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JUNE 19 - JULY 20, 1974

Conducted by O.N.R.D. and USAID
Report Prepared January 3, 1975
By Carol Adelman

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SUMMARY OF CONCLUSIONS

- Approximately 22% of children between 6 months and 4 years old in Kinshasa are malnourished.
- After a child is weaned the rate of malnutrition rises to 28%.
- 95% of children come from zones where less than 8 Zaires is spent on all consumption goods per person per month.
- 46% of children are weaned by the age of 13 months.
- 21% of children are weaned because the mother is pregnant.
- 91% of children receive food supplements during breast feeding and 76% of these children receive the regular family meal.
- 98% of children are introduced to the regular family meal after weaning.
- Only 17% of mothers have ever attended a nutrition education course. A mother's having taken a nutrition education course has no direct influence on a child's nutritional status.
- 98% of Kinshasa mothers give birth in clinics.
- Fever, diarrhea, measles and cough account for over 80% of diseases/symptoms affecting children between 6 months and 4 years old.
- Children who have been sick weigh significantly less than children who have never been sick.
- Diarrhea, anemia, flu, skin disease and malaria significantly increase malnutrition.
- Children who take mothers' milk plus the regular family meal weigh significantly more than other children who are not yet weaned. However, such children have a significantly higher frequency of disease.
- Children who take mothers' milk plus a special meal weigh less than other children who are not yet weaned, but they have fewer diseases.
- Taking mothers' milk plus artificial milk has no significant impact on a child's weight, though it reduces the frequency of disease.
- The longer a mother has lived in Kinshasa makes no difference in nutritional status for the weaned child and results in lower nutritional status for the unweaned child.

- Children whose mothers originate from Angola have a higher rate of malnutrition than children from Kinshasa while children whose mothers originate from Haut Zaire and Equateur have a lower rate of malnutrition.

- For children already weaned their weight increases and frequency of disease declines significantly, the older the mother is.

The above interpretation of conclusions is subject to the qualifications which are discussed later in this report.

I. INTRODUCTION

From June 19 to July 20, 1974, a wide-scale health nutrition survey was conducted for children between the ages of 6 months and 4 years from all 24 zones of Kinshasa. The survey was organised and conducted by O.N.R.D. (National Office of Research and Development) and USAID with the assistance of FOMECO (Medical Service of the Presidency). The survey was conducted in conjunction with a city-wide measles campaign, jointly undertaken by FOMECO, the Department of Health and WHO, whose goal was to vaccinate 100 percent of those children between 6 months and 3 years' old who had not yet had measles, nor been vaccinated against measles. The campaign vaccinated a total of 114,664 children between 0 and 4 years of age which is approximately 42% of the total 0-4 age groups in Kinshasa. Although the measles campaign was to be limited to this 6 month to 3 year age group, for various reasons, it was necessary to allow children over 3 years to be vaccinated. This was fortunate for the health/nutrition survey as it increased the representative sample. The health/nutrition survey accumulated data on 3,864 mothers and 4,391 children between 6 months and 4 years of age. The number of children represents approximately 3.8% of total children vaccinated and 1.6% of the total Kinshasa population between 0 and 4 years' old. [1)]

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1) The 1.6% is based on 1.5 million total population for Kinshasa with infants and children under 4 years comprising approximately 18% of total population or 270.000.

II. REASONS FOR SURVEY

The reason for undertaking the survey was based on the following rationale. It is well known that the health/nutritional status of the age group under observation has a profound impact in determining future physical and mental development. In addition to the effects of poor health and malnutrition on the well-being of an individual, the economic costs to the nation are great in terms of losses in work productivity, high medical costs and reduced working years as a result of low life expectancy. It is also estimated that the age group surveyed accounts for 80% of the crude death rate in Zaire with malnutrition either a primary or associated cause of approximately 60% of these deaths. The major fatal childhood diseases in Zaire such as measles, malaria and gastro/enteritis are diseases which are rarely fatal to a well-nourished child.

Data on food consumption and availability indicate an insufficient protein/calorie intake and availability for the Zairian population. In addition to this, other constraints play a key role in the health/nutritional status of the population - beliefs and practices, lack of knowledge on correct nutritional practices, disease and infection, water and environmental sanitation, transportation, marketing and low income. In sum, the problem is complex, requiring expertise in various disciplines and a comprehensive and systematic approach to the problem.

The first step in a systems approach to combatting morbidity and malnutrition requires the gathering of baseline data so that we know the scope and magnitude of the problem. This is essential for measuring the

results of any action programs undertaken later to combat the problem. The health/nutrition survey attempted to gather this essential baseline data for the city of Kinshasa and specifically for the most vulnerable group to the effects of malnutrition and morbidity. As the attached questionnaire shows, data was gathered on the following questions: 1) weight for age as an indicator of nutritional status; 2) the incidence of child morbidity and mortality; 3) the mothers' age, residence, origin, and arrival date in Kinshasa; 4) whether the mother had taken courses in nutrition education and where she gave birth, whether at home or in a clinic; 5) feeding practices before and after weaning; and 6) age that the child was weaned and reason for weaning.

