ☐ 1	NUNCA LE DIO ☐ 1	NUNCA LE DIO ☐ 1
MENOS DE 1 MES ☐ 2	MENOS DE 1 MES ☐ 2	MENOS DE 1 MES ☐ 2	MENOS DE 1 MES ☐ 2	MENOS DE 1 MES ☐ 2	MENOS DE 1 MES ☐ 2	MENOS DE 1 MES ☐ 2
1-3 MESES ☐ 3	1-3 MESES ☐ 3	1-3 MESES ☐ 3	1-3 MESES ☐ 3	1-3 MESES ☐ 3	1-3 MESES ☐ 3	1-3 MESES ☐ 3
4-6 MESES SN1 ☐ 4	4-6 MESES ☐ 4	4-6 MESES ☐ 4	4-6 MESES ☐ 4	4-6 MESES ☐ 4	4-6 MESES ☐ 4	4-6 MESES ☐ 4
7-11 MESES ☐ 5	7-11 MESES ☐ 5	7-11 MESES ☐ 5	7-11 MESES ☐ 5	7-11 MESES ☐ 5	7-11 MESES ☐ 5	7-11 MESES ☐ 5
1-2 AÑOS ☐ 6	1-2 AÑOS ☐ 6	1-2 AÑOS ☐ 6	1-2 AÑOS ☐ 6	1-2 AÑOS ☐ 6	1-2 AÑOS ☐ 6	1-2 AÑOS ☐ 6
MAS DE 2 AÑOS ☐ 7	MAS DE 2 AÑOS ☐ 7	MAS DE 2 AÑOS ☐ 7	MAS DE 2 AÑOS ☐ 7	MAS DE 2 AÑOS ☐ 7	MAS DE 2 AÑOS ☐ 7	MAS DE 2 AÑOS ☐ 7
TODAVIA TOMA ☐ 8	TODAVIA TOMA ☐ 8	TODAVIA TOMA ☐ 8	TODAVIA TOMA ☐ 8	TODAVIA TOMA ☐ 8	TODAVIA TOMA ☐ 8	TODAVIA TOMA ☐ 8
NO RECUERDA ☐ 9	NO RECUERDA ☐ 9	NO RECUERDA ☐ 9	NO RECUERDA ☐ 9	NO RECUERDA ☐ 9	NO RECUERDA ☐ 9	NO RECUERDA ☐ 9
29.- PORQUE NO LE DIO PECHO AL NIÑO?						
FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1
FALTA DE PEZON ☐ 2	FALTA DE PEZON ☐ 2	FALTA DE PEZON ☐ 2	FALTA DE PEZON ☐ 2	FALTA DE PEZON ☐ 2	FALTA DE PEZON ☐ 2	FALTA DE PEZON ☐ 2
ENF. DE LA MADRE ☐ 3	ENF. DE LA MADRE ☐ 3	ENF. DE LA MADRE ☐ 3	ENF. DE LA MADRE ☐ 3	ENF. DE LA MADRE ☐ 3	ENF. DE LA MADRE ☐ 3	ENF. DE LA MADRE ☐ 3
ENF. DEL NIÑO SN2 ☐ 4	ENF. DEL NIÑO ☐ 4	ENF. DEL NIÑO ☐ 4	ENF. DEL NIÑO ☐ 4	ENF. DEL NIÑO ☐ 4	ENF. DEL NIÑO ☐ 4	ENF. DEL NIÑO ☐ 4
NO QUISO DARLE ☐ 5	NO QUISO DARLE ☐ 5	NO QUISO DARLE ☐ 5	NO QUISO DARLE ☐ 5	NO QUISO DARLE ☐ 5	NO QUISO DARLE ☐ 5	NO QUISO DARLE ☐ 5
OTRA: _____	OTRA: _____	OTRA: _____	OTRA: _____	OTRA: _____	OTRA: _____	OTRA: _____
_____ ☐ 6	_____ ☐ 6	_____ ☐ 6	_____ ☐ 6	_____ ☐ 6	_____ ☐ 6	_____ ☐ 6
ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE
30.- PORQUE DEJO DE DARLE PECHO AL NIÑO?						
FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1	FALTA DE LECHE ☐ 1
ENF. DE LA MADRE ☐ 2	ENF. DE LA MADRE ☐ 2	ENF. DE LA MADRE ☐ 2	ENF. DE LA MADRE ☐ 2	ENF. DE LA MADRE ☐ 2	ENF. DE LA MADRE ☐ 2	ENF. DE LA MADRE ☐ 2
ENF. DEL NIÑO SN3 ☐ 3	ENF. DEL NIÑO ☐ 3	ENF. DEL NIÑO ☐ 3	ENF. DEL NIÑO ☐ 3	ENF. DEL NIÑO ☐ 3	ENF. DEL NIÑO ☐ 3	ENF. DEL NIÑO ☐ 3
NUEVO EMBARAZO ☐ 4	NUEVO EMBARAZO ☐ 4	NUEVO EMBARAZO ☐ 4	NUEVO EMBARAZO ☐ 4	NUEVO EMBARAZO ☐ 4	NUEVO EMBARAZO ☐ 4	NUEVO EMBARAZO ☐ 4
TRABAJA ☐ 5	TRABAJA ☐ 5	TRABAJA ☐ 5	TRABAJA ☐ 5	TRABAJA ☐ 5	TRABAJA ☐ 5	TRABAJA ☐ 5
OTRA: _____	OTRA: _____	OTRA: _____	OTRA: _____	OTRA: _____	OTRA: _____	OTRA: _____
_____ ☐ 6	_____ ☐ 6	_____ ☐ 6	_____ ☐ 6	_____ ☐ 6	_____ ☐ 6	_____ ☐ 6
ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE	ESPECIFIQUE

SOLO MENORES DE 5 AÑOS (Cont.)

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
NOMBRE DE LA MADRE						
31.- A QUE EDAD EMPEZO A DARLE LOS SIGUIENTES ALIMENTOS (EN MESES)						
JUGO DE FRUTAS SN14	JUGO DE FRUTAS ___	JUGO DE FRUTAS ___	JUGO DE FRUTAS ___	JUGO DE FRUTAS ___	JUGO DE FRUTAS ___	JUGO DE FRUTAS ___
PURE DE FRUTAS SN15	PURE DE FRUTAS ___	PURE DE FRUTAS ___	PURE DE FRUTAS ___	PURE DE FRUTAS ___	PURE DE FRUTAS ___	PURE DE FRUTAS ___
PURE DE VERDURAS SN16	PURE DE VERDURAS ___	PURE DE VERDURAS ___	PURE DE VERDURAS ___	PURE DE VERDURAS ___	PURE DE VERDURAS ___	PURE DE VERDURAS ___
SOPAS SN17	SOPAS ___	SOPAS ___	SOPAS ___	SOPAS ___	SOPAS ___	SOPAS ___
CREMAS DE CEREALES SN18	CREMAS DE CEREALES ___	CREMAS DE CEREALES ___	CREMAS DE CEREALES ___	CREMAS DE CEREALES ___	CREMAS DE CEREALES ___	CREMAS DE CEREALES ___
LECHE SN19	LECHE ___	LECHE ___	LECHE ___	LECHE ___	LECHE ___	LECHE ___
CEREALES SN20	CEREALES ___	CEREALES ___	CEREALES ___	CEREALES ___	CEREALES ___	CEREALES ___
HUEVOS SN21	HUEVOS ___	HUEVOS ___	HUEVOS ___	HUEVOS ___	HUEVOS ___	HUEVOS ___
FRIJOLES SN22	FRIJOLES ___	FRIJOLES ___	FRIJOLES ___	FRIJOLES ___	FRIJOLES ___	FRIJOLES ___
CARNES SN23	CARNES ___	CARNES ___	CARNES ___	CARNES ___	CARNES ___	CARNES ___
32.- CON QUE ALIMENTOS REEMPLAZO AL PECHO?						
CREMAS DE CEREALES ☐1	CREMAS DE CEREALES ☐1	CREMAS DE CEREALES ☐1	CREMAS DE CEREALES ☐1	CREMAS DE CEREALES ☐1	CREMAS DE CEREALES ☐1	CREMAS DE CEREALES ☐1
SN24 LECHE FRESCA ☐2	LECHE FRESCA ☐2	LECHE FRESCA ☐2	LECHE FRESCA ☐2	LECHE FRESCA ☐2	LECHE FRESCA ☐2	LECHE FRESCA ☐2
LECHE EN POLVO ☐3	LECHE EN POLVO ☐3	LECHE EN POLVO ☐3	LECHE EN POLVO ☐3	LECHE EN POLVO ☐3	LECHE EN POLVO ☐3	LECHE EN POLVO ☐3
LECHE DESCREMADA ☐4	LECHE DESCREMADA ☐4	LECHE DESCREMADA ☐4	LECHE DESCREMADA ☐4	LECHE DESCREMADA ☐4	LECHE DESCREMADA ☐4	LECHE DESCREMADA ☐4
LECHE EVAPORADA ☐5	LECHE EVAPORADA ☐5	LECHE EVAPORADA ☐5	LECHE EVAPORADA ☐5	LECHE EVAPORADA ☐5	LECHE EVAPORADA ☐5	LECHE EVAPORADA ☐5
OTROS (ESPECIFIQUE) ☐6	OTROS (ESPECIFIQUE) ☐6	OTROS (ESPECIFIQUE) ☐6	OTROS (ESPECIFIQUE) ☐6	OTROS (ESPECIFIQUE) ☐6	OTROS (ESPECIFIQUE) ☐6	OTROS (ESPECIFIQUE) ☐6
_____ ☐7	_____ ☐7	_____ ☐7	_____ ☐7	_____ ☐7	_____ ☐7	_____ ☐7
_____ ☐8	_____ ☐8	_____ ☐8	_____ ☐8	_____ ☐8	_____ ☐8	_____ ☐8
_____ ☐9	_____ ☐9	_____ ☐9	_____ ☐9	_____ ☐9	_____ ☐9	_____ ☐9
33.- HA ESTADO EL NIÑO ENFERMO DE DIARREA EN LOS ULTIMOS 15 DIAS?						
SI LEVE SN25 ☐1	SI LEVE ☐1	SI LEVE ☐1	SI LEVE ☐1	SI LEVE ☐1	SI LEVE ☐1	SI LEVE ☐1
SI SEVERA ☐2	SI SEVERA ☐2	SI SEVERA ☐2	SI SEVERA ☐2	SI SEVERA ☐2	SI SEVERA ☐2	SI SEVERA ☐2
NO ☐3	NO ☐3	NO ☐3	NO ☐3	NO ☐3	NO ☐3	NO ☐3
33.A SI USTED TRABAJA, USA EL TIEMPO DE SU TRABAJO PARA ATENDER SU NIÑO CUANDO SE ENFERMA?						
SI SN26 ☐1	SI ☐1	SI ☐1	SI ☐1	SI ☐1	SI ☐1	SI ☐1
NO ☐2	NO ☐2	NO ☐2	NO ☐2	NO ☐2	NO ☐2	NO ☐2
33.B CUANTO TIEMPO DE SU TRABAJO UTILIZA PARA ATENDER A SU NIÑO CUANDO SE ENFERMA?						
SN27 HORAS	___HORAS	___HORAS	___HORAS	___HORAS	___HORAS	___HORAS
SN28 DIAS	___DIAS	___DIAS	___DIAS	___DIAS	___DIAS	___DIAS

SOLO MENORES DE 5 AÑOS (Cont.)

