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REPORT ON INCAP PROJECTS IN THE AREA OF RISK
FACTORS OF LOW BIRTHWEIGHT, NEONATAL MORTALITY
AND LACTATION PERFORMANCE

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I. INTRODUCTION

The following is the final consultant report resulting from a review of INCAP's projects (Table 1) in the area of risk factors of low birthweight, neonatal mortality, and lactation performance.

The first section of this report considers the degree to which the projects address the area of concern and their relative priority; the second section contains comments on all the projects submitted regardless of their priority and the final sections contain general conclusions and recommendations.

TABLE 1

INCAP PROJECTS REVIEWED

A. VALIDACION DE INDICADORES

1. Validación de indicadores antropométricos sencillos predictores del retardo en el crecimiento intrauterino. Oscar Aquino, Rebeca Arrivillaga, Hernán Delgado, Teresita González-Cossio
2. Investigación operacional sobre alternativas al peso al nacer como indicador de alto riesgo de morbimortalidad infantil. Hernán L. Delgado.
3. Relación Urea-creatinina y consumo de leche del lactante para evaluar impacto de intervenciones nutricionales. Bertita García, Hernán Delgado, Teresita González-Cossio, Benjamín Torón.
4. Bioelectrical impedance and body composition. Teresita González Cossio, Erick Diaz, Hernán Delgado.

B. INTERVENCIONES ESPECIFICAS PARA BAJAR LA INCIDENCIA DE BPN Y EL RETARDO EN EL CRECIMIENTO POSTNATAL.

1. Conducta de la nodriza y producción de leche. Teresita González Cossio
2. Comportamiento alimentario de la madre durante el embarazo y lactancia y con respecto al niño pequeño. Berta García, Hernán Delgado, Mario Molina.
3. Alimentación de la nodriza y producción de leche. Teresita González-Cossio.
4. Morbilidad infecciosa durante el embarazo y su relación con el BPN. Ricardo Hurtado, Hernán Delgado.

TABLE 1/ continued

5. Proyecto de intervenciones para modificar factores de riesgo psicosocial durante el embarazo y parto. Elena Hurtado.
6. Relación entre edad de menarquia y composición corporal. Hernán Delgado
7. Uso de utensilios con plomo y estado de nutrición férrico. Rebeca Arrivillaga
8. Impacto de la Vitamina C en frutas cítricas como medio de prevención de la anemia por deficiencia de hierro. Ricardo Hurtado, Hernán Delgado.
9. Propuesta de posibles intervenciones para lograr el control de las enfermedades diarreicas a través de mejoras en los servicios de agua y disposición de excretas. Rosa Amurrio.
10. Evaluación del impacto en el peso al nacer al reducir las concentraciones de CO ambiental (casero) por medio del uso de poyos Lorena. Rosa Amurrio.
11. Efectividad de técnicas populares de promoción para introducir conceptos de salud. Elvira Conde.

C. MODELO DE ENTREGA DE SERVICIOS

1. Información de utilidad en la prestación de servicios de salud materno infantil en Guatemala. Mario García.
2. Detección de riesgo de bajo peso al nacer y morbimortalidad infantil y preescolar. Oscar Aquino, Rebeca Arrivillaga, Rosa Amurrio, Ricardo Hurtado, Teresita González-Cossío.
3. Monitoreo del crecimiento en atención primaria de salud. Teresita González-Cossío, Mario García, Hernán Delgado.
4. Investigación evaluativa sobre la atención materno infantil

TABLE 1/ continued

proporcionada por la comadrona tradicional. Hernán Delgado.

II. OVERALL OBJECTIVES OF THE PROJECT

INCAP included projects for our reading and consideration that focused on the mother as well as on the child, arguing that it is best to consider mother and infant as a unit. Elena Brineman from AID, on the other hand, thought that focus should be on the mother and that it should address the following two questions:

1. How best to identify mothers at high risk of poor performance during pregnancy and lactation? (Performance to be understood in terms of outcomes such as birth weight and quantity and quality of breast milk.)
2. What mix of feasible and cost-effective measures can be implemented to decrease the level of risk?