III. HYPOTHESES

The above data was primarily selected to prove or disprove certain hypotheses on the causes of malnutrition as measured by weight of pre-school children in Kinshasa. The factors we consider are as follows: 1) effect of frequency of disease on nutritional status; 2) effect of specific diseases on nutritional status; 3) effect of feeding practice on nutritional status; 4) effect of mothers' length of stay in Kinshasa on nutritional status; 5) effect of origin of the mother on nutritional status; 6) impact of nutrition education on nutritional status; 7) effect of the age of the mother on nutritional status, and 8) the effect of income on nutritional status.

The statistical analysis to test the above centered on essentially whether and to what degree the above factors did in fact cause the weight of children to differ (holding age constant), thereby establishing causes of malnutrition.

Statistical tests were first done for the whole sample of children and then for those children not yet weaned and those already weaned. It was important to distinguish between these two groups, since in most cases malnutrition becomes most severe in the post weaning period when nutrients from the mother's milk are not adequately replaced by the regular diet.

The computer analysis techniques used for the above tests were partial correlation and multiple regression.

IV. BIASES/QUALIFICATIONS

The survey did not ask all of the questions pertinent to the nutrition problem. Most notably lacking were questions on water and sanitation, certain anthropometric measurements and quantities and types of food consumed. Time was a limiting factor as the survey was conceived and organized in five working days. Additionally, minimum resources, both material and human, were at our disposal. Given these constraints the decision was made to gather general although limited data on the largest sample possible. Also, since Dr. Ngwete had conducted a separate more detailed longitudinal study on 600 Kinshasa children, it was felt that a larger cross sectional sample could help confirm and clarify some of the results of this study as well as provide a general base for children living in Kinshasa.

Another limitation is that the sample is a representative but not random sample of children and mothers in Kinshasa. As stated earlier, approximately 42% of the population of Kinshasa between the ages of 6 months and four years was vaccinated of whom data on 3.8% was gathered. It may be that the characteristics of mothers and children who did not come to the vaccination centers are significantly different from those that did come. For example, the mothers who did come may be better informed or perhaps more conscientious about their children. If this were true, then it is likely that children who came to the vaccination centers were better nourished than those who did not come. On the other hand, certain children may have been turned away at the vaccination tables, since the vaccination teams were instructed not to vaccinate those below 6 months and above three years as well as those who had already had measles. This stipulation was not observed very closely; however, since approximately 22% of those vaccinated were above three years of age and 16% of children surveyed were reported as having had measles.

On the whole, it should be noted that to obtain a truly random sample, a much more intensive survey requiring greater resources is necessary. This survey provides us with important baseline data for a geographically representative sample which is larger than any prior surveys in Kinshasa.

V CHARACTERISTICS OF THE SAMPLE

Data was gathered for 4,386 children and approximately 3,900 mothers. In those cases where we analyzed maternal characteristics and where a mother brought in more than one child, we corresponded mothers to the number of children for whom data was obtained. Characteristics of the sample will be presented in this section and the following section will examine the general hypotheses on nutritional status.

Of the children 49.2 percent were female and 50.8 percent male. The children were almost equally divided between those who had been weaned and those not yet weaned indicating that about half of sample of children are still breast feeding.

Ninety-five percent of the children were taken to the vaccination centers by their mothers, two percent by sisters, 1.4 percent by fathers and the remaining by some other relative.

ORIGIN OF MOTHERS

The following table shows the origin of mothers in Kinshasa.

REGION	NUMBER	PERCENT
Bandundu	1,140	25.9
Bas Zaire	1,447	33.0
Equateur	492	11.2
Haut Zaire	178	4.0
Kasai Occidental	151	3.4
Kasai Oriental	504	11.5
Kivu	122	2.7
Shaba	8	.1
Angola	334	7.5
Foreign[2]	10	.2
TOTAL	4,386	100.0

INCOME/EXPENDITURE

Unfortunately, no information on income or expenditures was requested by this survey. However, the survey does identify zone of residence which can be compared to the household budget survey conducted by J. Houyoux

[2] Foreign refers to other African origin excluding Angola.

which indicates that zones of residence in Kinshasa are identified by income level.[3] That is, there is a certain homogeneity of the population of each zone in terms of economic well-being. The children in the survey were grouped according to their zone of residence and thus categorized by the average expenditure by his/her family per consumption unit. The measurement is extremely crude since there is certainly variation among expenditures in each zone; however, it does give an idea of average expenditure per person in the zones where the children surveyed live. The following table shows the number and percent of children falling into various expenditure levels.