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
NOMBRE DE LA MADRE						
34.- HA ESTADO ENFERMO EL NIÑO EN LOS ULTIMOS 6 MESES DE:						
SARAMPION SN19 ☐ 1	SARAMPION ☐ 1	SARAMPION ☐ 1	SARAMPION ☐ 1	SARAMPION ☐ 1	SARAMPION ☐ 1	SARAMPION ☐ 1
ENF. RESPIRATORIAS ☐ 2	ENF. RESPIRATORIAS ☐ 2	ENF. RESPIRATORIAS ☐ 2	ENF. RESPIRATORIAS ☐ 2	ENF. RESPIRATORIAS ☐ 2	ENF. RESPIRATORIAS ☐ 2	ENF. RESPIRATORIAS ☐ 2
INFECC. DE LA PIEL ☐ 3	INFECC. DE LA PIEL ☐ 3	INFECC. DE LA PIEL ☐ 3	INFECC. DE LA PIEL ☐ 3	INFECC. DE LA PIEL ☐ 3	INFECC. DE LA PIEL ☐ 3	INFECC. DE LA PIEL ☐ 3
35 TIENE EL NIÑO TARJETA DE VACUNACION? (Puede Presentármela?						
SI ☐ 1 SN20	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1
NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2
36.- HA LLEVADO EL NIÑO A CONTROL LOS ULTIMOS 6 MESES?						
SI ☐ 1 SN21	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1	SI ☐ 1
NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2	NO ☐ 2
37.- QUIEN CUIDA EL NIÑO CUANDO USTED ESTA FUERA DE CASA?						
NO LO DEJA EN CASA ☐ 1	NO LO DEJA EN CASA ☐ 1	NO LO DEJA EN CASA ☐ 1	NO LO DEJA EN CASA ☐ 1	NO LO DEJA EN CASA ☐ 1	NO LO DEJA EN CASA ☐ 1	NO LO DEJA EN CASA ☐ 1
LA EMPLEADA SN22 ☐ 2	LA EMPLEADA ☐ 2	LA EMPLEADA ☐ 2	LA EMPLEADA ☐ 2	LA EMPLEADA ☐ 2	LA EMPLEADA ☐ 2	LA EMPLEADA ☐ 2
UN FAM. DE + DE 10 A. ☐ 3	UN FAM. DE + DE 10 A. ☐ 3	UN FAM. DE + DE 10 A. ☐ 3	UN FAM. DE + DE 10 A. ☐ 3	UN FAM. DE + DE 10 A. ☐ 3	UN FAM. DE + DE 10 A. ☐ 3	UN FAM. DE + DE 10 A. ☐ 3
UN FAM. DE – DE 10 A. ☐ 4	UN FAM. DE – DE 10 A. ☐ 4	UN FAM. DE – DE 10 A. ☐ 4	UN FAM. DE – DE 10 A. ☐ 4	UN FAM. DE – DE 10 A. ☐ 4	UN FAM. DE – DE 10 A. ☐ 4	UN FAM. DE – DE 10 A. ☐ 4
LA VECINA ☐ 5	LA VECINA ☐ 5	LA VECINA ☐ 5	LA VECINA ☐ 5	LA VECINA ☐ 5	LA VECINA ☐ 5	LA VECINA ☐ 5
GUARDERIA O C.O.INF. ☐ 6	GUARDERIA O C.O.INF. ☐ 6	GUARDERIA O C.O.INF. ☐ 6	GUARDERIA O C.O.INF. ☐ 6	GUARDERIA O C.O.INF. ☐ 6	GUARDERIA O C.O.INF. ☐ 6	GUARDERIA O C.O.INF. ☐ 6
LO DEJA SOLO ☐ 7	LO DEJA SOLO ☐ 7	LO DEJA SOLO ☐ 7	LO DEJA SOLO ☐ 7	LO DEJA SOLO ☐ 7	LO DEJA SOLO ☐ 7	LO DEJA SOLO ☐ 7
37.A CUANTO PAGA PARA QUE LE CUIDEN A SU NIÑO CUANDO TRABAJA O SALE DE CASA?						
B/. SN23	B/. _____	B/. _____	B/. _____	B/. _____	B/. _____	B/. _____

SOLO PARA MUJERES ENTRE 15 Y 49 AÑOS

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
38.- HISTORIA DE EMBARAZOS:						
NUM. DE EMBARAZOS SM1	NUM. DE EMBARAZOS _____	NUM. DE EMBARAZOS _____	NUM. DE EMBARAZOS _____	NUM. DE EMBARAZOS _____	NUM. DE EMBARAZOS _____	NUM. DE EMBARAZOS _____
NUM. DE ABORTOS SM2	NUM. DE ABORTOS _____	NUM. DE ABORTOS _____	NUM. DE ABORTOS _____	NUM. DE ABORTOS _____	NUM. DE ABORTOS _____	NUM. DE ABORTOS _____
NACIDOS VIVOS SM3	NACIDOS VIVOS _____	NACIDOS VIVOS _____	NACIDOS VIVOS _____	NACIDOS VIVOS _____	NACIDOS VIVOS _____	NACIDOS VIVOS _____
NACIDOS MUERTOS SM4	NACIDOS MUERTOS _____	NACIDOS MUERTOS _____	NACIDOS MUERTOS _____	NACIDOS MUERTOS _____	NACIDOS MUERTOS _____	NACIDOS MUERTOS _____
NO HA TENIDO SM5	NO HA TENIDO _____	NO HA TENIDO _____	NO HA TENIDO _____	NO HA TENIDO _____	NO HA TENIDO _____	NO HA TENIDO _____

SOLO PARA MUJERES 15 Y 49 AÑOS (Cont.)