Assuming that appropriate projects would be identified and defined in the area of poor maternal performance, there would be approximately \$190,000 to carry out the investigation over a period as long as four years. Since the overall effort has a regional character (i.e., Central America perspective), the knowledge gained should be applied to the particular situation in the member countries. Specifically targeted to strengthen this aspect are \$180,000 for countries to do operation research, presumably selecting options from among the research results of the area of poor maternal performance as well as from other research areas (e.g., etiology of chronic diarrhea). Also there are \$90,000 contemplated for multi-center studies in the area of risk factors of low birth weight and neonatal mortality. One important aim of the last component is the promotion of institutional and manpower development in the region.

Given the two perspectives, those of INCAP and AID, the following methodology was used:

1. Classification of projects into those that fit within the area of poor maternal performance during pregnancy and lactation and into those which do not.
2. Assessment of the relative priority of the projects already identified, and of others that might be identified, in the area of poor maternal performance during pregnancy and lactation.
3. Classification of projects falling outside the main theme identified above into those that merit high priority (and for which therefore efforts ought to be made to carry them out) and into those which do not. This last assessment was considered important because there is the danger that critical elements of a coherent maternal and child health program might be eliminated in the process of consolidating projects along a unifying theme.

The results of this exercise are presented in Table 2. The numbering system used is the same as that in Table 1. Low priority projects are identified; all others are classified as high priority. In addition, a number of projects which fit in other areas of the project "ORT Growth Monitoring and Education" are identified.

TABLE 2

CLASSIFICATION OF PROJECT TYPES AND LEVEL OF PRIORITY

SUBJECT FITS IN AREA OF HIGH RISK IN PREGNANCY AND LACTATION	PROJECTS FOR IDENTIFICATION OF RISK INDICATORS	SPECIFIC INTERVENTION PROJECTS	HEALTH CARE DELIVERY PROJECTS
YES	<p>A(1)-A(2) Anthropometric Indicators</p> <p>B(4) - Morbidity during pregnancy (low priority)</p>	<p>B(1) - Lactation behavior (low priority)</p> <p>B(2) - Feeding behavior in women</p> <p>B(3) - Feeding lactating women</p> <p>B(5) - Stress during pregnancy</p> <p>B(8) - Vitamin C-Iron (low priority)</p> <p>B(10) -Carbon Monoxide</p>	<p>C(1) - Identification of high risk</p> <p>C(2) - Growth Monitoring</p> <p>C(3) - Comadronas</p>
NO	<p>Bio-electrical impedance (already done)</p> <p>A(3) - U/C and milk ingestion (already done)</p>	<p>B(7) - Lead (low priority)</p> <p>B(11) -Vendedores ambulantes (low priority)</p> <p>B(2) - Component dealing with Feeding during diarrhea</p> <p>B(9) - Water and excretia disposal</p>	

III. SPECIFIC PROJECTS

Consultants, INCAP investigators and in some instances Elena Brineman from AID met to discuss the projects. The principal investigators identified in Table 1 opened the discussion with a brief overview of each project. What follows are brief summaries of the discussions.

A. ANTHROPOMETRIC HIGH-RISK INDICATORS

Two related projects were discussed in this area. The first focuses on deriving alternatives to birthweight, which would have to be appropriate for use in rural areas. The second seeks to identify simple indicators for predicting intrauterine growth retardation. Both of these projects were judged to be central to the overall project for they deal with basic methods for detecting high risk pregnancies.

1. Anthropometric Indicators of Intrauterine Growth Retardation

The effects of maternal nutrition on birthweight can be divided in theory into those that result from chronic childhood undernutrition, pre-pregnant status and status during pregnancy. The anthropometric dimensions can be measured in each area and their proxies are as follows:

	<u>Dimension</u>	<u>Proxy</u>
Chronic undernutrition	Linear Growth	Weight, arm length
Pre-pregnant status	Mass/Length	W/H^2 , arm circumference
Status during pregnancy	Change in body stores	Weight gain
Fetal Development	Attained measures, velocities	Ultra-sound measures, uterine height

The following suggestions and comments were made during the discussion of this project.

