931026.62
PNAAQ069
ISN-34733

TARGETING: A MEANS TO BETTER INTERVENTION

Submitted to:

United States Agency For
International Development

Targeting Guidance Project No. 938-0800 and No.939-0700
Under Contract Number IQC-PDC-0262-1-02-3097-00

by
Robert J. Timmons, Ph.D.
Roy I. Miller, Ph.D.
William D. Drake, Ph.D.

November 30, 1983

Community Systems Foundation
1130 Hill Street
Ann Arbor, Michigan 48104
(313) 761-1357

ACKNOWLEDGMENTS

This report was prepared by Robert J. Timmons, Roy I. Miller and William D. Drake of Community Systems Foundation. However, the initial framing and the subsequent development of the study benefited greatly from the timely feedback of several persons both within and outside the U.S. Agency for International Development. Most notable among these persons are Hope Sukin-Klauber and Judith Gilmore of the Bureau for Food For Peace and Voluntary Assistance, USAID, Eileen Kennedy of the International Food Policy Research Institute and Odin Knudsen of the World Bank.

EXECUTIVE SUMMARY

In the last decade, humanitarian goals have played an increasing role in shaping the American non-military foreign assistance program. During this time, the United States Congress issued a mandate to channel resources to the neediest segments of the populations of the poorest countries in the world. Confronted with a growing emphasis on humanitarian concerns, the United States Agency for International Development (USAID) has developed methods of selecting beneficiaries from large population groups, that is, methods of targeting.

This document is the product of a major effort to consolidate our knowledge of the complex issues which confound the selection of an appropriate targeting strategy for a nutrition intervention. The paper draws from the literature, from a quantitative analysis, and from a decade of experience in nutrition planning to identify the costs and benefits of various targeting schemes. Supplementary feeding programs are emphasized in our discussion, especially in relation to maternal and child health projects.

Three broad categories of targeting schemes encompass all specific targeting strategies: targeting based upon geographic locations, targeting based on socioeconomic conditions of the family, and targeting based upon the characteristics of the individual child. From over twenty specific targeting strategies, ten of the most widely used schemes were selected for intensive analysis.

Data on over eight thousand children participating in nutrition programs in five different countries were monitored over time. Nutritional status for each child was observed longitudinally. Each specific targeting strategy was tested on every child. Results of these runs were then classified by type of targeting strategy.

Data on program costs were gathered from case studies and other reports. Program costs were subdivided into broad categories and data from each case study were assigned to the appropriate category.

Regardless of which targeting strategy is selected and no matter how well the scheme is implemented, there is a surprisingly large percentage of children who are not included in the program but who should have been based upon their ensuing nutritional status. We call this an error of exclusion. Depending on the local conditions and the targeting strategy employed, this exclusion error can be as high as 20.1%.

Similarly, regardless of the targeting strategy, there

is a significant number of children included in the program who, in retrospect, probably did not need the services provided by the program. We call this an error of inclusion. Depending on the local conditions and targeting strategy employed, this inclusion error was as high as 84.1%.

Perhaps the most meaningful measure of any given targeting strategy is its error of exclusion (missed at-risk children) taken together with its error of inclusion (included children, not at-risk).

Results show that the most effective targeting strategy depends heavily on the amount of malnutrition in the population. When the amount (prevalence) is high, strategies which try to discriminate among families or among children within a particular community are less effective. On the other hand, when prevalence is low, the reverse is true.

Another critical determinant of the best targeting strategy is the amount of existing infrastructure in the region. If there is an ongoing program which is to receive supplementary feeding, targeting to individual children is more likely to be reasonable. The reason for this tendency is the relatively high cost of implementing a "stand-alone" targeting strategy.

Finally, the nature of the stated objectives of the local program, especially the relative emphasis between prevention and cure, influences the selection of the most appropriate targeting strategy. Use of anthropometrics is most appropriate for curative programs and child age is most appropriate for preventive programs. In neither instance is socioeconomic targeting within a community very helpful in isolating those preschoolers in need or at extreme risk of malnutrition from those who are more nutritionally well. Finally, in all cases, geographic targeting based on existing data and/or existing knowledge of a region is a useful first step.

Results of the cost analysis show that there is an extremely wide range of variation in relative cost within each category. For instance, commodity costs represent anywhere from 42 to 83 percent of the total program cost. Similarly, transportation, storage and handling costs can vary from 4 to 50 percent of the total (Table 3-9, page 55). Variation in cost is due in part to supplement distribution distance and size and method of feeding but perhaps more importantly to the amount of infrastructure available for distribution and local program operation. For instance, in some cases in Africa, transportation cost per ton-kilometer varies fivefold--between $.10 and $.49.

Two tables which enumerate program cost elements in general, and targeting strategy costs in particular, are provided to help program planners include all relevant costs (Table 3-1, page 50, and Table 3-10, page 57).

In order to embrace cost considerations, local conditions and the efficacy of different targeting strategies, twelve distinct scenarios were formulated. These scenarios encompass all possible situations which could be found in a country: high to low malnutrition prevalence, minimal to substantial logistical infrastructure and minimal to substantial on-site infrastructure. For each scenario, suggestions are made regarding the most appropriate targeting strategies (pages 60 through 68).