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
39.- HIJOS NACIDOS VIVOS QUE MURIERON ANTES DE CUMPLIR 5 AÑOS DE EDAD:						
EDAD / SEXO (H. / M.)	EDAD / SEXO (H. / M.)	EDAD / SEXO (H. / M.)	EDAD / SEXO (H. / M.)	EDAD / SEXO (H. / M.)	EDAD / SEXO (H. / M.)	EDAD / SEXO (H. / M.)
1. SM6 1 ☐ 2 SM7	1.- ____ 1 ☐ 2 ☐	1. ____ 1 ☐ 2 ☐	1.- ____ 1 ☐ 2 ☐	1. ____ 1 ☐ 2 ☐	1.- ____ 1 ☐ 2 ☐	1.- ____ 1 ☐ 2 ☐
2. SM8 1 ☐ 2 SM9	2.- ____ 1 ☐ 2 ☐	2.- ____ 1 ☐ 2 ☐	2.- ____ 1 ☐ 2 ☐	2.- ____ 1 ☐ 2 ☐	2.- ____ 1 ☐ 2 ☐	2.- ____ 1 ☐ 2 ☐
FECHA DE LA MUERTE (MES / AÑO)	FECHA DE LA MUERTE (MES / AÑO)	FECHA DE LA MUERTE (MES / AÑO)	FECHA DE LA MUERTE (MES / AÑO)	FECHA DE LA MUERTE (MES / AÑO)	FECHA DE LA MUERTE (MES / AÑO)	FECHA DE LA MUERTE (MES / AÑO)
1 SM10 / SM11	1 ☐☐ / ☐☐	1 ☐☐ / ☐☐	1 ☐☐ / ☐☐	1 ☐☐ / ☐☐	1 ☐☐ / ☐☐	1 ☐☐ / ☐☐
2 SM12 / SM13	2 ☐☐ / ☐☐	2 ☐☐ / ☐☐	2 ☐☐ / ☐☐	2 ☐☐ / ☐☐	2 ☐☐ / ☐☐	2 ☐☐ / ☐☐
40.- HIJOS NACIDOS VIVOS QUE MURIERON ANTES DE CUMPLIR 5 AÑOS DE EDAD						
CAUSA DE MUERTE:	CAUSA DE MUERTE:	CAUSA DE MUERTE:	CAUSA DE MUERTE:	CAUSA DE MUERTE:	CAUSA DE MUERTE:	CAUSA DE MUERTE:
SM14 DIARREA SI ☐1 ☐2 NO	DIARREA SI ☐1 ☐2 NO	DIARREA SI ☐1 ☐2 NO	DIARREA SI ☐1 ☐2 NO	DIARREA SI ☐1 ☐2 NO	DIARREA SI ☐1 ☐2 NO	DIARREA SI ☐1 ☐2 NO
SM15 FIEBRE SI ☐1 ☐2 NO	FIEBRE SI ☐1 ☐2 NO	FIEBRE SI ☐1 ☐2 NO	FIEBRE SI ☐1 ☐2 NO	FIEBRE SI ☐1 ☐2 NO	FIEBRE SI ☐1 ☐2 NO	FIEBRE SI ☐1 ☐2 NO
SM16 SARAMPION SI ☐1 ☐2 NO	SARAMPION SI ☐1 ☐2 NO	SARAMPION SI ☐1 ☐2 NO	SARAMPION SI ☐1 ☐2 NO	SARAMPION SI ☐1 ☐2 NO	SARAMPION SI ☐1 ☐2 NO	SARAMPION SI ☐1 ☐2 NO
SM17 HINCHAZON SI ☐1 ☐2 NO	HINCHAZON SI ☐1 ☐2 NO	HINCHAZON SI ☐1 ☐2 NO	HINCHAZON SI ☐1 ☐2 NO	HINCHAZON SI ☐1 ☐2 NO	HINCHAZON SI ☐1 ☐2 NO	HINCHAZON SI ☐1 ☐2 NO
SM18 ENF. RESP. SI ☐1 ☐2 NO	ENF. RESP. SI ☐1 ☐2 NO	ENF. RESP. SI ☐1 ☐2 NO	ENF. RESP. SI ☐1 ☐2 NO	ENF. RESP. SI ☐1 ☐2 NO	ENF. RESP. SI ☐1 ☐2 NO	ENF. RESP. SI ☐1 ☐2 NO
SM19 ACCIDENTE SI ☐1 ☐2 NO	ACCIDENTE SI ☐1 ☐2 NO	ACCIDENTE SI ☐1 ☐2 NO	ACCIDENTE SI ☐1 ☐2 NO	ACCIDENTE SI ☐1 ☐2 NO	ACCIDENTE SI ☐1 ☐2 NO	ACCIDENTE SI ☐1 ☐2 NO
SM20 OTRO SI ☐1 ☐2 NO	OTRO SI ☐1 ☐2 NO	OTRO SI ☐1 ☐2 NO	OTRO SI ☐1 ☐2 NO	OTRO SI ☐1 ☐2 NO	OTRO SI ☐1 ☐2 NO	OTRO SI ☐1 ☐2 NO
41.- ESTADO CIVIL						
VIUDA ☐5 ← ESTA BIEN NO COMPA						
SOLTERA ☐1	SOLTERA ☐1	SOLTERA ☐1	SOLTERA ☐1	SOLTERA ☐1	SOLTERA ☐1	SOLTERA ☐1
SM21 CASADA ☐2	CASADA ☐2	CASADA ☐2	CASADA ☐2	CASADA ☐2	CASADA ☐2	CASADA ☐2
UNION LIBRE ☐3	UNION LIBRE ☐3	UNION LIBRE ☐3	UNION LIBRE ☐3	UNION LIBRE ☐3	UNION LIBRE ☐3	UNION LIBRE ☐3
SEPARADA ☐4	SEPARADA ☐4	SEPARADA ☐4	SEPARADA ☐4	SEPARADA ☐4	SEPARADA ☐4	SEPARADA ☐4
42.- HA ESTADO USTED EMBARAZADA EN LOS ULTIMOS 5 AÑOS?						
SM22 / SM23						
SI ESTUVO ☐1 VECES ☐	SI ESTUVO ☐1 VECES ☐	SI ESTUVO ☐1 VECES ☐	SI ESTUVO ☐1 VECES ☐	SI ESTUVO ☐1 VECES ☐	SI ESTUVO ☐1 VECES ☐	SI ESTUVO ☐1 VECES ☐
SI ESTA ☐2 MESES ☐	SI ESTA ☐2 MESES ☐	SI ESTA ☐2 MESES ☐	SI ESTA ☐2 MESES ☐	SI ESTA ☐2 MESES ☐	SI ESTA ☐2 MESES ☐	SI ESTA ☐2 MESES ☐
NO ☐9	NO ☐9	NO ☐9	NO ☐9	NO ☐9	NO ☐9	NO ☐9
43.- DONDE CONTROLO/A EL ULTIMO/ESTE EMBARAZO?						
PUESTO DE SALUD ☐1	PUESTO DE SALUD ☐1	PUESTO DE SALUD ☐1	PUESTO DE SALUD ☐1	PUESTO DE SALUD ☐1	PUESTO DE SALUD ☐1	PUESTO DE SALUD ☐1
SUB. CENTRO SALUD ☐2	SUB. CENTRO SALUD ☐2	SUB. CENTRO SALUD ☐2	SUB. CENTRO SALUD ☐2	SUB. CENTRO SALUD ☐2	SUB. CENTRO SALUD ☐2	SUB. CENTRO SALUD ☐2
C. DE SALUD ☐3	C. DE SALUD ☐3	C. DE SALUD ☐3	C. DE SALUD ☐3	C. DE SALUD ☐3	C. DE SALUD ☐3	C. DE SALUD ☐3
HOSPITAL ☐4 SM24	HOSPITAL ☐4	HOSPITAL ☐4	HOSPITAL ☐4	HOSPITAL ☐4	HOSPITAL ☐4	HOSPITAL ☐4
CLINICA PRIVADA ☐5	CLINICA PRIVADA ☐5	CLINICA PRIVADA ☐5	CLINICA PRIVADA ☐5	CLINICA PRIVADA ☐5	CLINICA PRIVADA ☐5	CLINICA PRIVADA ☐5
NO SE CONTROLO/A ☐6	NO SE CONTROLO/A ☐6	NO SE CONTROLO/A ☐6	NO SE CONTROLO/A ☐6	NO SE CONTROLO/A ☐6	NO SE CONTROLO/A ☐6	NO SE CONTROLO/A ☐6
44.- DESDE QUE MES CONTROLO/A EL ULTIMO/ESTE EMBARAZO?						
MES: SM25	MES: ____	MES: ____	MES: ____	MES: ____	MES: ____	MES: ____

SOLO PARA MUJERES ENTRE 15 Y 49 AÑOS

1ª PERSONA	2ª PERSONA	3ª PERSONA	4ª PERSONA	5ª PERSONA	6ª PERSONA	7ª PERSONA
45.- A CUANTAS VISITAS DE CONTROL FUE/HA IDO?						
No. DE VISITAS _____	No. DE VISITAS _____	No. DE VISITAS _____	No. DE VISITAS _____	No. DE VISITAS _____	No. DE VISITAS _____	No. DE VISITAS _____
NO RECUERDA ☐9	NO RECUERDA ☐9	NO RECUERDA ☐9	NO RECUERDA ☐9	NO RECUERDA ☐9	NO RECUERDA ☐9	NO RECUERDA ☐9
Sm26						
46.- DONDE OCURRIO EL ULTIMO PARTO EN LOS ULTIMOS CINCO AÑOS?						
EN CASA ☐1	EN CASA ☐1	EN CASA ☐1	EN CASA ☐1	EN CASA ☐1	EN CASA ☐1	EN CASA ☐1
PUESTO SALUD ☐2 Sm27	PUESTO SALUD ☐2	PUESTO SALUD ☐2	PUESTO SALUD ☐2	PUESTO SALUD ☐2	PUESTO SALUD ☐2	PUESTO SALUD ☐2
SUB. C. SALUD ☐3	SUB. C. SALUD ☐3	SUB. C. SALUD ☐3	SUB. C. SALUD ☐3	SUB. C. SALUD ☐3	SUB. C. SALUD ☐3	SUB. C. SALUD ☐3
C. S. CON ANEXO M.I. ☐4	C. S. CON ANEXO M.I. ☐4	C. S. CON ANEXO M.I. ☐4	C. S. CON ANEXO M.I. ☐4	C. S. CON ANEXO M.I. ☐4	C. S. CON ANEXO M.I. ☐4	C. S. CON ANEXO M.I. ☐4
C. S. SIN ANEXO M.I. ☐5	C. S. SIN ANEXO M.I. ☐5	C. S. SIN ANEXO M.I. ☐5	C. S. SIN ANEXO M.I. ☐5	C. S. SIN ANEXO M.I. ☐5	C. S. SIN ANEXO M.I. ☐5	C. S. SIN ANEXO M.I. ☐5
HOSPITAL ☐6	HOSPITAL ☐6	HOSPITAL ☐6	HOSPITAL ☐6	HOSPITAL ☐6	HOSPITAL ☐6	HOSPITAL ☐6
CLINICA PRIVADA ☐7	CLINICA PRIVADA ☐7	CLINICA PRIVADA ☐7	CLINICA PRIVADA ☐7	CLINICA PRIVADA ☐7	CLINICA PRIVADA ☐7	CLINICA PRIVADA ☐7
OTRO ☐8	OTRO ☐8	OTRO ☐8	OTRO ☐8	OTRO ☐8	OTRO ☐8	OTRO ☐8
47.- QUIEN ATENDIO EL PARTO?						
SOLA (NADIE) ☐1 Sm28	SOLA (NADIE) ☐1	SOLA (NADIE) ☐1	SOLA (NADIE) ☐1	SOLA (NADIE) ☐1	SOLA (NADIE) ☐1	SOLA (NADIE) ☐1
CON FAM., AMIGO ☐2	ALGUN FAM., AMIGO ☐2	ALGUN FAM., AMIGO ☐2	ALGUN FAM., AMIGO ☐2	ALGUN FAM., AMIGO ☐2	ALGUN FAM., AMIGO ☐2	ALGUN FAM., AMIGO ☐2
PART. O COMADRONA ☐3	PART. O COMADRONA ☐3	PART. O COMADRONA ☐3	PART. O COMADRONA ☐3	PART. O COMADRONA ☐3	PART. O COMADRONA ☐3	PART. O COMADRONA ☐3
AYUDANTE DE SALUD ☐4	AYUDANTE DE SALUD ☐4	AYUDANTE DE SALUD ☐4	AYUDANTE DE SALUD ☐4	AYUDANTE DE SALUD ☐4	AYUDANTE DE SALUD ☐4	AYUDANTE DE SALUD ☐4
AUX. ENFER. ☐5	AUX. ENFER. ☐5	AUX. ENFER. ☐5	AUX. ENFER. ☐5	AUX. ENFER. ☐5	AUX. ENFER. ☐5	AUX. ENFER. ☐5
ENFERMERA ☐6	ENFERMERA ☐6	ENFERMERA ☐6	ENFERMERA ☐6	ENFERMERA ☐6	ENFERMERA ☐6	ENFERMERA ☐6
MEDICO ☐7	MEDICO ☐7	MEDICO ☐7	MEDICO ☐7	MEDICO ☐7	MEDICO ☐7	MEDICO ☐7
☐8	OTRO ☐8	OTRO ☐8	OTRO ☐8	OTRO ☐8	OTRO ☐8	OTRO ☐8
ESTA DANDO PECHO ACTUALMENTE?						
SI ☐1 Sm29	SI ☐1	SI ☐1	SI ☐1	SI ☐1	SI ☐1	SI ☐1
NO ☐2	NO ☐2	NO ☐2	NO ☐2	NO ☐2	NO ☐2	NO ☐2
CUANTO TIEMPO PASA UD. FUERA DE CASA (Horas x día) (						
HORAS: _____ Sm30	HORAS: _____	HORAS: _____	HORAS: _____	HORAS: _____	HORAS: _____	HORAS: _____