a. Fuse the maternal and the newborn anthropometry projects into a single study.

b. Include arm length measurements as a proxy for height (arm length and height are highly related and behave, relative to associations with other variables, in similar fashion).

c. Do not discard the possibility of using maternal height as a risk indicator. A stick for example, where the cut-off point is clearly marked, could be dried out in the field.

d. Place particular emphasis on the testing of the Villar/Belizan tape for uterine height with and without knowledge of gestational age. This should be done in only a selected number of the large hospitals where longitudinal assessments are possible.

e. Explore whether mothers can accurately predict delivery (the general feeling was they they could even when they do not remember the date of the last menstruation).

2. Alternatives to Birthweight

Rural paramedical personnel (e.g. comadronas, promotoras de salud) have not had much success in Guatemala, according to INCAP, in weighing newborns, even when Salter scales have been used. If another indicator could be found that would be more easier to use under field conditions, a major contribution would be made.

The literature, including studies from INCAP, has shown that length provides important information not included in birthweight and gestational age. Low birthweight babies born at term can either be appropriate in terms of weight for length (probably chronic undernutrition in utero) or low in weight for length (late fetal undernutrition). Mortality, postnatal growth and motor and cognitive development have been shown to differ markedly depending upon this characterization at birth. Though potentially useful, the measurement of length is impractical in rural areas and hence alternatives are desired.

INCAP presented a project which focused on arm circumference and proposed the collection of arm circumference, birthweight and gestational age data in 10 hospitals, selecting 400 consecutive newborns per institution (4,000 cases). Additional cases of newborns with arm circumferences less than 9 cm. would also be included (number unspecified). The cut-off point of 9 cm. was based on results of a prior investigation in a Guatemalan hospital. Suggestions were made as follows:

a. Expand the anthropometric battery to include other variables of potential interest including arm length (as a proxy for length), length (to verify its relationship to arm length), foot length (a proxy for linear growth used in a previous study), and perhaps head circumference.

b. Do not use the cut-off point of 9 cm. for arm circumference in selecting the sample but rather collect a consecutive series of newborns with undefined characteristics.

c. Investigate to what extent (sensitivity, specificity, associations, etc.) the anthropometric measures reflect birthweight and length.

d. Collect data if possible on perinatal and neonatal mortality.

e. Test in rural areas whatever measures prove to be important in technically appropriate ways (e.g., color tape for arm circumference)

f. Renew efforts to see if "comadronas" can be trained to weigh babies, maybe using more resistant Salter scales (up to 25 kg.).

3. Urea Creatinine and Breast Milk Consumption

A very interesting study has been carried out to see if the measurement of urea creatinine in casual or 24-hour urine samples can be used to estimate breast milk consumption in infants. Preliminary findings were presented and discussed and the comments made below are basically about data analysis and interpretation.

Twenty mother/child pairs from Santa Maria Cauque were brought to the hospital in Guatemala and detailed information was collected about the timing and duration of feedings, the amount of breast milk ingested (test weighing) and the frequency and amount of urination. The mothers were in a relaxed environment and had plenty of time to breastfeed.

The findings revealed that daily breast milk intakes were extremely high (about 800 ml). These values are higher than those generally reported in the literature including studies carried out in the United States. Mean intakes of the current study seem higher than those of Santa Maria Cauque measured 20 years ago. Are the increases due to improved maternal status or to having more time to breastfeed under restful conditions? To test the latter part of this question, breast milk intake is also being assessed at the mothers' home. Valuable information is available for seven women and for six out of seven, higher in the hospital. The number of sucklings, on the other hand, seem to be fewer in the hospital.

Case No.	<u>Hospital</u>		<u>Home</u>	
	# of Sucklings	Volume (ml.)	# of Sucklings	Volume (ml.)
1	10	863	11	787
2	10	956	9	883
3	8	875	12	802
4	8	1,027	13	818
5	7	977	10	947
6	7	876	12	810
7	11	804	11	837

Obviously, this study must be completed and reported in the literature. If the effects of the hospital setting on milk production are confirmed, one could then attempt to see what might

be done if rural households do improve milk production (see project B1). It is very important that INCAP report these findings as the current perception in the United States is that well nourished mothers produce between 700-750 ml. Dietary recommendation of the new RDA's were to have been based on 750 ml instead of 850 ml. The present data suggest that this reduction is inappropriate.