Average Expenditure On Consumption Goods Per Month Per Person in Zaires	Number of Children Surveyed	Percent	Cumulative Percent
Zaires 5.38	1,171	26.9	26.9
5.60	713	16.4	43.3
7.45	658	15.1	58.4
7.52	497	11.4	69.8
7.58	1,117	25.7	95.5
20.95	198	4.5	100.0
	4,354	100.0	100.0

[3] See Houyoux, Joseph: Budgets Menagers, Nutrition et Mode de Vie a Kinshasa, UNAZA, I.R.E.S., Kinshasa, Zaire, 1973.

The preceding table shows that 95.5% of the children in this survey are from zones where families spend less than 8 Zaires per person per month on all consumption goods.

DISTRIBUTION OF MOTHERS BY ZONE

The following table shows the distribution of mothers surveyed by their zone of residence.

Zone	Number of Children Surveyed	Percent
Ngaliema	131	3.0
Gombe	18	0.4
Lingwala	126	2.9
Kinshasa	262	6.0
Barumbu	196	4.5
Kintambo	74	1.7
Bandalungwa	343	7.9
Kasa-Vubu	190	4.4
Kalamu	223	5.1
Limete	180	4.1
[illegible]-Ngiri	168	3.9
Bumbu	192	4.4
Makala	138	3.2
Ngaba	210	4.8
Lemba	335	7.7
Matete	216	5.0
Mongafula	44	1.0
Masina	292	6.7
Ndjili	139	3.2
Selembao	173	4.0
Kimbanseke	475	10.9
Nsele	25	0.6
Maluku	3	0.1
Kisenso	201	4.6
TOTAL	4,354	100.0

VI HEALTH/NUTRITIONAL CHARACTERISTICS OF THE SAMPLE

Infant/Child Weaning Practices

The analysis of health/nutrition data was done on children before and after weaning since this is a known determinant of malnutrition, with the rate of malnutrition usually increasing after a child is weaned. The following table shows the weaning age of the 2,039 children of the total sample who were already weaned:

Age of Weaning (In Months)	Number Surveyed	Percent	Cumulative Percent
1 month	7	0.3	0.3
2 months	19	0.9	1.3
3 months	19	0.9	2.2
4 months	10	0.5	2.7
5 months	20	1.0	3.7
6 months	46	2.3	5.9
7 months	27	1.3	7.3
8 months	79	3.9	11.1
9 months	94	4.6	15.7
10 months	74	3.6	19.4
11 months	47	2.3	21.7
12 months	406	19.9	41.6
13 months	95	4.7	46.2
14 months	247	12.1	58.4
15 months	201	9.9	68.2
16 months	138	6.8	75.0
17 months	140	6.9	81.9
18 months	194	9.5	91.4
19 months	48	2.4	93.7
20 months	40	2.0	95.7
21 months	15	0.7	96.4
22 months	7	0.3	96.8
24 months	57	2.8	99.6
25 months	1	0.0	99.6
26 months	1	0.0	99.7
29 months	2	0.1	99.8
30 months	2	0.1	99.9
31 months	2	0.1	100.0
34 months	1	0.0	100.0
TOTAL	2,039	100.0	100.0

It is interesting to note that about 46% of children are weaned at 13 months with a corresponding 54% of the children who are still being breast fed at 13 months

Reasons for Weaning

The mothers or person accompanying the child were asked why the child was weaned. The following reasons were given:

	Absolute Number	Percent
Mother's decision	839	40.1
Child refused	253	12.1
Child sick	193	9.2
Mother pregnant	435	20.8
Mother sick	95	4.5
Child matured	142	6.8
Defect in mother's milk	67	3.2
Lack of mother's milk	19	.9
Mother's work	33	1.6
Mother's death	3	.1
Premature infant	4	.2
TOTAL	2,083	100.0

An obvious problem with the above data is in the interpretation of the reasons for weaning. Unfortunately, where a mother said it was her decision to wean her infant, she was not questioned further as to the reason for this decision. Thus, the mother may well have been

sick, pregnant or have decided that the child was mature enough to be weaned. Also, the children who refused mother's milk as a reason for weaning may well have been sick or the mother might not have been supplying sufficient milk. Despite these qualifications, a significant number of mothers (20.8 percent) weaned their children because they were pregnant again.

Feeding Practices

The children's food intake was divided into two groups, food intake before weaning and food intake after weaning. These two groups were divided into sub-groups - for before weaning the sub-groups were: 1) mother's milk only; 2) mother's milk and artificial milk,and 3) mother's milk and other food, either a special baby food or family meal. For food intake after weaning two sub-groups were established: 1) special meal, and 2) family meal. These groupings were made so that we could determine the effects of different feeding practices on the nutritional status of the child.

The following table shows the number and percent of children in the three categories of feeding practices before weaning.