CARACTERISTICAS DE LA VIVIENDA

Boleta No. _____
Hoja No. _____

1 TIPO DE VIVIENDA:

V1(1)

- CASA INDIVIDUAL ☐ 1
- APARTAMENTO ☐ 2
- CUARTO EN CASA DE VECINDAD ☐ 3
- LOCAL NO DESTINADO A HABITACION PERO USADO COMO VIVIENDA ☐ 4

2.- CUARTOS EN LA VIVIENDA:

- CUANTOS CUARTOS TIENE V2(1) ☐
- DE ESTOS CUANTOS SON DORMITORIOS V3(1) ☐
- TIENE AREA EXCLUSIVA DE COCINAR? V4(1) SI ☐ 1 NO ☐ 2

3.- TENENCIA:

V5(1)

- PROPIA ☐ 1
- PROPIA HIPOTECADA ☐ 2 B/. _____ PAGO MENS V6(4)
- ALQUILADA ☐ 3 B/. _____ PAGO MENS
- CEDIDA ☐ 4
- CONDENADA ☐ 5

4.- MATERIAL PREDOMINANTE EN LAS PAREDES EXTERIORES DEL EDIFICIO O CASA:

V7(1)

- BLOQUE, ADOBLLO, PIEDRA, HORMIGON ☐ 1
- FIBRO-CEMENTO, MADERA (TABLAS TROZOS ETC) ☐ 2
- QUINCHA, ADOBE ☐ 3
- PAJA, PENCA, CAÑA, PALOS ☐ 4
- OTRO MATERIAL O SIN PAREDES ☐ 5

5.- MATERIAL PREDOMINANTE EN EL TECHO DEL EDIFICIO O CASA:

V8(1)

- CEMENTO ☐ 1
- TEJA ☐ 2
- FIBRA - CEMENTO ☐ 3
- METAL (ZINC, ALUMINIO, ETC) ☐ 4
- MADERA PROTEJIDA ☐ 5
- PAJA O PENCA ☐ 6
- OTRO ☐ 7

6.- MATERIAL PREDOMINANTE EN EL PISO DE DE LA VIVIENDA

V9(1)

- PAVIMENTO ☐ 1
- MADERA ☐ 2
- TIERRA ☐ 3
- OTRO ☐ 4

7 TIPO DE ABASTECIMIENTO DE AGUA PARA PARA BEBER Y COCINAR:

V10(1)

- ACUEDUCTO-CONEXION DOMICILIARIA ☐ 1
- ACUEDUCTO-PLUMA PUBLICA ☐ 2
- ACUEDUCTO-PLUMA FAMILIAR O VECINO ☐ 3
- POZO SANITARIO ☐ 4
- POZO BROCAL NO PROTEGIDO ☐ 5
- RIO O QUEBRADA ☐ 6
- COSTO MENSUAL B/. V11(3)

8.- SERVICIO SANITARIO:

V12(1)

PRIVADO:

- CONECTADO AL ALCANTARILLADO ☐ 1
- CONECTADO A TANQUE SEPTICO ☐ 2
- HUECO O LETRINA ☐ 3

COMUNAL:

- CONECTADO AL ALCANTARILLADO ☐ 1
- CONECTADO A TANQUE SEPTICO ☐ 2
- HUECO O LETRINA ☐ 3
- SIN SERVICIO SANITARIO ☐ 4

V13(1)

9.- ALUMBRADO:

V14(1)

CON ALUMBRADO ELECTRICO:

- DEL I.R.H.E. ☐ 1
- DE PARTICULARES ☐ 2

CON OTRO TIPO DE ALUMBRADO:

- GAS ☐ 3
- KEROSIN ☐ 4
- OTRO ☐ 5 COSTO MENSUAL B/. _____ V15(3)

10.- COMBUSTIBLE PARA COCINAR:

V16(1)

- ELECTRICIDAD ☐ 1
- GAS ☐ 2
- KEROSIN ☐ 3
- CARBON ☐ 4
- LEÑA ☐ 5
- NO COCINA ☐ 6 COSTO MENSUAL B/. _____ V17(3)

11.- DISPOSICION DE BASURA:

V18(1)

- RECOLECCION PUBLICA ☐ 1
- QUEMA O ENTIERRO ☐ 2
- TIRADO (NO CONTROLADO) ☐ 3
- OTRO ☐ 4 COSTO MENSUAL B/. _____ V19(3)

12.- EQUIPO DOMESTICO:

TIENE UD.:	SI	NO		SI	NO	
TELEVISOR V20	☐ 1	☐ 2	V21 Pagado	☐ 1	☐ 2	Pago Mens. B/. V22
RADIO V23	☐ 1	☐ 2	V24 Pagado	☐ 1	☐ 2	Pago Mens. B/. V25
TELEFONO V26	☐ 1	☐ 2	V27 Pagado	☐ 1	☐ 2	Pago Mens. B/. V28
REFRIGERADORA V29	☐ 1	☐ 2	V30 Pagado	☐ 1	☐ 2	Pago Mens. B/. V31
LAVADORA V32	☐ 1	☐ 2	V33 Pagado	☐ 1	☐ 2	Pago Mens. B/. V34
MAQUINA COSER V35	☐ 1	☐ 2	V36 Pagado	☐ 1	☐ 2	Pago Mens. B/. V37

13.- TIENE ALGUN MEDIO DE TRANSPORTE?

- VEHICULOS A MOTOR ☐ SI ☐ NO ☐ V38
- OTRO _____ ☐
- _____ ESPECIFIQUE V39

Betty for abastecimiento.
Nacho (a) mir

Appendix B

Considerations for Selecting Anthropometric Indicators of Nutritional Status

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Appendix B

Considerations for Selecting Anthropometric Indicators of Nutritional Status

In the context of an impact evaluation, "indicators of nutritional status" should be measurements or observations which reflect the nutritional situation in the population or subpopulation under consideration. They are expected to reflect the severity or extent of malnutrition in the population (Beaton and Bengoa, 1976).

The selection of indicator(s) of nutritional status should take into account the following criteria.

1. Objectivity and Numerical Designation

In order to be reliable, an indicator should be based on objective data. For ease of presentation and comparison, it should be capable of expression as a numerical value rather than as a subjective judgement such as "poor," "good," "thin" (Beaton and Bengoa, 1976).

2. Feasibility

The data should be relatively easy to obtain without the need for complex procedures or equipment and, in many areas, without a substantial infrastructure. It should also be ethically acceptable and operationally feasible.

3. Specificity/Dependability

The indicator should be cause-specific to the factor being measured, in this case, nutritional status. Other nonnutritional factors should exert a minimum effect, if any at all, on the indicator.

Habicht, et al. (1979) consider an indicator to be dependable when the indicator can be depended on to reflect changes in nutritional status. Consequently, the more nonnutritional factors which affect the indicator, the less dependable is the indicator. The term undependability is used to describe the random nonnutritional influences on the indicator. Although the random nonnutritional influences often cancel each other out when summed together so that changes in the average value of the indicator reflect differences in nutritional status, still, the influence of the nonnutritional factors adversely affects the dependability of the indicator on an individual level. Thus, one cannot be sure that any single individual change in the indicator is due to a change in nutritional status.

Therefore, it is very important that the nutritional influence of interest be carefully specified, since this will also define, by exclusion, the nonnutritional influences. Take, for example, body weight as an indicator of hydration (water nutrition). Its dependability is adversely affected by short-term changes in stomach content, which although it may be a nutritional process, is not the nutritional influence of interest in measuring hydration, and thus, would be considered in such context a "nonnutritional" influence. Analogously, short-term changes in hydration reduce the dependability of body weight as an indicator of protein-calorie nutrition. Hydration, in this context, would be considered a nonnutritional influence. The dependability of the variable used as an indicator, therefore, depends on what kind of information is requested from it. Furthermore, even for identical purposes the same variable will have different dependabilities as an indicator, depending on whether one is measuring nutritional status at one point in time or changes across time. Table 1 provides values for the dependability of some anthropometric indicators of nutritional status in a young-aged malnourished population. These examples demonstrate that the dependability of an indicator cannot be evaluated in isolation of its intended purpose and setting. For instance, one can see that the dependability of weight is quite different for attained measurements (i.e., cross-sectional or one-time only), than it is for incremental measurements (i.e., longitudinal, or changes between two points in time). It should be stressed that the values presented in this table, as well as those presented in Tables 1-3, are valid for this population only, which is relatively homogeneous, ethnically, and of young age (3 years and under). In selecting an indicator, one would aim for that with the highest dependability value.

Several strategies are available for improving the dependability of an indicator. One strategy is derived from the statistical fact that the average of many measurements is more dependable than any single one measurement. If the nonnutritional influences are random within an individual over a span of time, averaging repeated measurements over that span of time will increase the dependability of the indicator. If the nonnutritional influences are distributed at random across many individuals, increasing the number of individuals measured increases the dependability of the indicator average.