Some preliminary analyses of urea creatine and milk production have been carried out. Results do not look promising as the casual or 24 hour values measured failed to predict breast milk intake. The following suggestions were made:

a. Consider only urea (as opposed to urea/creatinine). This was done and the predictive power increased markedly though it is still questionable whether satisfactory levels will be achieved.

b. Explore whether volume of urine is a useful predictor.

c. Carry out an exhaustive analyses of the information and include the best combination of independent variables. This will require a fishing exploration with all conceivable variables. The result should be published even if the outcome shows urea measurements in urine not to be useful for estimating breast milk.

4. Accuracy and Precision of Bioelectrical Impedance and Anthropometry

Bioelectrical impedance is a new promising technique for estimating body composition. However, its relationship to densitometric derived data and to anthropometric estimates of the body composition remains unclear, particularly in populations of developing countries.

INCAP has carried out a study comparing the degree to which bioelectrical impedance and anthropometry predict body fat and fat free mass estimated from densitometry (Seri equation). The main findings were that better predictions were achieved for fat free mass than for body fat, that bioelectrical impedance was somewhat better than anthropometry, and that both approaches underestimate percent body fat.

It was emphasized that INCAP should develop its own equations for predicting body fat and fat free mass and not rely on the manufacturer's equations which were derived from studies in the U.S. and which are felt to be inadequate even there. It was also emphasized that it was perhaps more important for bioelectrical impedance to be able to rank individuals in terms of body composition. Even with the use of the manufacturer's equations, R squares were very high (93.7% for fat free mass and 75.8% for body fat). As most of the applications will be in the context of epidemiological studies, the ability of bioelectrical impedance to rank individuals will be the most important quality.

B. PREGNANCY AND LACTATION BEHAVIOR

1. Conducta de la Nodrizza y Produccion de Leche

This project may, in the future, be placed in the high priority group as it aims to increase the volume of human milk, though as yet there are undefined strategies which would optimize time use by the mother and allow more time to breastfeed. However, the hypothesis is based on preliminary results of a study being completed in a small group of mothers, who apparently are able to produce a larger amount of milk when placed in a quiet and friendly hospital environment than when they were at home and involved with their busy schedule (see A3).

Therefore, it is suggested that data collection and data analysis from the pilot study be completed before starting the present one.

Regarding the methodology, it appears that the proposed design for studying the same population before and after introducing alterations such as increasing duration of breastfeeding should be modified. It seems that a randomized controlled trial is more appropriate, with mothers being allocated either to an intervention or to a control group. The volume of milk produced would be known by test-weighing (before and after each feeding, and the effect of possible confounding variables controlled through the research and design and/or through data analysis).

Finally, the estimation of sample sizes, a two-tailed alpha is to be considered, instead of one-tailed as it is presented in the project, since the possibility that the proposed intervention will decrease the amount of milk produced cannot be disregarded a priori.

2. Comportamiento Alimentario de la Madre Durante el Embarazo y Lactancia y con Respecto al Nino Pequeno

It is proposed that information be obtained about the feeding behaviour of mothers of small children and of pregnant women. The project aims to study how indian mothers of poor rural communities feed their children during episodes of diarrhea and during the recovery phase.

However, it is possible that enough information about these aspects might be available from previous INCAP studies, such as the Patulul project, and it is suggested that the part dealing with diarrhea should be left out until the previous studies are properly analyzed.

The study should focus on the feeding patterns of pregnant women during the entire pregnancy. There are strong indications that the food consumption of women during the first three months of pregnancy is less than that seen in non-pregnant women, probably due to nausea and vomiting. In the second trimester a somewhat higher food consumption pattern is observed, but during the third trimester

it decreases again to less than non-pregnant levels. It is possible that the stomach of short women might be compressed by the enlarged uterus rendering them unable to ingest large volumes. If so, pregnant women, like young children, may be constrained by the low nutrient density diets that characterize developing countries and may require therefore, more frequent feedings and/or nutrient-dense foods to meet recommended intakes.