	Absolute Number	Percent
Mother's milk only	120	5.4
Mother's milk and artificial milk	82	3.7
Mother's milk and other food	2,012	90.9
	2,214	100.0

Of the above 91% of children who receive both mother's milk and other food before weaning, 76 percent receive the same meal as the rest of the family. Only 24% receive a special meal for infants. This fact implies serious consequences for the vast majority of Kinshasa children since the average family meal consists primarily of starchy foods in the form of manioc with an inadequate protein content which is crucial for early child development. Based on income and nutrition data from the budget consumption study mentioned earlier, the majority of children in this survey come from families where the adult members are receiving approximately half of their minimum daily protein requirement. A smaller more detailed survey would be helpful in determining the reason or combination of reasons as to why children are introduced to the family

meal without consideration for their special nutritional needs. In order to change this likely detrimental practice, it is necessary to know whether the reasons ar a result of economics - the family cannot afford other foods - taboos on child feeding, or simply lack of knowledge as to correct infant nutritional requirements.

The following table shows the number and frequency of the two types of feeding practices after a child was weaned:

	Absolute Number	Percent
Family Meal	2,115	98.1
Special Meal	35	1.6
Both Family and Special Meal	5	.2
TOTAL	2,155	100.0

Again, after weaning just as before weaning, the vast majority of children receive the regular family meal.

Rates of Malnutrition

Every child was weighed and this weight was compared against age to determine whether the child fell below or above an average weight for age as established in the Ilesha health/ weight chart which is used in the Mama Yemo Hospital MCH program as well as in hundreds of clinics throughout Zaire. This chart was first used in Ilesha, Nigeria and was tested over an eight year period in several countries. It is presently being used in eleven African countries as well as Ira and some parts of India.

It is generally agreed that slowing in the physical growth rate is the earliest and perhaps best indicator of malnutrition or a pre-malnutrition state. There is a difference of opinion as to what weight standards should be used in developing countries and, obviously, it is preferable to obtain longitudinal data rather than cross sectional so that the normal or abnormal progress of the child can be followed rather than simply weight taken at one point in time. Despite these considerations, in the absence of particular weight standards for the Zairian child, it is felt that the standards set in the Ilesha chart, used in many other African countries, are an

acceptable indicator of the nutritional status of the Zairian child taken at one point in time.

The per cent malnourished, or those falling below the minimum weight for age standards, were calculated for children before and after weaning as well as for the specific feeding categories before and after weaning. The following table summarizes the per cent of malnourished children:

	Per Cent Malnourished	Per Cent Of Total Sample
A. Children Before Weaning	19%	52%
1. Those taking mother's milk only.	21%	3%
2. Those taking mother's milk plus artificial milk.	15%	2%
3. Those taking mother's milk plus family meal.	20%	36%
4. Those taking mother's milk plus special meal.	N/A	9%
B. [illegible]	28%	48%
1. Those taking family meal.	29%	47%
2. Those taking special meal.	27%	.9%
3. Those taking both family & special meal	N/A	.1%

Nutrition Education

It is generally thought that malnutrition throughout the world, as well as Zaire, is largely a result of a lack of knowledge of correct feeding practices. Indeed, we know of many regions in Zaire where various feeding practices and food taboos are likely to severely affect the nutritional status of the infant and young child. As this survey indicates, very few children in Kinshasa receive any special infant foods, but rather, the majority are introduced directly to the family meal which is low in protein and other essential nutrients. Based on this, various government and private organizations have launched nutrition education programs, as possible solutions to changing dietary habits. Unfortunately, few if any of these programs have been evaluated for their actual effect on reducing malnutrition. Most programs assume that nutrition education will solve the problem and, therefore, contain no provisions for actually following the nutritional health progress of a child whose mother is attending a nutrition education class.

In an attempt to ascertain the degree of participation in nutrition education courses and the effect on a child's nutritional status, the mothers in this survey were asked whether they had ever attended a nutrition education course and, if so, was the advice easy to put into practice. The following table summarizes the mothers' responses.

	Absolute Number	Per cent
Mothers who attended nutrition education courses	747	17%
Mothers who had never attended a nutrition education course	3,634	83%
Total	4,381	100%

Thus, only 17 per cent of the mothers had ever attended a nutrition education course. Of these, some 13 per cent profited from this or said they were able to put the nutrition education into practice. The regression analysis which will be discussed in more detail in Part VII indicated that there is no significant difference in weight between children whose mothers had taken a nutrition education course and children whose mothers had not taken a course. In other words, a mothers having taken a nutrition educa-

tion course has no direct influence on the child's nutritional status.

The mothers were asked at which centers they took the course. The centers were as follows:

Mama Yemo
Clinique Kinoise
Centre Social de Matete
Centre de Matonge
Centre Kimbanguiste de Kintambo
Centre Protestant de Kinsenso
Centre Officiel de Lingwala
Centre Catholique Kumba (Hors Kin)
Radionet Television
Centre Kalamu
Centre de Bumbu (Eglise)
Centre de Kasa-Vubu
Centre de Kinshasa
Centre Kimbaaseke (Soeurs)
Centre Kimbaaseke (Kimbanguiste)
Centre Saint-Clement-Makala
Centre Social Marsavco
Centre de Selembao
Centre de Ngaba
Centre de Yolo-Sud
Centre Social Cnatra (Kalamu)
Centre Social Ngiri-Ngiri
Centre de Gombe
Centre d'Itaga (Kinshasa)
Centre de Kintambo
Centre Social Gambela
Centre Social Camp. Militaire
Centre Social de Kinsenzo
Centre Protestant Yolo
Centre Social de Lemba
Centre Social de Kinshasa
Ecole Normale Limete
Centre de Bandalungwa
Centre Fomeco Baumbu
Centre de Sante Ndjili
Centre Social de Masina
Clinique Universitaires
Centre de Nsele
Centre de Bata
Centre Singer
Maternite Binza
Centre Kingabua
Centre Protestant Kalembelembe