A second strategy for improving dependability is to exclude or take into account nonnutritional influences. These influences can be excluded through experimental design. For instance, the effect of age can be excluded by comparing the growth between groups of children all of the same age, or the effect of diurnal variations can be excluded by always measuring at the same time of day, or the effects of parity on birth weight can be excluded by analyzing primiparas separately from multiparas. On the other hand, when disturbing influences cannot be controlled through the experimental design, the factors can be measured, trying to exclude their effects from the analysis. This procedure has an additional payoff in that it allows for relative comparisons among the factors which influence nutritional status. For example, a study in an area of moderate malnutrition was able to determine that malnutrition accounted for only half of the stunting in growth in preschool children while diarrheal disease accounted for another tenth and other common diseases had no marked adverse effect on growth (Habicht, et al., 1979). This type of information could be useful in leading to practical recommendations for public health interventions.

4. Sensitivity

The sensitivity of an indicator of nutritional status is a function of the extent to which it reflects or predicts changes in nutriture (Habicht, et al., 1979). Some indicators reflect events of past and present nutriture and hence are reflective indicators of nutritional status, for example, small height for age is indicative of past or chronic malnutrition. Other indicators are predictive, in that they predict future outcomes, such as improved performance, or death due to malnutrition. Some indicators may be both reflective and predictive at the same time. Weight for age, for example, reflects chronic malnutrition and predicts mortality (Gomez, et al., 1956; Kielmann and McCord, 1978). Thus, the purpose of the indicator must be defined prior to evaluating its sensitivity or specificity. Indicators that are both reflective and predictive may have very different sensitivities depending on how they are used (Habicht, et al., 1979).

The cut-off point selected as the division for "normal" and "abnormal" values will also influence the sensitivity of the indicator in terms of its response to changes in the conditioning factors. This characteristic is called the "selectivity of the indicator's cut-off point." For instance, Habicht and Butz (1979) describe an example of the selectivity of the cut-off

point: the official hemoglobin "cut-off point" for anemia in the USA is 12g for black women. This "cut-off-point" delivers a prevalence of 20 percent anemics among black women, all presumed to be iron deficient. However, probably less than 10 percent of those classified as anemic would benefit from iron therapy--thus, the selectivity of this "cut-off point" is only about 10 percent. If each of those black women who could benefit from iron therapy responded to an iron fortification program by raising their hemoglobin 2g, this increase in hemoglobin would be diluted to a mean 0.2g increase among those classified as anemic. Such results would not indicate iron therapy to be an effective intervention if the selectivity were not known beforehand.

It should further be noted that the sensitivity of a specific indicator may not be identical throughout all stages of malnutrition, that is, the consequences of moderate malnutrition often cannot be predicted from severe malnutrition (Habicht, et al., 1979). For example, the severe protein deficiency syndrome of kwashiorkor is accompanied by a deterioration of the body's defense mechanisms against infection and by impaired intestinal function, both of which result in diarrhea. However, protein deficiency sufficient to stunt growth does not result in increased diarrhea. Therefore, one may not expect proportionately reduced indicator values under less severe malnutrition. This seems to suggest that in many situations the relationship between nutrient deficiencies and deficiencies may not be linear (Figure 1). Indeed, in those rare studies which have looked for a dose-response on performance, health and survival, through improved nutrition in man, one finds a significantly lessened benefit as one improves nutritional state even at levels of nutrition universally accepted as inadequate. This means that for many indicators of health performance, health and survival, one may not expect much improvement after intervention, unless the levels of the indicators in the malnourished population are quite different from normal levels in well-nourished regions (Habicht, et al., 1979). This would explain why, in most supplementary feeding programs, for example, the children who tend to show the greatest response to the intervention are those with the greatest apparent weight deficit at entry (i.e., with greatest need), (Beaton and Ghassemi, 1979).

Finally, the same change in nutritional status may reflect quite different changes in nutriture at different levels of nutriture. To use an

extreme case, a 5 percent increase in weight for height is not the same in an emaciated child with only 60 percent of the weight he should have for his height as in an overweight child with 150 percent weight for height. It is thus inaccurate to assume that equal changes in nutritional status reflect equal amounts of change in nutriture. Quantifying the relationships between nutritional status indicators and nutriture improves accuracy because it permits one to specify the magnitude of change in the indicator that one expects at various levels of nutriture. This is particularly important if one is using indicators of nutritional status to diagnose malnutrition in individuals. In such a case one should ascertain and improve the accuracy of nutritional status at the level of nutriture one has defined as warranting nutrition intervention (Habicht, et al., 1979).

5. Precision of Measurement

Precision is the degree to which repeated measurements yield the same value. The precision of measurement is lowered by random imperfections in the measuring instruments or in the measuring and recording techniques. (Habicht, et al., 1979).

Table 2 presents the precision of measurement of some anthropometric measurements in a malnourished population. Again, in selecting an indicator, one would aim for that which has the highest precision value.

Imprecision depends on measurement technique. In contrast to undependability, imprecision is independent of the population and setting except as these affect the range of the variable. However, the precision score does not include undependability and therefore the score is dependent on the population and setting.

There are two different basic strategies to improve precision. One improves the technology, the second takes advantage of the statistical fact that averages of measurements are more precise than single individual measurements.

6. Reliability

A combination of dependability and precision, reliability can be used to compare variables among themselves, and has the advantage of being independent of the units of measurement (Habicht, et al., 1979).

Table 3 presents reliability values of some anthropometric indicators [illegible]

Unreliability is made up of undependability and imprecision (Table 4). A low ratio of undependability to unreliability identifies which indicators would benefit the most from improvements in precision (Habicht, et al., 1979).

Longitudinal or Cross-Sectional Measurements

In addition to the requirements described above, the selection of indicators will also depend on whether the evaluation is directed towards change in individuals or in communities.

Evaluation of interventions in individuals usually depends on sequential (longitudinal) measurements in the same individuals. This kind of evaluation compares the improvement in those individuals who receive the intervention with the lack of improvement in those who do not. In contrast, the evaluation of interventions in populations often depends on sampling individuals at different points in time. Where the variability between individuals with respect to some indicator is large compared to the expected response of that indicator to intervention, then measuring different individuals each time instead of the same individuals longitudinally, will result in a marked decrease in the sensitivity of the indicator. The decision as to whether the improved sensitivity of an evaluation acquired by longitudinally measuring the same individuals in populations, as compared to sampling different individuals each time, can and should be calculated before an intervention is started (Habicht, et al., 1979).

Possible Reasons for Failure of Detecting Changes in the Indicators of Nutritional Status

Aisde from the reasons previously mentioned, such as errors in data collection, large variability, and small difference in indicator values between normal and "abnormal" values, Beaton and Ghassemi (1979) also suggest that, with the existing state of knowledge, it could be possible that evaluations and assessments are not directed towards the most important parameters.

For example, the effect of infection on nutritional status (by increasing energy requirements and often associated with decreased food intake), could mask any impact the intervention might have had on the indicators of nutritional status.

Additionally, the above-named authors also believe that chronically underfed populations may adapt to the situation in a number of ways, involving both physiologic and social adjustments. As an example, they cite an Ugandan child population in which physical growth rates had been maintained at reasonable levels in the face of chronic energy undernutrition, and where the adaptation seemed to have occurred partly due to a reduction in voluntary activity, play, and also probably due to a depressed BMR (basal metabolic rate).

Table 1. Upper Limits of Dependability of Some Anthropometric Indicators of Protein-Calorie Nutritional Status[a]

Variable used as indicator	Nonnutritional variability of indicator[b] = undependability	Total variability of indicator between children[c]		Dependability of indicator[d] (%)	
		Attained	Incremental	Attained	Incremental
Body weight (kg)	0.29	1.23	0.64	94	59
Supine length (cm)	0.25	4.00	1.54	100	95
Crown-rump length (cm)	0.50	2.30	1.25	95	68
Total arm length (cm)	0.27	1.85	1.23	98	90
Head circumference (cm)	0.30	1.40	0.51	95	31
Chest circumference (cm)	1.23	2.00	1.74	62	28
Mid-arm circumference (cm)	0.16	1.00	0.84	97	92
Thigh circumference (cm)	0.54	2.02	1.40	93	70
Calf circumference (cm)	0.00	1.40	0.68	100	100
Wrist breadth (cm)	0.06	0.23	0.24	93	88
Knee breadth (cm)	0.00	0.39	0.34	100	100
Triceps skinfold (mm)	0.36	1.65	1.54	95	89
Subscapular skinfold (mm)	0.15	1.15	1.03	98	96
Biceps skinfold (mm)	0.47	1.10	0.98	82	54
Midaxillary skinfold (mm)	0.34	1.20	0.93	92	73
Anterior thigh skinfold (mm)	0.30	1.86	1.69	97	94
Lateral thigh skinfold (mm)	0.00	2.07	0.94	100	100
Medial thigh skinfold (mm)	0.58	1.30	1.19	80	52

[a] Data from Martorell *et al.* (1975c) in 30-month-old malnourished boys and girls.

[b] $d = \sqrt{d^2}$. d^2 is defined as in the footnote on page 382; d^2 was estimated by remeasuring the children 1-2 weeks apart, finding the variance around each child's means of the two measurements, and subtracting the variance due to measurement imprecision and the variance over this short period due to the children's mean growth. d^2 is therefore made up of all short-term influences on the anthropometric variables. We think that d^2 is a good approximation of the variance of all nonnutritional influences on differences in growth in this population, because these children are sufficiently malnourished (Yarbrough *et al.*, 1977) so that we believe that all differences in growth between the children are due to differences in nutriture. If this assumption is in substantial error and there are, for instance, strong nonnutritional influences on growth in this population (i.e., genetic), the tabled estimates of d^2 will be too small.

[c] This is a standard deviation, the square root of the variance which is made up of $(n^2 + a^2 + d^2 + p^2) = (n^2 + v^2)$ as in Notes 2 and 3 on page 382. It was estimated by measuring attained size in children aged 30 months or the 6-month incremental growth of children from 24 to 36 months.

[d] Dependability $= 1 - [d'^2/(n^2 + v^2)]$ where $d'^2 = d^2$ for attained growth, and for incremental growth $d'^2 = 2d^2$; d^2 as in footnote *b*.

FROM: Habicht et al., 1979.