Beyond the aforementioned specific recommendations there are two universal recommendations which may have especially significant policy implications:

- It is perhaps self evident that the most appropriate and cost-effective strategy varies dramatically depending upon the stated program goals and objectives, the specific observed rate of malnutrition, the country, the state of existing logistical infrastructure, and the status of on-site infrastructure. It may therefore be quite inappropriate to have specific guidelines which do not respond to these local, context specific conditions.

- The second general implication which can be derived from this study is an outgrowth of the large exclusion errors which were observed in the analysis phase of the study. To define at-risk populations as only those which have already been identified as malnourished ignores the dynamic nature of conditions in the developing world. Rather, at-risk populations should include those young children who may not be malnourished but who, because of age and environmental conditions, have a high likelihood of becoming malnourished.

TABLE OF CONTENTS

ACKNOWLEDGMENTS i

EXECUTIVE SUMMARY ii

LIST OF TABLES vii

LIST OF FIGURES ix

LIST OF APPENDICES x

1 INTRODUCTION 1

1.1 DEFINITIONS 2

1.2 WHY TARGET? 6

1.3 TARGETING ISSUES 12

1.4 FRAMEWORK OF ASSESSMENT 18

2 ANALYSIS 26

2.1 IDENTIFICATION OF TARGETING STRATEGIES . 26

2.2 DESCRIPTION OF DATA SETS 30

2.2.1 Kottar (Kanyakumari, India) 30

2.2.2 Candelaria 31

2.2.3 Thailand 31

2.2.4 Esperança 32

2.2.5 Sri Lanka 33

2.3 ANALYSIS OF TARGETING STRATEGIES 34

2.3.1 Targeting Geographically 34

2.3.2 Targeting by Age Cohort 37

2.3.3 Targeting by Anthropometry 38

2.3.4 Targeting by Age and Anthropometry . 40

2.3.5 Targeting by Socioeconomic Indicators 42

2.3.6 Targeting by Village 45

2.3.7 Targeting by Weight Trend Criteria . 45

3 PROGRAM COSTS 48

3.1 FRAMEWORK 48

3.1.1 Perspectives on the Framework . . . 48

3.1.2 Recurring and Non-recurring Costs . 49

3.1.3 Fixed vs. Variable Costs 49

3.1.4 Marginal vs. Total Costs 50

3.2 COST ELEMENTS ASSOCIATED WITH IMPLEMENTING A TARGETED FEEDING PROGRAM 50

3.2.1 Commodity Costs 52

3.2.2 In-Country Processing, Storage and Shipping Costs 54

3.2.3 Local Field-Level Program Costs . . 55

4 TARGETING SCENARIOS 59

4.1.1 Prevalence 60

4.1.2 Logistical Infrastructure 60

4.1.3 On-Site Infrastructure 61

5 SUMMARY OF FINDINGS AND POLICY IMPLICATIONS 70

APPENDICES 73

BIBLIOGRAPHY 138

LIST OF TABLES

2-1 List of Targeting Strategies 27

2-2 Illustration of a Targeting Strategy as a 2x2 Contingency Table 29

2-3 List of Targeting Strategies and Their Orientations 35

2-4 Geographically Targeted Preschooler Populations: Errors of Inclusion and Exclusion 37

2-5 Preschooler Populations Targeted by Age Cohort: Errors of Inclusion and Exclusion . . 39

2-6 Preschooler Populations Targeted by Anthropometry (Weight-for-Age): Errors of Inclusion and Exclusion 41

2-7 Preschooler Populations Targeted by Age Cohort and Anthropometry (Weight-for-Age): Errors of Inclusion and Exclusion 42

2-8 Preschooler Populations Targeted by Socioeconomic At-Risk Indicators: Errors of Inclusion and Exclusion 44

2-9 Preschooler Population Targeted by Village Selection in the Kottar Data Set: Errors of Inclusion and Exclusion 46

2-10 Preschooler Populations Targeted by Weight Trend Criteria in the Kottar Data Set: Errors of Inclusion and Exclusion 47

3-1 Enumeration of Cost Elements Associated with Implementation of a Targeted Feeding Program . 51

3-2 Estimated Costs of Feeding Programs 53

3-9 Range in Costs by Category Expressed as a Percentage of Total Reported Costs (Take-Home Programs Only) 56

3-10 Cost Elements Associated with the Implementation of a Socioeconomic or Anthropometric Targeting Scheme 58

3-3 Project Poshak Take-Home Program - Early Stage 132

3-4 Project Poshak Take-Home Program - Later Stage 133

3-5 Sri Lanka - Maternal and Child Health Program Utilizing Thriposha 134

3-6 India - Maternal and Child Health - ICDS Program as Implemented 135

3-7 India - Maternal and Child Health - Joint ICDS-USAID as Proposed 136

3-8 Project Poshak On-Site Program - Later Stage . 137

LIST OF FIGURES

1-1 Conceptual Representation of Definitions . . . 4

1-2 Targeting in the Design Process 9

LIST OF APPENDICES

APPENDIX A.	Detailed Description of Data Sets	73
APPENDIX B.	Targeting Strategies for Kottar .	88
APPENDIX C.	Targeting Strategies for Candelaria	99
APPENDIX D.	Targeting Strategies for Thailand	107
APPENDIX E.	Targeting Strategies for Esperança	115
APPENDIX F.	Targeting Strategies for Sri Lanka	123
APPENDIX G.	Cost Tables	131

1 INTRODUCTION

In the last decade, humanitarian goals have played an increasing role in shaping the American non-military foreign assistance program. During this time, the United States Congress issued a mandate to channel resources to the neediest segments of the populations of the poorest countries in the world. Confronted with a growing emphasis on humanitarian concerns, the United States Agency for International Development (USAID) has developed methods of selecting beneficiaries from large population groups, that is, methods of targeting.