Place of Delivery

In order to obtain more information on the utilization of clinics in Kinshasa as well as postnatal care, which is extremely important to the nutritional status of infants, information on where mothers gave birth was requested. Interestingly enough, 98.3 per cent of the mothers gave birth in maternity clinics with only 1.7 per cent giving birth in their homes. This statistic has tremendous implications for health/nutrition programs and projects since such a large per cent of mothers and babies can be reached through the existing network of clinics.

Frequency and Type of Disease

The survey attempted to examine the relationship between disease and nutritional status as the two are so interdependent. That is, when a child is sick, his or her nutrient requirements are raised, thus aggravating the state of malnutrition if not producing it. In turn, malnutrition increases the frequency and gravity of diseases so that a normally non-fatal disease such as malaria or measles will result in infant/child death.

The mothers were first asked whether their child had ever been sick. The following table shows the high per cent of children who have had one or more diseases:

	Number of Children	Per Cent
Child never sick	570	13%
Child had been sick	3,813	87%
Total	4,383	100%

Of the children who were sick, frequency or the number of times the child was sick is shown in the table below.

	Number of Children	Per Cent
One Disease	2,717	71.2%
Two Diseases	924	24.2%
Three Diseases	168	4.4%
Four Diseases	9	0.2%
Total	3,818	100.0%

Thus, the majority of children have had one disease with 24.2% having two diseases.

The mothers were asked to identify their child's disease. Results are summarized below for the ten most frequent

diseases of the majority of children or those having one and two diseases.

Type and Frequency of First Disease Among Children

Disease		Number of Children	Per Cent
1.	Fever	1,278	34%
2.	Diarrhea	915	24%
3.	Measles	610	16%
4.	Cough	280	7%
5.	Malaria	142	4%
6.	Cold	96	3%
7.	Bronchitis	94	3%
8.	Whooping Cough	70	2%
9.	Anemia	56	2%
10.	Flu	53	1%
			96%

The above ten diseases or symptoms as identified by Kinshasa mothers account for 96% of children's first diseases. Eighty one per cent of diseases are attributed to fever, diarrhea, measles and cough. As mentioned before, those children who had measles were supposed to have been excluded from the vaccination lines and, therefore, this survey; thus, the 16%

measles occurrence is probably understated.

Type and Frequency of Second Disease Among Children

Disease		Number of Children	Per Cent
1.	Fever	325	28%
2.	Diarrhea	297	26%
3.	Cough	158	14%
4.	Measles	93	8%
5.	Cold	86	7%
6.	Anemia	40	3%
7.	Bronchitis	37	3%
8.	Malaria	36	3%
9.	Whooping Cough	30	2%
10.	Vomiting	10	1%

From the above two tables, it is clear that if a child does not become sick with one of the above ten diseases as a first disease, he or she will catch one of them when sick for a second time. Again, the same four diseases/symptoms--fever, diarrhea, cough and measles--account for over 80% of the diseases affecting children between six months and four years old in Kinshasa. What is most dis-

turbing about the above statistics is that the majority of the diseases/symptoms could be prevented, most likely through basic preventive health care and better nourished children who are more resistant to disease. Section VII will look at the statistical significance of the association between disease and malnutrition.

It should be noted that the above diseases were those identified by the mothers. In the absence of clinical verification of diseases and further questions on symptoms of diseases, some of the diseases may be under or over-reported. For example, it is likely that malaria accounts for a much higher per cent of child morbidity. Many of the reported cases of fever, the number one disease listed, may have indeed been cases of malaria with symptoms of fever. In a widescale survey of this kind, it is extremely difficult to accurately assess type of disease, particularly with non-medical survey personnel. The results are useful, however, in giving a general idea of type and frequency of children's diseases. At the very least, the data does verify certain commonly-held notions on major causes of child morbidity in Kinshasa.

Conclusions

In conclusion to this section on health/nutritional characteristics, it must be added that there is much more data on tape which has not yet been exploited for reasons of time and trained personnel in computer programming. The services of one computer programmer/statistician (able to use the SPSS program) for one month could easily obtain such useful statistics as infant/child mortality, age and causes of infant/child mortality, and diseases by age and city location. This data exists on the tape but has simply not yet been programmed and run. Further, the data collected, including the various qualifications mentioned, point to many smaller more in-depth studies which could be carried out by students and other researchers to more accurately identify causes of malnutrition. In sum, the health/nutrition data presented is just a start to a better understanding of the complex set of causes and inter-relationships of infant/child morbidity, mortality and malnutrition.