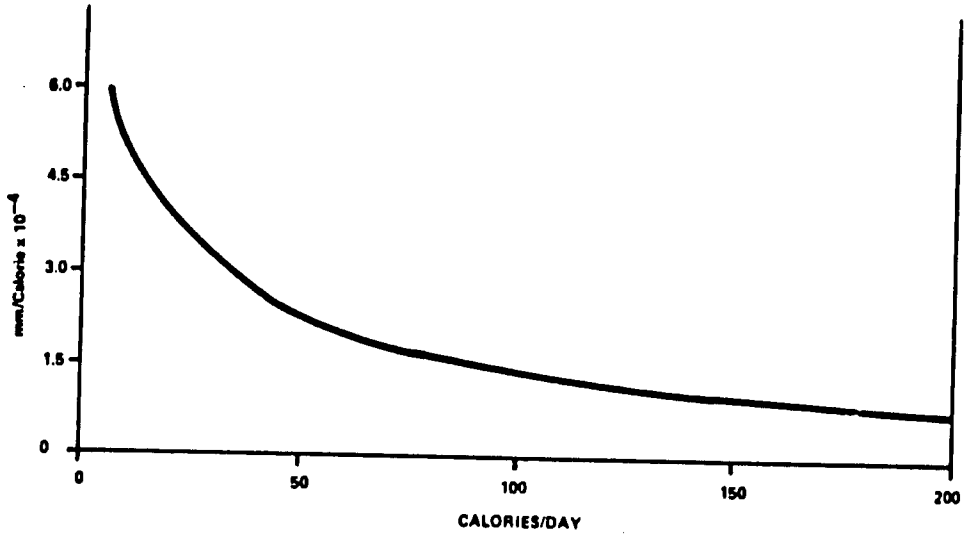

Fig. 1. Efficiency of calorie conversion to growth at different levels of calorie intake in young children.

Based on two year increments in growth at different levels of supplementation in one year old children (taken from Habicht and Butz, 1979).

Table 2. Precision of Some Anthropometric Indicators of Protein-Calorie Nutritional Status[a]

Variable used as indicator	Measurement variability[b] = imprecision	Between groups of children (%)	
		Attained growth[c]	Incremental growth[d]
Body weight	±0 02 kg	100	100
Supine length	±0.34 cm	99	90
Crown-rump length	±0.33 cm	98	86
Total arm length	±0.57 cm	91	57
Head circumference	±0.14 cm	99	85
Chest circumference	±0.79 cm	84	59
Mid-arm circumference	±0.18 cm	97	91
Thigh circumference	±0.40 cm	96	84
Calf circumference	±0.23 cm	97	77
Wrist breadth	±0.09 cm	85	72
Bicondylar femur	±0.11 cm	92	79
Triceps skinfold	±0.66 mm	84	63
Subscapular skinfold	±0.38 mm	89	73
Biceps skinfold	±0.37 mm	89	72
Midaxillary skinfold	±0.30 mm	94	79
Anterior thigh skinfold	±0.88 mm	78	46
Lateral thigh skinfold	±1.34 mm	58	0
Medial thigh skinfold	±0.38 mm	91	80

[a]Data from Martorell et al. (1975c) in 30-month-old malnourished boys and girls.

[b]$p = \sqrt{p^2}$; p^2 as defined in Note 8 on page 383, p^2 was estimated by repeating the measurement twice within an hour on each child and finding the variance around the mean of the two measurements.

[c]$1 - (p^2/(n^2 + v^2))$; $(n^2 + v^2)$ from Table 8 second column and footnote c.

[d]$1 - (2p^2/(n^2 + v^2))$; $(n^2 + v^2)$ from Table 8 third column and footnote c.

SOURCE: Habicht, et al. (1979).

Table 3

Reliability of Some Anthropometric Indicators of Protein-Calorie Nutritional Status

Variable used as indicator	Attained[a] (%)	Incremental[b] (%)
Body weight	95	59
Supine length	99	85
Crown-rump length	93	54
Total arm length	88	48
Head circumference	94	16
Chest circumference	47	0
Mid-arm circumference	94	84
Thigh circumference	89	54
Calf circumference	97	77
Wrist breadth	78	59
Bicondylar femur	92	79
Triceps skinfold	79	52
Subscapular skinfold	87	69
Biceps skinfold	70	25
Midaxillary skinfold	86	52
Anterior thigh skinfold	75	39
Lateral thigh skinfold	58	0
Medial thigh skinfold	71	32

[a] $1 - (p^2 + d^2)/(n^2 + v^2)$; d and $(n^2 + v^2)$ from Table 8, p from Table 9.

[b] $1 - (2p^2 + 2d^2)/(n^2 + v^2)$.

SOURCE: Habicht, et al., 1979

Table 4

THE RATIO OF UNDEPENDABILITY TO UNRELIABILITY OF SOME ANTHROPOMETRIC INDICATORS OF PROTEIN-CALORIE NUTRITIONAL STATUS[a]

Variable Used as Indicator	Ratio (%)
Body weight	99
Supine length	34
Crown-rump length	70
Total arm length	28
Head circumference	82
Chest circumference	71
Mid-arm circumference	44
Thigh circumference	64
Calf circumference	0
Wrist breadth	33
Bicondylar femur	0
Triceps skinfold	23
Subscapular skinfold	14
Biceps skinfold	60
Midaxillary skinfold	56
Anterior thigh skinfold	10
Lateral thigh skinfold	0
Medial thigh skinfold	70

[a] $d^2/(d^2 + p^2) = d^2/r^2$; d from Table 8, p from Table 9, r is unreliability.

SOURCE: Habicht *et al.*, 1979.

Appendix C

ANALYTICAL-CAUSAL MODEL

by

Dr. Cutberto Parillon

Translation from the Spanish
by
Marţii Ardito-Barletta

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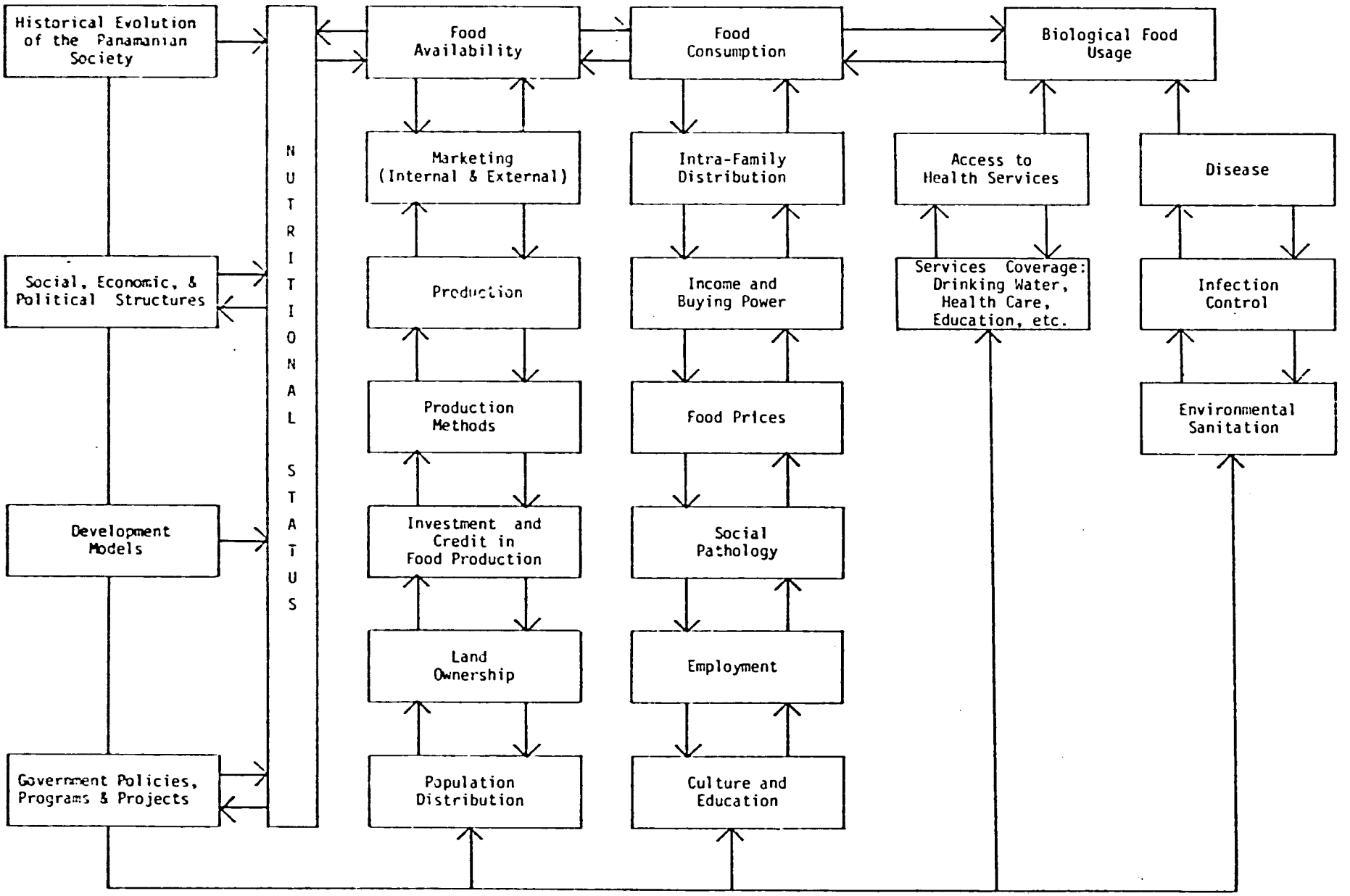
CAUSAL MODEL OF THE NUTRITIONAL STATUS

(Panama)