This document is the product of a major effort to consolidate our knowledge of the complex issues which confound the selection of an appropriate targeting strategy for a nutrition intervention. To the extent possible, some of those issues are examined empirically using data featuring longitudinal observations of preschool children in the developing world.[1] Our intention is to draw from the literature, from a quantitative analysis, and from a decade of experience in nutrition planning to identify the costs and benefits of various targeting schemes. We will emphasize supplementary feeding programs in our discussion because of the central role played by these programs in alleviating widespread malnutrition; however, we will consider the role of feeding in integrated nutrition interventions whenever possible.

Our use of the expression "widespread malnutrition" is indicative of the phenomenon generally called protein-energy deficiency. This form of malnutrition has a complex etiology which manifests itself most overtly in the

---

[1]The data is drawn largely from a nutrition data based management system maintained by Community Systems Foundation. That system contains data drawn from approximately twelve nutrition interventions from all over the world.

retardation of growth and development, especially in young children. There are other, more specific, nutritional disorders, for example, vitamin A deficiency which leads to blindness, or iodine deficiency which results in goiter. In the balance of this report, the term malnutrition refers to the more general condition of widespread nutritional deprivation--called protein-energy malnutrition.

From the outset, let us emphasize one of our major findings:

> Ultimately, the costs and benefits of any given targeting strategy must be estimated in the context of a particular intervention in a specific country. General propositions regarding a given strategy are useful as guidelines for assessing the costs and benefits in specific situations; however, due to varying levels of infrastructure, differing political climates, and diverse cultures across countries, each situation calling for targeting must be reviewed on its own merits.

Because of our strong feelings regarding this major finding, much of what follows is directed to establishing the framework for a comparative analysis of targeting strategies. We will not and, we believe, we could not identify the ultimate targeting strategy for universal application. Rather, we offer general propositions regarding a process for arriving at an appropriate targeting scheme.

1.1 DEFINITIONS

In discussion of any given problem in the social sciences, terms are drawn from the language we use everyday but they are given rather specific meaning in the context of that particular problem. Regarding the allocation of scarce resources to needy individuals, the terms used are common to the social welfare community. To avoid confusion, we define several of those terms here.

COMMUNITY POPULATION--The community population consists of all persons residing in a well-defined political unit.

In the context of a nutrition aid program, the community is often the country as a whole.

RISK POPULATION--The risk population is a subset of the community population perceived to have some special need or problem. In the nutrition field, the "at-risk" group is often taken to be some subset of the population known to be suffering from protein-energy malnutrition or a more narrowly defined nutritional deficiency (such as vitamin A deficiency which leads to blindness). With regard to pervasive undernutrition, the risk population is generally taken to be preschool children and pregnant and/or lactating mothers.

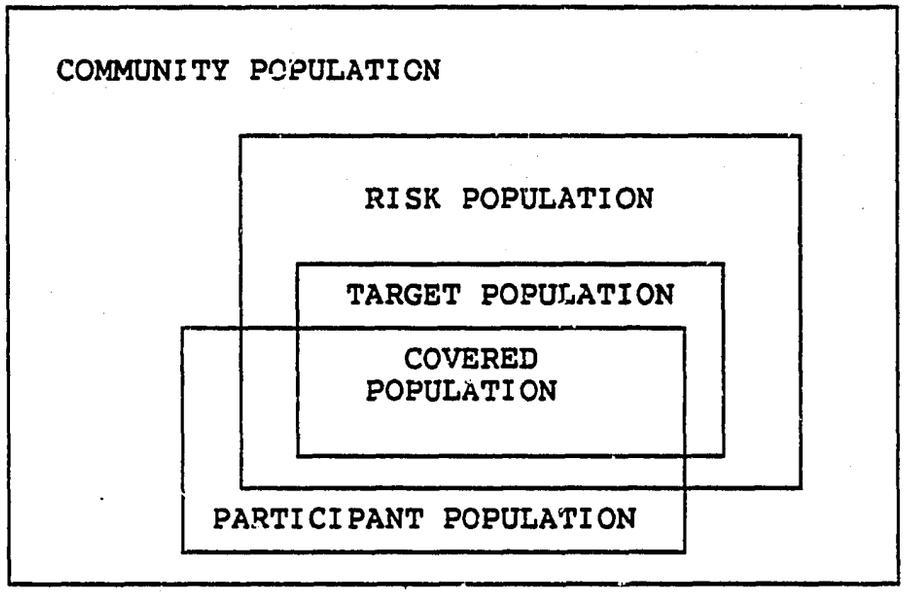
TARGET POPULATION--The target population is a subset of the risk population (it might, in some cases, be the whole risk population) designated as eligible for services by the governmental agency administering the program. Regarding nutrition, eligibility criteria are often established based on various primary indicators of current nutritional status or secondary indicators purported to predict future nutritional status.