Certainly, the survey did not ask all of the questions pertinent to the problem of malnutrition. Most immediately useful to broaden the data base on determinants of malnutrition would be a smaller in-depth survey of water

and sanitation and actual food consumption and how these compare to nutritional status or weight for age. A small representative longitudinal study of these factors as well as the same questions asked in this survey is necessary to complete a health/nutrition sector analysis. The survey does identify points of intervention, particularly in preventive health care and child feeding practices where programs and projects can and should begin immediately.

VII. THE HYPOTHESES AND THE STATISTICAL RESULTS

The two methods of analysis are partial correlation and multiple regression. Multiple regression analysis is a more rigorous form of testing in that it eliminates certain variables which may show a significant association using partial correlation. Unless specifically indicated, the results reported in this section are those found significant in both the correlation and multiple regression analyses. The significance level gives the degree of confidence we may have in saying that the estimated relationship between two variables is real rather than a purely chance occurrence. The cut off level below which an association is determined to be non-significant is 90 percent in this study for both correlation and regression analysis.

There are two variables which may affect weight but are unrelated to nutritional status. One of these is sex. Males weigh more than females, even when females are no more malnourished than males. A second variable is age. An older child is likely to weigh more than a younger child, even if more malnourished. Sex and age of a child in this study are held constant or statistically discounted by the computer.

Hypothesis 1

Effect of Frequency of Disease on Nutritional Status

The first hypothesis examined was the higher the frequency of disease, the lower the weight of a child. There is a problem of determining causality since disease aggravates the condition of malnutrition which, in turn, increases the frequency and gravity of disease. Therefore, we use correlation to determine the degree of association between frequency of disease and nutritional status.

Statistical Results:

1) For the whole sample there is no statistically significant association between frequency of disease among all children who have been sick and the weight of these children, holding sex and age constant. Using regression analysis, however, we found a significant difference in weight between children who have been sick one or more times and children who have never been sick. Children who have been sick weigh significantly less than children who have never been sick.

2) These results are true for both groups of children, those weaned and those not yet weaned.

Since there is a high degree of association between frequency of disease and weight of a child, in the rest of our analysis we use both as indicators of nutritional status.

Hypothesis 2

Effect of Specific Diseases on Nutritional Status

It was hypothesized that diseases lower a child's weight. This occurs because diseases increase a child's nutrient requirements and unless these requirements are met by increased intake, weight is likely to fall. Using regression analysis we tested the effect of approximately thirty diseases on the weight of a child, holding selected variables constant. We carried out two regressions, one on children not yet weaned and one on children already weaned.

Statistical Results:

1) For Children Not Yet Weaned

Both the correlation and regression analysis showed that children who had diarrhea weighed significantly less than other children. The

correlation analysis further showed that a child's weight is significantly associated with anemia, flu, skin disease and malaria. In addition, the regression analysis indicated that certain diseases, while making no difference in a child's weight, significantly increase susceptibility to other diseases. In other words, if a child has had one of the following diseases, he or she will be sick significantly more often than a child who has not had one of the diseases: fever, diarrhea, cough, cold, malaria, whooping cough, bronchitis, flu, bubo, anemia, asthma, yellow fever, vomiting, sickle-cell anemia, pneumonia, chicken pox, skin disease and worms. (Listed in order of impact on frequency of disease.)

2) <u>For Children Already Weaned</u>

For children already weaned only diarrhea significantly reduces weight, thus lowering nutritional status. In this group also, the regression analysis showed that certain diseases significantly increase frequency of disease. For those children already weaned the diseases in order of their impact on frequency of other

diseases are as follows: cold, cough, diarrhea, fever, measles, bubo, malaria, bronchitis, anemia, whooping cough, asthma, constipation, flu, skin disease, vomiting, pneumonia and yellow fever.

In conclusion, if we regard weight as the sole indicator of nutritional status, there are fewer diseases which have a significant impact on that status (as seen above - only diarrhea, anemia, flu, skin disease and malaria). When we add frequency of disease as an indicator of nutritional status, there are a larger number of diseases which affect the status, for both weaned and unweaned children. In both categories of children, it is of interest to note the rank of various diseases in effecting both weight and frequency of disease.

Hypothesis 3

Effect of Feeding Practice on Nutritional Status

Six possible kinds of feeding practices were identified in the questionnaire. These were:

1. Mother's milk only;
2. Mother's milk plus artificial milk;
3. Mother's milk plus family meal;
4. Mother's milk plus special meal;
5. After weaning, family meal;
6. After weaning, special meal.

The hypothesis was that, for children who are not yet weaned, a feeding practice which includes additional supplements to mother's milk raises a child's weight. It was proposed that taking artificial milk or a special meal has a greater effect than eating the regular family meal.

For children who are weaned, it was hypothesized that eating a special meal raises a child's weight relative to eating only the family meal.