ANALYTICAL-CAUSAL MODEL

CHAPTER ONE

MAGNITUDE AND CONSEQUENCE OF THE FOOD/NUTRITION PROBLEM

I. Historical Analysis of the Last Twenty Years and the Present Solution: Specific Problems

A. Proteinic-Caloric Malnutrition (DPC)

1. Prevalence in children under five (5) years
   a. Weight at birth: average and distribution
   b. Changes in the weight/age ratio
      i. In children of less than one (1) year
      ii. In children of one (1) year
      iii. In children from two (2) to four (4) years
   c. Changes in the height/age ratio
      i. In children of one (1) year
      ii. In children of two (2) to four (4) years
   d. Changes in the weight/height ratio
      i. In children of less than two (2) years
      ii. In children of two (2) to four (4) years
2. Prevalence in children of five (5) to fourteen (14) years
   a. Changes in the weight/height ratio
   b. Changes in the height/age ratio
3. Magnitude and consequence of damage in the adult population
   a. In pregnant and nursing women
      i. Estimated quantity of pregnant and nursing women in socio-economic low income groups whose diets are possibly insufficient to satisfy their proteinic- and caloric requirements
      ii. Weight/height ratio according to age at pregnancy
      iii. Quantity and spacing of children to women of socio-economic low income groups in their fertile years whose diets are possibly insufficient to satisfy their proteinic-caloric requirements
      iv. Ratio of living children to pregnancies for women in their fertile years (if possible, distributed according to socio-economic strata)
      v. Sickness due to DPC or to other nutritional deficiencies, if specific information is not available, in pregnant and nursing women who receive health services
   b. In individuals in their productive years
      i. Estimated quantity of individuals of low income groups in their productive years, whose diets are possibly insufficient to satisfy their proteinic-caloric requirements

ii. Low production levels in the undernourished population

iii. Sickness due to DPC or to other nutritional deficiencies, if specific information is not available, in individuals in their productive years

4. Indicators of sickness and death

a. Consultations at health service centers for DPC or for other nutritional deficiencies, if specific information is not available

b. Hospital discharge records indicating proteinic-caloric malnutrition or other nutritional deficiencies, if specific information is not available

c. Death due to proteinic-caloric malnutrition according to age, or to other nutritional deficiencies if specific information is not available

d. Infant death

e. Death of children from one (1) to four (4) years (rate and proportion)

f. Ratio of the death rate of children under five (5) years to the general death rate

B. Nutritional Anemias (if possible, to specify if the cause is deficiency of iron, vitamin B_{12} or folic acid)
To indicate if the information refers to records of diseases cared for at health centers or to special studies. To try to regionalize problem
[illegible] according to age groups
[illegible]emias in pregnant and lactating women
[illegible]emias in children of less than five (5) years of age
4. Anemias in the rest of the population

C. Vitamin A Deficiency
Prevalence of A avitaminosis
To indicate dates and types of studies

D. Iodine Deficiency
Prevalence of endemic goiters
To indicate if the information refers to records of diseases cared for at health centers, or to special studies, indicating dates

E. Other Nutritional Deficiencies, Alcoholism, Hepatic Cirrhosis, etc.

F. Chronic and Degenerative Pathology Related to Food Excess
1. Prevalence of obesity
2. Prevalence of incidence of Mellitus diabetes
3. Disease and death due to coronary illness
4. Disease and death due to cerebral vascular illness
5. Disease and death due to arterial hypertension

CHAPTER TWO

CONDITIONING FACTORS ON THE FOOD/NUTRITION QUESTION

I. Analysis Model

II. Historic Behavior of the National Economy and its Relationship with Food/Nutrition

A. General Aspects
   1. Territorial extension
   2. Total population
      a. Evolution and rates of steady state growth
      b. Birth rate
      c. Death rate
   3. Demographic structure
      a. Distribution according to age and sex
      b. Distribution according to area: urban and rural
      c. Dispersion
      d. Migration: seasonal and internal
      e. Distribution by region
   4. Population density: total and regional
   5. Average number of people per family
   6. Economically active population
      a. Distribution according to age and sex
      b. Distribution according to productive sectors
      c. Evolution and growth rates national and by sectors
      d. Productivity of the economically active population according to activity sectors

B. Nationwide Economic Analysis
   1. Evolution and growth rates of the gross national product and some components
      a. Total gross national product
      b. Consumption
      c. Investment
      d. Exports
      e. Imports
   2. Distribution of gross national product according to sectors of origin
   3. Employment
   4. Income
      a. Evolution and trends in national, total, and per capita income
      b. Distribution of the population according to income categories
      c. Trends in income distribution
      d. Determining factors of income distribution
   5. Public sector budget: evolution and growth rates
      a. Total
      b. Source of financing
      c. Assignment according to sectors
      d. Public debt: internal and external
      e. Current and capital expenditures: total and according to sectors

C. Role of Food/Nutrition in the National Economy
   1. Contribution of food production in the gross national product
   2. Participation of national food production in satisfying nutritional requirements
   3. Food production activities as sources for employment

4. Importance of the food producing population
5. Public expenditure in food/nutrition activities

III. Food Consumption

A. Analysis of Food Supply
1. Analysis of domestic production
   a. Source of production
      i. Agriculture
      ii. Fishing
      iii. Hunting
2. Analysis of productive factors found in food production
   a. Natural resources by sector
      i. Soil
      ii. Weather
      iii. Water
      iv. Fauna and flora
   b. Human resources by sector
      i. Types of human resources
      ii. Evolution, changes and causes
      iii. Use and productivity
   c. Capital, science and technology resources
      i. Types of capital, according to the investment destination
      ii. Evolution and source
      iii. Productivity according to use
      iv. Technology used. Present state and productivity
   d. Other inputs in food/nutrition production
   e. Credit and technical assistance
3. Geographical location of food production. Land use capacity (maps)
   a. Agro-livestock and fishery production
   b. Food industry
   c. Pharmaceutical industry, producing nutrients
   d. Other sources of production for other foods/nutrients
4. Structure of the food production system
   a. Possession of land, capital, science and technology
   b. Characteristics of production firms
   c. Production methods
   d. The role of government
5. Analysis of food imports, present situation and evolution over the last twenty (20) years
   a. Participation in total imports
   b. Origin, tariffs, taxes, and price variations
   c. Import structure according to domestic destination (direct consumption; human and animal; raw materials for the food and pharmaceutical industries, etc.) Possibilities of substitution through national production
   d. Food donations
6. Analysis of the overall supply. Evolution. Changes registered in the last twenty (20) years

B. Analysis of Food Demand
   1. Overall demand (domestic production, less exports, plus imports)
      a. Composition
      b. Participation in the national expenditures
      c. Analysis of tendencies
   2. Foreign demand (exports)
      a. Composition and destination of exports
      b. Participation in the foreign trade of the country
      c. Analysis of tendencies: probable causes of modifications
   3. Domestic demand
      a. Composition
         i. Human consumption, animal nourishment, industry
         ii. Relation between national production and imports
      b. Evolution of domestic demand
C. Analysis of Foreign Food Trade
   1. Tendencies in the World Market and their impact on the country's production and foreign trade
   2. Analysis of the rates of exchange and buying power of exports
   3. Balance of foreign food trade
D. The Food Market
   1. Price behavior
   2. Factors that influence marketing
   3. Functions and services of commercialization
E. The Availability of Food
   1. The availability, by headings, of the principal products for human consumption, according to the balance sheet which interrelates domestic production, imports and exports with internal demand and losses
   2. The availability, per capita, of principal products for human consumption
   3. Availability tendencies for the principal products analyzed
F. Real Consumption of Food
   1. Consumption
      a. Per capita and family consumption at national and regional levels
      b. Consumption by socio-economic strata
      c. Consumption by age groups and occupation
      d. Evolution. Determining factors of tendencies
   2. Composition and quality of diet
      a. Of the average diet
      b. Of the diet by socio-economic strata
      c. Percentage of suitability in function of necessities
   3. Costs of the average diet and of the diet by socio-economic strata
      a. Price of the average diet
      b. Price of a minimum adequate diet
      c. Relationship between the acquisitive capacity of the different population strata and the cost of a minimum adequate diet

4. Apparent consumption or availability (according to balance sheets) versus real consumption (according to surveys)
5. Maternal lactation
   a. Number of nursing mothers
   b. Duration of lactation
   c. Analysis of the causes of weaning
6. Intra-family food distribution

G. Conditioning Factors of Food Consumption

IV. Biological Food Utilization

A. Morbidity-Mortality Due To Transmissible Diseases
1. Analysis of the principal causes of morbidity-mortality
   a. Overall
   b. Regional
   c. Urban-rural
   d. Marginal
2. Morbidity due to infectious and parasitic diseases (diarrhea, respiratory diseases, diseases preventable by vaccination, intestinal parasites)
   a. According to information from health service outpatient clinics
   b. According to information from hospital discharge records
   c. According to health surveys
3. Death analysis according to principal causes
4. Death due to infectious and parasitic diseases
5. Morbidity-mortality from diseases due to food and nutritional causes (lack or excess)

B. Environmental Sanitation
1. Distribution of water
   a. Population with water services: intra or extra residential, in urban and rural areas. Potability
   b. Tendencies in coverage
2. Disposal of sewage and solid waste
   a. Population covered according to type of service in urban and rural areas
   b. Tendencies in coverage
   c. Solid waste. Types of disposal, coverage and tendencies
3. Food control and veterinary vigilance
4. Food quality control
   a. Operational restrictions and legislation
   b. Control mechanisms and resources to make them effective

C. Health Services
1. Existing resources and their distribution
2. Organization
3. Coverage and accessibility
4. Priority system for care to population groups
5. Price restrictions to use

D. Conditioning Factors of Biological Food Utilization

V. Behavior of Social Pressure, Influence and Power Centers Towards Food/Nutrition Policies

A. The State
   1. Central government
   2. Autonomous institutions
B. Producing Organizations' Goods and Services
C. Trade Organizations
D. Organizations Tied To Foreign Trade
E. Transnational Corporations
F. International Development Agencies
G. Political Parties
H. Communications Media
I. Unions and Other Labor Organizations
J. Consumer Organizations
K. Other Organizations: Educational, Scientific, Cultural, Religious, Community, etc.