PARTICIPANT POPULATION--The participant population consists of the people who actually receive the services. In the nutrition field, this group is often called the beneficiary population under the assumption that the receipt of service leads invariably to benefit.

It should be clear that, in reality, there are often members of the participant population who are in neither the target or risk populations, because of errors in the selection process. Except in the rarest of cases, the participant population is smaller than the target population due to the scarcity of resources and the difficulties inherent in trying to reach everyone in a designated group. Figure 1-1 illustrates the relationship between these four populations.

FIGURE 1-1

CONCEPTUAL REPRESENTATION OF DEFINITIONS



In the nutrition field, there is nearly unanimous accord as to the proper definition of the risk population. Preschool children are generally believed to be the group most susceptible to the harmful effects of malnutrition, especially death and developmental retardation.

> The four or six- to thirty-six-month period is particularly critical because this is the age at which permanent nutritional stunting most often occurs and the age at which the combined result of inadequate feeding of solid foods and frequent episodes of infection is high mortality rates.[2]

Because there is a relationship between the nutritional well-being of infants and maternal nutrition, both during pregnancy and while breast feeding, pregnant and lactating mothers are often included in the risk population. They may

---

[2]James E. Austin and Marian F. Zeitlin, eds., Nutrition Intervention in Developing Countries: An Overview (Cambridge, Mass.: Oelgeschlager, Gunn & Hain, Publishers, Inc., 1981), p. 28.

also be included because of their increased potential for nutritional deterioration during such times.

For the sake of clarity, let us reiterate the causal sequence of events that so often leads to severe retardation in the growth and development of the young, events that, in the extreme, lead to death. (We offer but one reference to the literature pertaining to each of the posited relationships; a complete bibliography of relevant literature is attached.)

1) Undernutrition in the pregnant mother, a woman who may herself be overly slight or frail due to a history of poor health and undernutrition, is likely to lead to the delivery of low birth-weight babies.[3]

2) Low birth-weight babies fail to develop properly more frequently than do normal newborns.[4]

3) Undernutrition in the lactating mother may lead to an insufficiency of breast milk (a decrease in milk quality may also exist for more seriously malnourished lactating mothers) which further exacerbates malnutrition in the infant. (Of course, low birth-weight babies are more adversely affected by inadequate food intake because they have fewer reserves.)

4) The lack of adequate weaning foods and/or poor practice regarding the timing of weaning and frequency of feeding continue to keep the child in an undernourished state.[5]

5) As the child becomes more mobile and is exposed to more disease causing agents, infectious disease,

---

[3]Aaron Lechtig, et. al, "Maternal Nutrition and Fetal Growth in Developing Societies," American Journal of Diseases of Children, Vol. 129, No. 4 (1975).

[4]Jean-Pierre Habicht, Charles Yarbrough, Aaron Lechtig and Robert E. Klein, "Relationships of Birthweight, Maternal Nutrition and Infant Mortality, Nutrition Reports International, Vol. 7, No. 5 (1973).

[5]J. C. Waterlow, "Observations on the Suckling's Dilemma--A Personal View," Journal of Human Nutrition, Vol. 35, No. 2 (1981).

especially diarrhea, becomes likely. Infectious disease has a synergistic relationship with poor nutrition--the one feeds on the other, often leading to death.[4]

One further term, one which has taken on a variety of definitions in discussions of targeting, is "coverage". Multiple definitions result from distinguishing between the target population and the risk population, or choosing not to make the distinction. We choose to define "coverage" as follows.

> COVERAGE--Coverage is the percentage of the target population captured in the client population.

If our target population is 100,000 people (out of a risk population of 1,000,000), and we serve 50,000 people--only 40,000 of whom are in the target--our coverage is 40%. Coverage, in this case, is not 4% (40,000 out of 1,000,000). The confusion arises because too many program evaluators fail to differentiate the risk and the target populations. One often hears the criticism that a particular program is only serving 10% of the total preschool population. This may be an unfair statement if the total resources available to the program are sufficient to serve only a fraction of that total preschool population and an a priori decision was made to focus those limited resources on that group most at risk.

1.2 WHY TARGET?

There is a simple and obvious answer to the question, "Why target?" In the real world of scarce resources, it is necessary to direct those resources to those who most need

---

[4]Nevin S. Scrimshaw, Carl E. Taylor and John E Gordon, Interactions of Nutrition and Infection, WHO Monograph Series No. 57 (Geneva, Switzerland: World Health Organization, 1968).

them and/or[7] those who can most benefit from them. It is almost trivial to point out that any major effort to alleviate problems of malnutrition is destined to fail if those susceptible to malnutrition are not the target of that major effort. The only conceivable argument to contradict such a statement is that malnutrition can be eliminated only through general economic development in an atmosphere conducive to equitable distribution of wealth. In general, we agree that development and equitable income distribution hold the ultimate keys to the elimination of malnutrition; however, we recognize that this is the long term solution, one requiring decades. In the interim, a great deal can be done to alleviate the worst effects of malnutrition but only if the effort to do so is properly targeted.