Information about these aspects should be collected in this project and would be helpful for the better understanding and proper management of nutrition in pregnancy.

3. Alimentacion de la Nodrizas y Produccion de Leche

This is a controlled trial of maternal food supplementation designed to increase the amount of milk produced and/or improve its quality. It is an important subject, since there is no agreement in the nutrition literature on whether it is possible to increase the amount of human milk secreted or its characteristics by improving the maternal diet.

Thus, although it is accepted that there are many methodological difficulties in carrying out such a study, it appears that it should be done.

It is suggested that malnourished lactating women be selected and allocated to only two groups: one which will receive food supplements with high energy and protein content; and the other which will serve as a control.

Maternal nutrition will be measured throughout the study by weight, height and bioelectrical impedance (for body composition).

Breast milk volume will be measured by test-weighing during 24 hours, and it is estimated that for detecting a difference of 100 ml in the daily amount of milk produced, approximately 45 mothers need to be studied in each group (power of .80, significance of .05, two tailed). Other important aspects of the study that need to be properly addressed include:

- ensure that the mothers will take the supplementary food;
- evaluate maternal activity, since it is possible that the extra energy provided by the supplement will be used to increase physical activity instead of improving milk volume or quality.

Anthropometrical measurements of the babies from both groups will be evaluated throughout the study. However, the sample studied may not be large enough to detect significant differences in physical growth between the groups.

4. Morbilidad Infecciosa Durante el Embarazo y su Relacion con el Bajo Peso al Nacer

The objective of this study is to analyze information already available, mainly from the Patulul study, in order to know the incidence and clinical characteristics of infectious episodes during pregnancy and the relationship with birthweight. This information would be used for assisting primary health care personnel in recognizing symptoms associated with a bad pregnancy outcome.

The quantitative measurement of infections during pregnancy will probably bring interesting information about the relationship between infections, fetal development and perinatal performance. However, it is not clear if this information will improve the quality of health care at the primary level, since the identification of specific problems will be difficult. Also, symptoms may be fairly infrequent in women and this approach may not prove to be useful.

5. Proyecto de Intervenciones para Modificar Factores de Riesgo Psicosocial Durante el Embarazo, Parto y Posparto

Three phases are proposed: an initial assessment of psychosocial factors during pregnancy (for providers, patients and for their interaction); the use of the data to design an intervention study; and the intervention study itself.

The literature suggests that prenatal care works through the detection of high risk (and appropriate interventions) and through behavioral changes produced through education. It is also possible that there is selection in that the women who seek prenatal care may be at lower risk or may be more willing to adopt appropriate behaviors than women who obtain little or no care. Any intervention study will have to take this into account. The proposed study will review the literature and the first phase aims to identify the most appropriate interventions, in terms of impact, ease of administration and replicability. Behavioral interventions which may be important for the Central American region include increased rest during pregnancy, reduced physical stress during pregnancy, increased social support, and provision of coping skills to help deal with physical and psychological stress. Improvements in health services could help reduce stress associated with their use and hence increase their utilization. The portion of the project which identifies the health provider's knowledge of risk factors in pregnancy and which develops interventions to improve the level of knowledge is also important.

Some aspects of this project overlap with others and some joint work may be useful. For example, project B1 may develop an intervention to get nursing mothers to rest more and improve their task/time management. Since the same intervention would be valuable in pregnancy, the two might be combined in an intervention which begins in pregnancy and which follows the same women during lactation as well.

6. Relacion Entre Edad de Menarquia y Composicion Corporal

Although this project does not fit directly into the specific interest of at-risk pregnant and lactating women, it addresses one important point, which is the relationship between nutritional status and age at menarche. This is an important subject in Guatemala, where 15% of the pregnant women are adolescents, and it is hypothesized that an improvement in nutrition might lead to an earlier menarche and, perhaps, to a precocious start of sexual life and a young age at the first birth.