VI. Incidences of Conditional Factors in the Nutrition Question

CHAPTER THREE

INSTITUTIONAL ANALYSIS OF THE FOOD/NUTRITION SUB-SYSTEM

I. Institutional Analysis of the Food/Nutrition Sub-System

A. Description of the Food/Nutrition Sub-System within the Socio-Economic System
   1. Structures that make up the food/nutrition sub-system
   2. Principle elements in each structure: organization, objectives, activities and resources. Interrelations between these and similar ones in other structures. Compatibility with the objectives of food/nutrition policies
      a. Entities responsible for decision
      b. Entities responsible for programming
      c. Entities responsible for execution
      d. Entities responsible for supervision and control
      e. Entities responsible for evaluation
      f. Coordination structures and mechanisms; restrictions on effective coordination
      g. Power and decision centers in the different structures
B. Legislation Which Structures and Regulates the Functioning of the Sub-System
   1. Legislation referring to the structures that make up the food/nutrition sub-system
      a. Legal instruments which create the structures
      b. Degree of definition of objectives and purposes
      c. Degree of definition of areas of responsibility in terms of production and coverage
      d. Legal assignment of functions

e. Sources of financing and degree of determination in the destination of funds
f. Degree of flexibility in the administrative structure

2. Possibilities of modifying legislation, identified as restrictive, in the development of programs and projects

C. Analysis of the Sub-System's Functioning

D. Analysis of the Relationship of the Food/Nutrition Sub-System With Other Sub-Systems

E. Factors Which Affect Resource Assignment of the Components of the Food/Nutrition Sub-System

II. Planning and Policies for Food/Nutrition

A. Existing Resources, Organizations and Mechanisms for Policy Definition and Elaboration of Plans, Programs and Projects For Food/Nutrition

1. Analysis of available resources
   a. Persons with food/nutrition training
   b. Materials
   c. Financial
   d. General limitations
2. Evaluation of the present situation; organizational structure; characteristics; relationships with other elements of the sub-system; functions versus assigned resources; etc.
3. Evaluation of the capacity of the system to: plan, perform diagnoses in order to advise in policy definition, formulate plans, elaborate programs and projects, design control mechanisms for evaluation and information. Capacity of available personnel for elaboration of diagnoses, plans, programs and projects in food/nutrition
4. Coordination agencies or mechanisms for intersectorial food/nutrition planning
5. Availability of methodologies for the elaboration of overall criteria for plans, programs, and projects in food/nutrition
6. Availability of information for planning and decision making
   a. Existence of basic documents for the formulation of food/nutrition policies (overall development plan; nutrition evaluations; balance sheets; nutrition recommendations adjusted to the population, etc.)
   b. Existence of indicators of nutritional status or data for their elaboration. Degree of utilization; accuracy and adequacy to realities under study; quality of measurements and equipment responsible for the job; periodicity of collection
   c. Availability of equipment for data processing
   d. Effectiveness of the processing mechanisms
   e. Inter and intrastructural mechanisms which guarantee the provision of information necessary for decision making
   f. Opportunity for delivery of information to users
   g. Mechanisms which make or would make possible the functioning of a central data bank, with participation from all structures in the food/nutrition sub-system

B. Development and Coherence of the Food/Nutrition Planning Process
   1. Degree of process advancement
      a. In the definition of the overall food/nutrition policies and in the public sector's decision to implement them
      b. In the elaboration of intersectorial food/nutrition plans
      c. In the preparation of food/nutrition projects
   2. Interrelationships and coherence between the socio-economic development planning and that of food and nutrition
      a. Between plans and policies
      b. Between programs and projects and plans for programs and projects

III. Impact of the Existing Policies, Programs and Projects on the Food/Nutrition Question

A. Analysis of Existing Policies
   1. Policies for food production from agriculture and livestock sources and resource utilization: importance, objectives, strategies, goals, assigned resources, coverage, instruments, operational evaluation, and gains achieved in terms of
      a. Conservation of natural resources
      b. Irrigation and drainage
      c. Provision of capital goods and imports
      d. Mechanization
      e. Employment and human resource development
      f. Scientific and technological research
      g. Technical assistance
      h. Animal and plant health
   2. Food production policies from marine, lacustrian, fluvial, and water culture sources
   3. Food/Nutrition production policies from industrial and mining sources (salt fortifying)
   4. Economic and financial policies
      a. Prices and subsidies for producers and consumers
      b. For commercialization and provisioning
      c. For credit
      d. For taxation
   5. Social policies
      a. For welfare and social assistance
      b. For workers
      c. For health
      d. For education
      e. For social advancement and community development
   6. Policies for structural and institutional changes

B. Analysis of the Principal Existing Programs and Projects and Their Impact on the Food/Nutrition Question
   1. Projects
      a. Level of effort
         i. In formulation (probable starting date)
         ii. In execution
            - negotiating the financing
            - financed
         iii. Cancelled

iv. Terminated (completed)

b. Financial cost and execution
   i. Total and period (in years) of execution
   ii. Spent to date
   iii. Financing
      - percentage of domestic sources
      - percentage of foreign sources

c. Accountables
   i. Formulation
   ii. Execution

2. Inventory of existing principal programs and projects, grouped:
   a. According to how they affect availability
   b. According to how they affect consumption
   c. According to how they affect biological utilization
   d. According to other defined criteria

3. Criteria used and factors which influenced the selection of inventoried programs and projects
   a. Integration into and compatibility with the National Development Plan
   b. Political criteria
   c. Impact on the problem
   d. Temporary or permanent effects
   e. Financial, technical, and physical requirements
   f. Possibilities for financing
   g. International support and commitments
   h. Community felt necessities
   i. Organizational effort for implementation
   j. Indirect benefits
   k. Existence of previous projects in varying stages of development (projects behind schedule)

4. Analysis of the education component in the programs and projects which were inventoried
   a. Existence of the food/nutrition education component in programs and projects oriented towards the solution of food/nutrition problems
   b. Existence and level of development of food/nutrition education in the different levels of the formal education system
   c. Availability of professionally designed educational equipment and materials for instruction in food/nutrition
   d. Mechanisms for programming and coordinating the teaching of food/nutrition in the formal education system and for incorporating them as a component in related programs and projects

5. Analysis of resources (required and assigned for the execution of inventoried programs and projects)
   a. Human resources
      i. Availability of human resources for the execution of programs and projects in the different structures of the sub-system, and level of existing preparation for competent execution

ii. Utilization level of existing human resources, particularly in the different work areas (production of goods and services relative to the area of the training study, research, etc.) and the possibility of using them in the inventoried programs and projects

iii. Estimation of needs, present and future, for personnel with different levels of preparation, for different activities of the inventoried programs and projects

iv. Centers or organizations which can be utilized for training of food/nutrition personnel. Annual production capacity

v. Capacity building in food/nutrition problems to provide professional instruction in identification and resolution of various disciplines related to the solution of these problems (nutritionists, economists, physicians, nurses, agronomists, etc.)

vi. Real and relative quantity of professionals in disciplines related to the food/nutrition question who have received training in this field in the last five (5) years

b. Material resources

i. Availability of resources for inventoried programs and projects

ii. Potential resources with development possibilities

ii. Possibilities of resource contribution, from the different structures, for programs and projects integral to food/nutrition

iv. Level of rationality in the use of available resources

c. Financial resources

i. Financial analysis of the different structures of the sub-system

ii. Principal restrictions in the optimal utilization of financing available in the different structures for the solution of the food/nutrition question

.ii. Possible new financing sources

d. Resource administration

i. Level of administrative rationality in the organization of the structures which make up the sub-system

ii. Level of development of administrative mechanisms and instruments necessary for the execution, supervision, evaluation and control of programs and projects which are common to the various elements and structures of the sub-system, particularly in reference to: definition of functions; assigning responsibilities; assigning resources; and definition of norms and procedures

6. Impact of inventoried programs and projects

a. Indicators to judge nutritional impact of programs and projects

b. Impact on development (production, income, employment, commerce, etc.)

i. On overall development
ii. On sectorial development, as much in the social sectors (health, education, etc.) as in the economic sectors (agriculture, fishing, industry, etc.)
iii. On regional development
iv. On urban areas, rural areas and marginal areas

7. Compatibility of inventoried programs and projects
   a. Compatibility between each other
   b. Compatibility with plans
      i. With plans pertaining to each of the structures of food/nutrition sub-system
      ii. With the overall economic and social development plan
   c. Compatibility with defined policies
   d. Compatibility with existing obligations

C. Exploration of Alternative Hypotheses, of Their Practicability (Technical) and Their Feasibility (Political)

D. Conclusions and Suggestions

CHAPTER FOUR

PROGNOSIS OF THE FOOD/NUTRITION SITUATION, ACCORDING TO DIFFERENT ACTION ALTERNATIVES

I. Projection of the Food/Nutrition Question, According to the Tendency of the Last Historical Series Analyzed

A. Magnitude and Consequence of Damage

B. Availability of Food for Human Consumption
   1. Production behavior in the last twenty (20) years
      a. Tendencies
      b. Relation of food production growth to other products and services
      c. Changes in food production structures: origin of increases
      d. Role of export/import policies as elements for regulating internal production

C. Food Consumption

D. Biological Food Utilization

E. Available Resources

F. Projection to Date of Adopted Solutions on Programs and Projects

II. Projection of the Food/Nutrition Question, According to Distinct Action Alternatives

A. Hoped for Impact both on National Development and on Deprived and Vulnerable Groups by Continuing the Present Focus

B. Hoped for Impact, According to Different Action Alternatives, Based on a Solution Model Integral to the Food/Nutrition Question As Expressed in the National Food and Nutrition Plan

CHAPTER FIVE

DIAGNOSTIC SYNTHESIS/PRINCIPAL DIAGNOSTIC CONCLUSIONS

I. Magnitude, Nature and Causes of the Food/Nutrition Problem

   A. Principal Problem Areas Detected at Overall Level

   B. Principal Problem Areas Detected at Sectorial and Institutional Levels

II. Present Focus and Alternative Solutions to the Problem

   A. Analysis of Present Focus and Alternatives for Solution To the Problem

   B. Principal Inconsistencies Detected in Structure and Function Of the Food/Nutrition Sub-System

III. Factors Which Limit or Encourage Improvement in the Situation

IV. Summary of the Prognosis