There are some secondary, more subtle, reasons for introducing rational targeting strategies into nutrition intervention. To a large degree, these reasons reflect the checkered history of nutrition intervention. This is especially true for P.L. 480 supplementary feeding programs. Many of these were introduced at a time when program objectives were established which did not reflect the full cost of gifted commodities. Also, some programs were introduced to support United States foreign policy objectives rather than objectives focused strictly upon the welfare of the intended beneficiaries.[8] The introduction

---

[7]The use of "and/or" is a reminder that those most in need of help are not always those who can most benefit from a given set of services. This is especially true regarding supplementary feeding. Food supplements, in the absence of diarrheal disease control, may be of greatest benefit as a preventive measure for the moderately malnourished. However, in situations where diarrhea is rampant, the supplements may be ineffective when administered to the most seriously ill due to the absence of an effective program to arrest and prevent diarrheal disease.

[8]For a well-documented history of P.L. 480, see Mitchel B. Wallerstein, Food for War--Food for Peace: United

of targeting into such programs is one device to restructure them to conform more closely to nutritional objectives.

To understand this secondary need for targeting, it is necessary to place targeting in the broader context of overall program design. Targeting is one of a series of interrelated design elements making up a nutrition intervention. Modification of the targeting scheme for an ongoing intervention is tantamount to a complete redesign. Placing targeting at the forefront of the design of a new program virtually assures fair consideration of nutritional objectives.

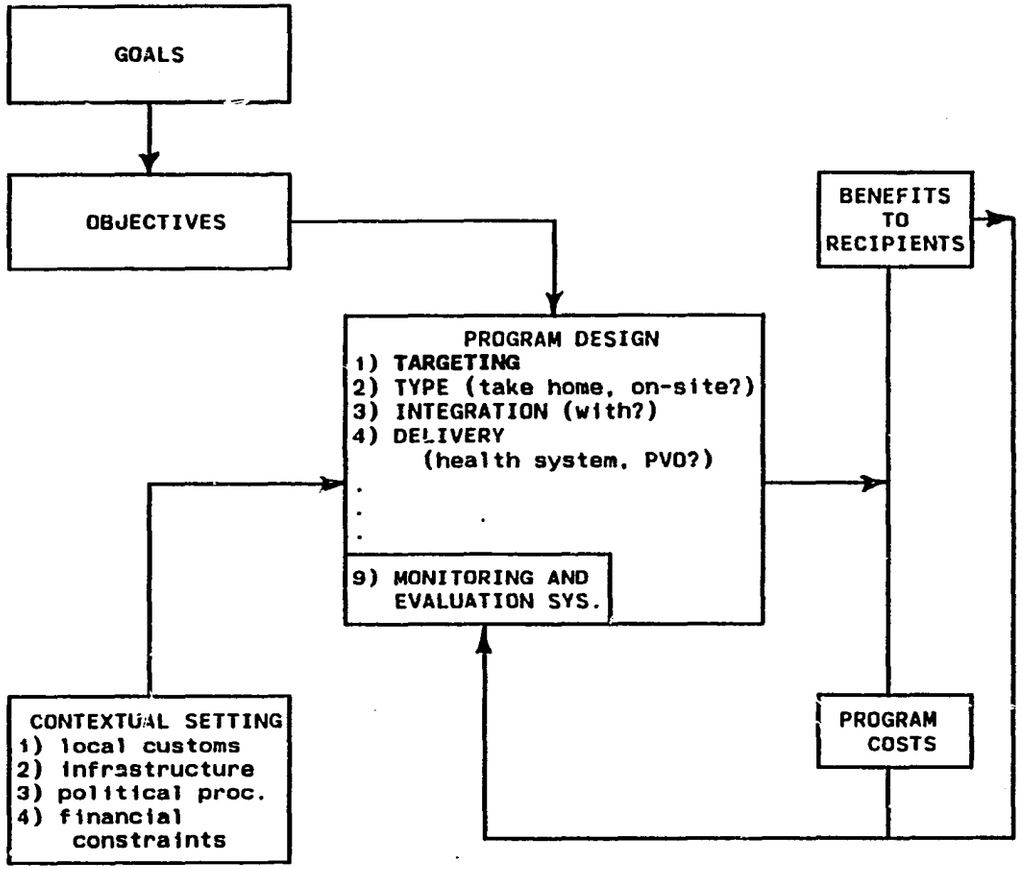
Figure 1-2 is a pictorial representation of the intervention design process. Targeting is shown to be one of a series of program design elements, elements which are so interconnected that modification of any one element requires modification of the others.

Let us consider some of the implications of Figure 1-2 in more detail because the figure explains not only the reasons for targeting but also helps set the stage for some of our subsequent discussions. The design process is "driven" by the broad goals and more specific operational objectives of the intervention. We emphasize the need to consider the operational objectives explicitly in the design process because most nutrition interventions share the same broad goals: a) to reduce infant mortality, b) to improve the nutritional well-being of preschool children, and c) to enhance the nutritional status of pregnant and lactating mothers. The number of ways of achieving these goals is substantial and it is only in the expression of more limited specific objectives that program designers can select their program elements.

States Food Aid in a Global Context (Cambridge, Mass.: M.I.T. Press, 1980).