The project design includes a survey of rural and urban adolescents aged 10-19 years. Information on age at menarche will be collected by the status-quo method whereas body composition will be measured through bioelectrical impedance.

This proposed design does not allow the study of the influence of the nutritional status on age of menarche, since a large part of the population will be studied after menarche has occurred, and the nutritional changes might be consequences and not causes of the hormonal changes associated with menarche. However, the study will permit the determination of the median age at menarche, and it will be of interest to know what are the differences between rural and urban women. Moreover, the comparison with previous information will show important time trends in age of menarche and in adolescent nutrition.

In order to allow the study of the possible association between better nutrition and earlier menarche, it is proposed that a sample of urban and rural girls aged 12 years be followed for 2-3 years, with measurements of body composition. The urban sample should not be drawn from secondary schools, as is proposed in the project, since this would probably introduce a selection bias towards better educated (and higher social class) adolescents.

7. Uso de Utensilio con Plomo y Estado de Nutricion Ferrico

The study raises the hypothesis that lead intoxication might be an important health problem among Guatemalan children, due to the following reasons:

- a. The high prevalence of iron-deficiency anemia, which would increase the susceptibility to lead poisoning;
- b. The traditional use of cooking utensils which are painted with lead-containing varnish; and
- c. The use of urban areas of leaded fuel, and also the painting of houses and toys with lead-containing products.

The project aims at showing that food contamination is the most important cause of lead intoxication in Guatemala, and a sample of children living in a settlement where cars and painted houses are not usually seen is to be studied.

It could be argued that enough is already known about the serious effects of lead to justify the ban of lead-containing varnish in traditional cooking utensils without any further study. On the other hand, it is possible that the quantification of the possible serious effects of this practice on children's health would provide a strong argument to be used by the health sector to propose the ban of leaded varnish.

However, the presently proposed design does not permit exploration of the hypothesis that food contamination is the main source of lead intoxication, as populations subjected to motor vehicle, or other sources of lead contamination are not studied. To make this possible, it would be necessary to study two different groups, with exposition to different sources of lead. The reason for this, however, is not clear, as the possible health intervention would be the ban of leaded varnish.

8. Vitamin C in Citric Fruits as a Means for Preventing Iron Deficiency Anemia

Anemia is a public health problem of great importance for mothers and children. Ways of increasing iron intake, of facilitating its absorption, and of improving utilization are urgently needed.

The project reviewed seeks to find out if a lemonade (formulation unspecified) provided to children six months to three years from a day care center improves iron status.

Since the effects of vitamin C on the absorption of non-heme iron is well known, this project, as currently conceived, appears unnecessary. The physiological effects of vitamin C will be the same regardless of its source. Rather it was felt that it was more important to design and test ways of achieving better diets (more heme iron, if possible, and certainly more non-heme iron and higher intakes of Vitamin C) through nutrition education, the promotion of home gardens and the like. Potential clashes against cultural barriers were also discussed; there is the possibility for example, that lemons will be rejected in Guatemala because of the belief that it will curdle the milk in breastfed infants causing havoc to the child's stomach. In summary, the project, as currently conceived, was not felt to be important and it is recommended that it either be dropped or completely reworked.

9. Interventions to Control Diarrheal Diseases Through Improved Water and Latrines

This is a complex and difficult study. Though it is not central to the main theme of high risk low birth weight and poor lactational performance, it deals with an important area. There has been well deserved emphasis on ORT and in the dietary management of diarrheal diseases but since these are basically curative approaches, one must continue to break new ground in terms of cost effective measures to interrupt the transmission of diarrheal diseases.

The project proposed uses low cost technology developed by ICAITI in Guatemala and includes a filter for purifying drinking water, a storage tank to trap rain water and a manual pump, and an innovative latrine (see project description for drawings). Dr. Greenough, former head of the International Center for Diarrheal Disease Research in Bangladesh feels that soap is a cost effective tool for interrupting transmission. He proposed that intense efforts be made to popularize home-made soaps. Some thought might be given to efforts in this area.