Statistical results:

1) <u>For Children Not Yet Weaned</u>
   a) Children who take mother's milk plus a family meal weigh significantly more than children with other feeding practices.
   b) Children who take mother's milk plus a special meal weigh significantly less than children with other feeding practices.
   c) Taking mother's milk plus artificial milk has no significant impact on a child's weight.

These results are inconsistent with our hypothesis. Perhaps this is explained by the fact that the family

meal is more nutritious than we had expected or that the categories proposed are not sufficiently identified to determine quality of nutritional intake between special and family meal.

Using frequency of disease as an indicator of nutritional status, we found that:

a) Children who take mother's milk plus a family meal have a significantly greater frequency of disease.

b) Children taking a special meal along with mother's milk have a significantly lower frequency of disease.

c) Children taking artificial milk as well as mother's milk have a significantly lower

Using two different indicators of nutritional status lead to two different sets of conclusions. The lack of

precise definition of what constitutes a "special meal" or a "family meal" may have been the source of this confusion.

2) For Children Already Weaned

Using both weight and frequency of disease to measure nutritional status, we found no significant association with feeding practices - that is, taking a family meal or taking a special meal. These results do not mean that children already weaned are not malnourished. On the contrary, in the previous section we found a higher rate of malnutrition among children already weaned compared to children not yet weaned.

In conclusion, it seems clear that some other technique of measuring nutritional intake, whether by noting family food purchase or actually collecting and measuring food intake, is more appropriate for measuring the effect of feeding practices on nutritional status.

Hypothesis 4

Effect of Mother's Length of Stay in Kinshasa on Nutritional Status

It was hypothesized that mothers who had lived in Kinshasa longest would be more aware of correct nutritional practices, and, therefore, would provide meals which were of higher nutritional quality. Therefore, the longer the mother had been in Kinshasa, the heavier the offspring of the mother.

Statistical Results:

1) For Children Not Yet Weaned

The analysis indicates that the shorter the mother's stay in Kinshasa, the heavier her child. Further, there is no significant association between date of arrival in Kinshasa and frequency of disease.

2) For Children Already Weaned

The date of arrival of the mother in Kinshasa has no significant impact on the weight of the child, nor on frequency of disease.

One can conclude that length of stay in Kinshasa does not improve the knowledge or ability of the mother to properly nourish her children. In fact, length of stay in Kinshasa makes no difference at all, for the weaned child and results in a lower nutritional status for the unweaned child. The results for the unweaned child may imply better nutritional status of the rural child in Zaire since the children of mothers who have lived in Kinshasa for a longer time period weigh less than those just arriving. There are, however, many other variables which have not been considered which could go against this assumption. (For example, perhaps the type of woman migrating to the city is more educated and conscientious of her child's health and nutrition).

Hypothesis 5

Effect of Origin of Mother on Nutritional Status

The hypothesis was that the nutritional standing of children will differ according to the geographical origin of their mothers. This would result from differences in infant feeding practices, diet and other regional customs.

1) For children not yet weaned.

Children whose mothers originate from Angola weigh significantly less than other children. Children whose mothers originate from Haut-Zaire weigh significantly more than other children. There is no significant difference in the weight of children whose mothers originate from the other regions.

In terms of frequency of disease, children whose mothers originate from Kasai-Oriental have a significantly higher frequency of disease than other children. Children whose mothers originate from Bas-Zaire and Bandundu have a significantly lower frequency of disease. The results indicate that children whose mothers originate from Equateur and Angola, as well as Kasai Oriental, have a significantly higher frequency of disease than children from Kinshasa.

2) For children already weaned.

Children whose mothers originate from Angola weigh significantly less than children from Kinshasa, while children from Equateur weigh significantly more.

The results indicate that children whose mothers originate from Equateur, Kasai Occidental, Kasai Oriental, or Haut-Zaire have a significantly greater

frequency of disease than do children whose mothers originate from Kinshasa.

It would be interesting to look further at regional differences in feeding practices, and whether these practices are continued among people migrating to Kinshasa. The factors just discussed - length of stay in Kinshasa and origin of the mother - should be studied in more depth to help determine the reasons for their significant association with nutritional status.

Hypothesis 6

Impact of Nutrition Education on Nutritional Status

The hypothesis was that nutrition education makes the participant more aware of nutritional requirements. All other things equal, this greater awareness should lead to improved nutritional practice by the mother and hence improved nutritional status for the child. This hypothesis assumes that a Kinshasa mother attends a nutrition education course near the time of the child's birth or during the pre-school age period.

Statistical Results:

1) For Children Not Yet Weaned

There is no significant difference in weight between children whose mothers have taken the nutrition education course, and children whose mothers have not taken the course. Children whose mothers have taken the course, however, tend to have significantly fewer diseases than children whose mothers have not taken the course.