FIGURE 1-2

TARGETING IN THE DESIGN PROCESS



The objectives relative to cure and prevention of malnutrition are of particular relevance in the selection of a targeting strategy. Beaton and Ghassemi, in their review of supplementary feeding programs, echo the conventional wisdom that targeted populations reflect the true objective(s) of the program.[9] For example, the goals of rehabilitating severely malnourished children in a community and lowering the incidence of malnutrition of children in the same community should lead to programs with decidedly different target populations; participants in the former would be limited to malnourished children, whereas in the latter, a broader definition of "at-risk" would lead to the inclusion of a much larger group. Howard Barnum et al. point out that unless the program is strictly curative in nature, the appropriate target population is not obvious.[10] By introducing a program objective which lays claim to prevention or by introducing both program objectives, the target population is expanded because of the complexities of cause/effect formulation (e.g., low birth-weight, preschoolers' age, and a variety of household socioeconomic indicators are often suggested as predictors of malnutrition in young children).

In addition to goals and objectives, program design, and especially, targeting strategies, should reflect a broad range of additional contextual factors. These include, first and foremost, local customs. Such cultural traits as propensity to share or sequence of intra-family feeding should influence the selection of a targeting strategy. Similarly, the targeting scheme must be consistent with the

---

[9]George Beaton and Hossein Ghassemi, "Supplementary Feeding Programs for Young Children in Developing Countries," American Journal of Clinical Nutrition, Vol. 35, No. 4 (April, 1982), Supplement, p. 911.

[10]Howard Barnum et al., A Resource Allocation Model for Child Survival (Cambridge, Mass.: Oelgeschlager, Gunn and Hain, 1980).

level of infrastructure in an area. Schemes requiring frequent visits from health system personnel in areas with few roads, fewer vehicles and an inability to garner the resources to alleviate those shortages should be rejected. Also, the targeting strategy must be conceived within the political context--local and national--and within the financial constraints of most intervention work. If the local political organization is opposed to directing resources to only a subset of its constituency, targeting to individuals and/or families may be infeasible.

Figure 1-2 emphasizes that targeting is only one of many design elements which reflect goals, objectives and the contextual setting. These elements are interrelated and should be defined jointly. For example, the targeting strategy is intricately related to the type of program. A program calling for on-site feeding could take advantage of the gathering of the beneficiaries to mount a continuous screening program, for example, anthropometric screening calling for monthly weighings. By contrast, a take-home feeding program which requires a special effort to bring a scale to each participant should probably rely on a less frequent weighing scheme or, perhaps, dispense with anthropometry altogether. Similar arguments could be presented which relate the targeting strategy to other design elements. For example, if the health system is involved, health status could be used as a criterion for participation; otherwise, such a criterion might be infeasible.

In summary, due to the central role played by targeting in the overall design of an intervention, concentration on the targeting strategy by program designers proves to be an effective link to program design, to operational objectives, and broader goals.

1.3 TARGETING ISSUES

We now focus on some of the specific issues associated with targeting in the realm of nutrition intervention.

1.3.1 THE LEVEL AT WHICH TO TARGET

Three fundamental targeting strategies are regularly employed, singly or in combination, in nutrition programming:

1) geographic targeting
2) targeting to families
3) targeting to individuals

1) Geographic targeting - In fact, all nutrition programs are geographically targeted, although the selection of service area boundaries is not always based on nutritional criteria. Frequently, non-nutritional concerns (see the next section on political and other constraints) dominate in the designation of broad service areas (regions, provinces, states, etc.), and nutritional concerns govern the selection of specific villages within these broadly defined service areas.

This latter selection can take two forms, depending on the availability of data and/or the willingness of program designers to commit resources to the generation of data. The first form is the use of nutritional survey data to identify those villages with the highest prevalence of malnutrition.'' In the absence of specific nutrition data, indicators of economic well-being can be substituted. This

---

''Malnutrition in a preschool child is usually defined as a deficient weight-for-age score relative to the norm. (A weight-for-age score is the ratio of the weight of a given child to the standard weight for children of his/her age.) The prevalence of malnutrition is then defined as the percentage of all preschoolers with scores below a designated level. (The now famous Gomez classification is applied in almost all cases to define that level.) Other anthropometric measurements are occasionally used in a similar fashion; however, weight-for-age is, by far, the most popular.

assumes a high correlation between economic well-being and nutritional status--an assumption that is generally reasonable but rarely completely valid.

2) Targeting to Families - Empirical studies have demonstrated a relationship between malnutrition and various family characteristics. These include: family size, socio-economic status (especially the education of the mother), child spacing within the family, and a history of poor nutrition in any of the family members. One targeting strategy is to select families for inclusion into the program based on some subset of these family characteristics. This strategy is applied in combination with a geographic targeting scheme; that is, families are queried only within well-defined geographic boundaries and are admitted or rejected from the program on the basis of their socioeconomic status.

3) Targeting to Individuals - With the ever increasing use of weighing as a fundamental component in intervention design, often for educational purposes as well as individual diagnosis, targeting at the level of the individual on the basis of personal nutritional status has gained favor. In programs of a curative nature, current nutritional status is the obvious factor on which to target. In preventive programs, the role of direct measures of nutritional status is less obvious; however, changes in status over time (or even failure to gain weight) has been used to identify individuals who need help to prevent further deterioration.