A design was proposed by INCAP that would evaluate the following chain of events:

Adoption of----->	Improvement----->	Lower rates----->	Lower
the intervention	in water	of diarrheal	mortality
	quantity and	diseases	rates
	quality and		
	in excreta		
	disposal		

Each of the three interventions: water quality, water quantity and excreta disposal, was seen as a distinct study. A baseline of one year was proposed.

It was strongly suggested that in order to reduce the duration of the study and its cost and complexity, the investigators should focus on documenting the degree to which the interventions are accepted, the behavioral patterns related to their use, and the impact that these may have on water quantity and quality in the excreta disposal. The projects dealing with water quantity and quality ought to be combined and an intense, well designed education component should accompany the interventions. Also emphasized was that water is a highly desired commodity and that much effort and time, particularly by mothers and children, is devoted to fetching water. Thus, a water intervention will probably have important effects on time and its allocation in the household. Finally, it was felt that if these interventions are shown to significantly impact on environmental sanitation then an effort ought to be made to assess the impact on morbidity and mortality. Such a demonstration would motivate governments and bilateral and international agencies to aggressively launch programs.

10. Cooking Smoke and Low Birthweight

This is a highly interesting project on an important subject. In many countries, women are exposed to high levels of carbon monoxide from cooking smoke. In Guatemala, the poorer homes are one-room huts with very poor ventilation and often the cooking stove is located in one corner of the rooms. INCAP has some preliminary experiences suggesting that CO levels are high and that birthweight might be affected. It is very urgent that INCA' carry out further studies to strengthen this claim.

One opportunity is provided by the adoption in some villages of a new kind of stove which is fuel-efficient and designed not to leak smoke (poyos Lorena) in the household but rather to release it through a chimney. It would be relatively easy to see if these low-cost stoves decrease carbon monoxide levels in the household, carbohyhemoglobin levels in blood, and improve birthweight. Another potential outcome is respiratory infections in children.

An opportunity exists to study homes with and without stoves and the study should be carried out. However, careful attention must be placed to control, either through the design or by statistical analyses, for potential sources of bias. The users may differ from non-users in ways that affect birthweight.

A case control approach is recommended. It was suggested that newborns be monitored in many villages and that the households be classified for having or not having the poyos Lorena. Birthweights would be measured as well as social and economic characteristics of the household. Carbon monoxide and carboxyhemoglobin levels would be measured in the household and mother respectively, a fixed time after birth when the household returns to its usual routine. The assumption would be that these levels measured after birth are a good proxy of those during pregnancy.

Sample sizes need to be estimated. Suggested parameters are a mean impact of 100 g, power of .80 and statistical significance of 5%. The feasibility of matching cases and control in terms of potentially confounding variables should be explored.

In summary, this is a very important project that merits high priority. If successful in demonstrating impact on birthweight, a controlled intervention trial should be carried out. In this study, subjects would be randomly allocated to cases and control and prospective evaluations during pregnancy would be carried out.

11. Effectividad de Tecnicas Populares de Promocion para Introducir Conceptos de Salud

It seems that with the present knowledge of the importance of oral rehydration salts (ORS) for decreasing diarrhea morbidity and mortality, health planners in every country, as well as international agencies concerned with health issues, should join efforts to make ORS available to four populations free-of-charge. In this perspective, although the present project is of interest for the Guatemalan situation, where ORS is not available free of charge, it should not divert the attention from the urgent need to make this low-cost product available in areas of high prevalence of diarrhea, and where the population cannot afford to buy them.

Priority. This project is of potential interest to the child survival project but is not central to the area of low birth weight prevention. The aim of the project is to learn why the "vendedores ambulantes" are so successful in selling medicines in rural areas and to explore whether these same salesmen could be successful in

selling ORT and in providing information regarding feeding during episodes of diarrheal disease in infants and young children.

Comments. It would be useful to define (list) precisely what is meant by traditional and modern health personnel. Some potentially important distribution sources for ORT salts such as pharmacies and small stores (tiendas) are somewhere in between and are often neglected by health planners and policy makers.