2) For Children Already Weaned

The results are identical to those for unweaned children. Having followed the nutrition course has no significant impact on the child's weight, but reduces significantly his or her frequency of disease. As a measure of the value of nutrition education courses, mothers were asked if they found the advice easy to put into practice. For both weaned and unweaned children, there is no significant difference in weight between children whose mothers have claimed to have profited by such courses and the weight of children whose mothers have either not claimed to have profited or have not taken such a course.

In sum, it would appear that the effect of the nutrition course is to reduce the frequency of disease of children who are not yet weaned. To the extent that frequency of disease is an indicator of nutritional status, the nutrition education reduced malnutrition among children who are not yet weaned. At the very least, such courses contribute to a reduction in disease.

Hypothesis 7

Effect of Age of Mother on Nutritional Status

Using age as an indicator of increased education/experience in child care, the hypothesis was that older mothers would provide better nutritional care to their children. That is, older mothers

would be more experienced and perhaps more conscientious than younger mothers.

Statistical Results:

1) For children not yet weaned.

The age of the mother has no significant impact on either the weight of the child or frequency of disease.

2) For children already weaned.

The weight of the child increases significantly as the age of the mother increases, consistent with the hypothesis. In addition, the frequency of disease declines significantly as the age of the mother increases, also consistent with the hypothesis.

Hypothesis 8

Effect of Income on Nutritional Status

The hypothesis was that as family income increased, more and better food would be purchased and nutritional status would increase. As mentioned, no information on income or expenditures was requested by the questionnaire. However, the questionnaire did identify zone of residence, and the household budget

survey of Kinshasa by J. Houyoux indicates that zones of residence can be identified by income. As previously stated, this measurement is extremely crude as there is certainly variation between expenditures within each zone.

Statistical Results:

1) For Children Not Yet Weaned

   The fact that a child comes from a zone where there is low consumption expenditure has no direct effect on the child's weight nor frequency of disease.

2) For Children Already Weaned

   The results were the same as for those children not yet weaned.

The above results for both weaned and unweaned children were inconsistent with the hypothesis. This is particularly interesting as Houyoux's data shows nutritional intake declining as income level declines. The results, however, may be spurious because we assumed that the income level of a child in this survey was the same as income level in the zones classified by Houyoux. To accurately assess the effects of income on nutritional status, we must look more closely at income and food consumption on the family and individual levels rather than just the data collected at the zone level.

APPENDIX - Methodology and Operations

The technique used in this survey was questionnaires which were designed by O.N.R.D., USAID and FOMECO. Initially, we wanted many more questions especially more anthropometric data; however, with a total of nine researchers and only limited time to train them, this was considered not feasible, and the questionnaire was reduced to two pages taking weight as the only anthropometric measure. The questionnaires were standardized in French although the researchers asked the questions in Lingala when interviewing the mothers. Madame Perrier, a nutrition advisor at O.N.R.D., worked with the researchers over a three day period on techniques of weighing children and posing the questions.

Each interview took approximately ten minutes including weighing of the child with this increasing if the mother had more than one child within the age span of six months and four years. Separate data sheets were then filled out for each child and stapled to the mother's questionnaire. As the mother and child would leave the vaccination line, every fifth was requested to come to the weighing and interview table. This procedure worked very well and the mothers were extremely receptive to being interviewed and having their child weighed. In fact, many were disappointed when not selected to come to the table and would wait to see if they could be interviewed.

The survey team was comprised of nine researchers, six from I.N.S. (National Institute of Statistics), one from C.E.R.E.N.A (Center for Food and Nutrition Research of Zaire) and two from FOMECO. They were divided into three teams of three each so that one person could weigh children and the other two conduct the interviews. The measles campaign consisted of twelve mobile teams which went to twelve centers each day. Each morning three of these centers were selected on an alternating basis for the three survey teams. For the most part, the centers were alternated each day in order to assure a representative sample of the city; however, for a certain period of time, survey efforts were concentrated on the Pont Kassavubu Clinic since an inordinately large number of mothers kept coming to this clinic. Examination of the questionnaires at the time showed that the mothers at Pont Kassavubu were coming from all zones in Kinshasa so this was not considered a bias to the survey.

O.N.R.D. provided seven of the researchers as well as the services of Madame Perrier, a nutrition advisor, who supervised the training and daily operations.

USAID supplied two vehicles, paper and reproduction of the questionnaires and miscellaneous local costs including two of the researchers' salaries and small premiums for the other researchers. CRS (Catholic Relief Services) supplied three scales and one of their nurses part-time to assist in the weighing.

The coding, programming and computer runs took place between September and November 1974. This was jointly organized by Wawa Sakrini, Director of the Division of Demographic and Social Statistics of I.N.S.; Bokemposila Ike Ofishe, Director of the Division of Economic Statistics of I.N.S.; Kinkela, Chief of the coding team (I.N.S.); Tambu Kisoki, economist and USAID contractor; Kevin Cleaver, economist and USAID contractor and Carol Adelman, USAID Assistant Program Officer.

The results were run on the Department of Finance IBM 1400 Computer using the SPSS computer program. The coding system used by I.N.S. was modified to fit the SPSS program.