These last two strategies, targeting to individuals or to families, require periodic measurement of the factors used in the targeting scheme, even in groups initially rejected from the program. Otherwise, individuals or families excluded from the program at one point in time may well experience changes in their personal lives which would enable them to qualify for services at some later time. (Similarly, qualifying families or individuals may cease to

meet the requirements over time, especially if the program is having the desired effect.) This is particularly relevant in the use of anthropometric measurements of nutritional status such as weight-for-age. It is now well known that preschoolers tend to move into and out of states of malnutrition, often in a predictable manner related to age. (Steady nutritional deterioration from birth until the age of twenty-four months is a common phenomenon among children in harsh environments. After attaining the age of two, some children develop coping mechanisms which enable them not only to survive but to regain a measure of their nutritional well-being.) A consequence of this phenomenon is that, within a village, a targeting rule based on anthropometrics will exclude some individuals who would come to qualify for the program after relatively little time had elapsed.

A relevant argument for <u>not</u> targeting to individuals or families within a village emerges from this recognition that both individuals and families are constantly changing. The argument runs as follows:

> The prevalence rate of malnutrition in a village at a point in time is indicative of the potential of every individual in that village becoming malnourished within some reasonably short period of time. A high enough prevalence rate would indicate the need to serve every individual in the village because, at some point in time, just about everyone would experience sustained periods of nutritional deficiency.

We might call this the "tip of the iceberg" argument because it interprets the prevalence rate as a measure of the size of the underlying problem in the entire community. For a prevalence rate far less than 100%, that underlying problem becomes large enough to merit treating everyone.

We will consider this argument again after presenting our quantitative analysis of various targeting strategies. At that time, we will return to the question of the

appropriate level at which to target--the village, the family or the individual.

1.3.2 DEALING WITH CONSTRAINTS ON TARGETING

In practice, there are often very real and very important constraints which restrict the flexibility of the program designer in conceptualizing a targeting scheme. We will consider four such constraints:

1) political and cultural constraints
2) logistical constraints
3) technical constraints
4) budget sequence constraints

1) Political and Cultural Constraints - Politically, it is often unpopular to eliminate some segment of the population from receiving a desirable service. Government officials, with their broad view of society's needs and wants, find it untenable at times to restrict their constituents' accessibility to public programs. One might argue that this should not be the case--but it is and it must be accommodated in the design of a targeting scheme.

More important than the politicians' view is the view of the citizenry themselves. The receptivity of a community as a whole to a package of services may be adversely affected by a targeting scheme. For example, in a village where families receive assistance (such as a food supplement) on the basis of some index of poverty, receipt of the assistance may be perceived as a "stigma" to the poor and, therefore, something to be avoided. Also, if the targeting scheme requires an effort on the part of the family (for example, the bringing of a preschooler to a clinic once a month to be weighed), some families will choose not to participate because there is some likelihood that the effort will be too expensive.

2) Logistical Constraints - In the developing world, transportation systems, communications systems and facilities for storing perishable supplies (sera, food,

etc.) may be limited. The capacity of the infrastructure serves to constrain options for targeting, especially geographic targeting. Unfortunately, many of the poorest and least educated people, those most prone to nutritional problems, live in the most remote, least accessible regions.

In addition to the constraints due to limitations on the physical infrastructure, there are very real manpower issues which impinge not only on targeting but on the entire intervention design. In rural settings, it is difficult to maintain a highly skilled staff in the field charged with the implementation of an intervention. Skilled medical people, even highly trained nurses, sometimes reject plans which call for their taking up residency outside the major urban centers. As a result, targeting rules as well as service delivery schemes are often framed to work well with the available labor.

3) Technical Constraints - Finally, there are problems in measuring the factors that should theoretically be included in the construction of targeting schemes. Direct measures of nutritional status, even the more commonly used anthropometric measures, are difficult to assess in field settings. Scales break or become inaccurate with repeated use, height measurement is notoriously inaccurate, and, in many cultures, age is not recorded precisely for young children. More importantly, the scores themselves have known imperfections which will lead to an incorrect determination of the nutritional status of some individuals which, in turn, may well lead to the exclusion of some individuals who should qualify for services under the targeting rule or the inclusion of some who do not qualify.

In many settings, secondary measures used to anticipate nutritional deprivation are equally difficult to utilize correctly. For example, "income" in a predominantly subsistence economy is an undefinable concept. Even such apparently straightforward concepts as "birth order" are

often interpreted inconsistently in field settings--some people naturally restrict themselves to counting live children in assessing birth order while others include all births.

4) Budget Sequence Constraints - Due to the need for governments to plan far ahead in making budgetary allocations to given projects, aspects of program operation which should be left free to vary in a well-targeted program become prematurely fixed. (Note, governments include that of the United States and government agencies, especially USAID.) A targeting scheme in which the number of participants is allowed to vary from week to week or month to month is inconsistent with a budgetary scheme that allocates a fixed quantity of any critical program input months or even years ahead.[12]

In summary, one should not conceptualize a targeting scheme solely on the basis of the theoretical ideal. That scheme which best supports the specific objectives of a given program may, in practice, be unworkable. Any targeting scheme should be evaluated in the reality of the environment in which it will operate:

a) Is the scheme introduced at the optimal level of the societal structure?

b) Is it politically feasible with the the host government?

c) Is it culturally acceptable to the local citizenry?

d) Can the logistical constraints be overcome?

---

[12]Historically, this has given rise to targeting schemes like that used in parts of India in 1981 in connection with P.L. 480 Title II supplementary feeding. A fixed number of children were included in the program for each village selected--independent of any estimate of need in those villages. The number of villages was also fixed; therefore, the quantities of food commodities needed were known well in advance.

e) Are the data to be used easily generated in an accurate fashion?