- Who will the vendedores ambulantes be? How will they be selected and trained? It would be useful to distinguish by types of vendedores: House to house, buses, markets, etc.
- Why not include farmacias and tiendas in this approach? You could include one additional category in the experimental design: Farmacias/Tiendas. The research design needs to be clarified. The unit of analyses must be specified.
- On p. 4, the last hypothesis is not clear. It appears that some words are missing.
- Clearly, the entire project needs to be done on the basis of the anthropological data and with input from those who collected and analyzed it.

C. HEALTH CARE DELIVERY PROJECTS

1. Deteccion del Riesgo del BPN y MMIP

The objective of this project is to provide primary health care personnel working in remote areas (comadronas and health volunteers) with training in the use of risk factors in order to detect groups at high risk of low birthweight, and infant and child morbidity and mortality.

A score system of risk factors is being developed as well as instructions on the specific actions to be adopted when dealing with patients identified at high risk.

The success of this project will depend on the possibility of joint work by both INCAP and the Ministry of Public Health as it is proposed in project C3. Also, the adequacy of the risk factors in predicting a poor health performance needs to be tested and, if necessary, should be corrected.

As in project C3, it is well possible that the risk factors for low birthweight and morbidity and mortality which are valid in Guatemala prove to be not too important in other Central American countries.

2. Growth Monitoring

Growth monitoring has been emphasized by AID, UNICEF and other organizations. With few exceptions, experiences have been disappointing and more often than not, growth monitoring is ineffective at best and at worst, wasteful of precious resources.

INCAP proposes to carry out a careful assessment of growth monitoring activities in Guatemala. Attention will be paid to all aspects, including mother child, health personnel, data quality, coverage and use of the information. This seems a logical place to start.

A second phase will take the information obtained in the first phase in order to design and test growth monitoring approaches (operations research). Based upon the results of both phases it will be possible to conclude whether growth monitoring ought to be promoted or not and how.

This project has great priority in its own right. However, it is not central to the main theme of high risk of low birthweight and poor lactational performance except in so far as the use of growth data is considered in evaluating maternal performance.

3. Investigacion Evaluativa sobre la Atencion Materno Infantil Proporcionada por la Comadrona Tradicional

Although around 70% of deliveries in Guatemala are assisted by traditional midwives (comadronas), their work has been never properly evaluated and supervised. Thus, the present project is considered as highly important. Its objectives are:

- a. to evaluate the quality of health care provided by these 7,000 comadronas scattered around the country;
- b. to set a plan for improving their training; and
- c. to implement the proposed modifications in a short time.

This activity will be proposed to the national health authorities and is to be carried out jointly by both INCAP and the Ministry of Public Health.

It is not clear if other Central American countries will get much benefit from the specific findings and actions of the project. however, the experiences gained by Guatemalan health planners might be shared with the neighbouring countries, and used in other places to tackle their own specific problems.

IV. FINAL REMARKS

INCAP has been a pioneer in nutrition research for many years. The long-term success of institutions is linked to their ability to

identify and stimulate new investigators. In this regard it was gratifying to note that a number of new investigators have been included at this stage and that they were allowed to present their ideas. It is hoped that one or more of them will join INCAP on a long-term basis, and thus help renew INCAP's professional staff.

Since budgets and timetables for each specific project were not presented, and a fixed amount is available for funding, it seems that the order in which the projects will be carried out will depend on their relative importance and other aspects. For example, some projects would benefit from having some extra information from others of this same group before being started. In addition, some projects which did not fit into the main theme of interest, were nevertheless considered as highly important, due to their potential impact on morbidity and mortality. A good example in this group is the project on water and excreta disposal. It is suggested that funding from other components of AID programs should be sought in order to finance them.

The issue of the degree to which the package of investigations is relevant to the rest of Central America must be addressed at some point. All of the research projects we reviewed are to be done in Guatemala, while some are assessing biological relationships to a large extent (e.g., urea creatinine and breast milk ingestion), others are strongly related to cultural and life style factors (e.g., use of comadronas). Though the similarities between countries are many, unique features are also apparent. Funds for research in the rest of Central America are available and some thought ought to be given now to the research which might be carried out in the member countries. Thus, unnecessary delays might be avoided by planning now.