1.4 FRAMEWORK OF ASSESSMENT

The selection of an appropriate targeting scheme in a given context can best be resolved through an assessment of the costs and benefits of the feasible alternatives (those that meet the political, cultural, logistical and technical constraints). The difficulties inherent in attempting cost/benefit analyses of social programs are well known.[13] Still, the concept of comparing costs and benefits of alternative approaches to solving any problem remains the best avenue to rational decision making. As long as the analyst and policy maker retain an awareness of the limitations of the methodology and view it as a tool rather than as an answer, cost/benefit analysis continues to be a useful and worthwhile undertaking.

The analysis of the costs and benefits of targeting is especially complex. Techniques which might work well in assessing other program components are inappropriate for targeting. For most components of a nutrition intervention, there is a "dose-response" relationship which can be used to estimate the benefit accruing to the individual if given some amount of treatment. (For example, weight gain as a function of caloric intake might be used to estimate the benefit derived by an individual through a supplementary feeding program.) <u>However, targeting, per se, does not alter the response of a given individual to the package of services.</u> An individual, once in the program, receives the identical package of services whatever the screening mechanism which admitted him/her into the program. Targeting is incidental to the individual recipient; however, because the composition of the entire particpant

---

[13]Peter H. Rossi and Howard E. Freeman, <u>Evaluation: A Systematic Approach</u> (Beverly Hills, California: Sage Publications, Inc. 1982).

group does change in repsonse to targeting, it is far from incidental to the program designer. If that change in composition leads to the inclusion of a higher percentage of individuals likely to respond to the given package of services, the aggregate response of the participant population may improve. If, in response to the introduction of a more restrictive targeting policy, no new participants are found to replace those newly excluded, there can be no benefit due to targeting save the reduction of costs. If new participants are sought to replace those eliminated, the aggregate benefit might be estimated using the hypothesized dose-response relationships for those individuals but costs must also be reestimated to include the expense of finding and serving those new participants.

Similarly, the costs of targeting are inordinately difficult to assess. While there may be some direct costs or failure to take advantage of alternative uses of the health workers' time associated with a given targeting strategy (costs for scales, growth charts, survey forms, computer analysis, etc.), the more important costs are non-monetary, especially, the loss of benefits associated with denying services to an individual who may need them. Placing a value on such exclusionary practice is virtually impossible. We have already alluded to the potential political costs of targeting in our discussion of constraints, especially the loss of support from the community due to the denial of services to some of its members. These too are virtually impossible to quantify. Finally, there are indirect costs of targeting--the costs due to losses of the economies of scale associated with non-targeted programs. One such cost, for example, is the added cost required to move commodities or supplies over a larger physical area to reach a predetermined number of

beneficiaries. Another is the cost of needing more workers in more villages to reach the same number of people.[14]

1.4.1 A MORE DETAILED DEFINITION OF BENEFITS

The single most important benefit derived by targeting is the aggregate improvement in the population as a whole due to the inclusion of a higher proportion of the "right" people in the participant population. However, in a comparative analysis of targeting strategies, one must consider how well the alternatives identify the "right" people. Various strategies define "right" in different ways; therefore, depending on the concept of "right" held by the implementors of the program, there are substantial differences in benefits accruing from alternative targeting strategies.

1) The Curative-Preventive Dilemma - Nutrition intervenors are forever grappling with the curative-preventive dilemma--the setting of priorities regarding the cure of malnourished children as opposed to the prevention of further erosion of nutritional well-being in those most susceptible to disease. Curative programs require targeting rules that identify the current set of malnourished individuals, while preventive programs need rules to identify those individuals most likely to become malnourished. The former, though difficult, is easier than the latter. (While it is possible to conceive of program designs that support both curative and preventive objectives--those which provide differential treatment depending on the seriousness of the illness--such programs are rare. Most common are programs where the treatment offered is more suited to prevention than cure. Many

---

[14]Once again, as we noted in the preceding paragraph, such costs are a function of the response of program designers to the discretionary resources which become available because of more restrictive targeting.

achieve curative objectives through a referral system to the formal health system.)

Anthropometric targeting appears to be best suited to programs with a curative emphasis, while socioeconomic targeting, including the pregnancy history of mothers and the growth performance of siblings, appears to be best suited to programs stressing prevention. Anthropometrics can be used to categorize current nutritional status, whereas socio-economics, in theory, can predict problems before they arise and can provide useful indicators, at least in heterogeneous environments.

The selection of the appropriate anthropometric measurement for defining the current nutritional status of preschoolers is a subject of debate. Weight-for-height is the acknowledged indicator of current nutritional status (acute malnutrition); however, at any time relatively few individuals in a population with widespread nutritional problems show up as deficient in weight-for-height. Those few who do quickly become stunted (deficient in height-for-age) and, upon even the slightest recovery, return to normal in weight-for-height, the damage already perpetrated. The indicator weight-for-age is most frequently used because it is the composite measure which shows up deficiencies due to current and/or past nutritional deprivation. In our view, weight-for-age is the best anthropometric measurement for use in identifying individuals who need curative treatment not only because it is a composite measurement but also because of the consequences of inaccurate height readings on the other anthropometric ratios. (The range of values assumed by weight-for-height or height-for-age scores is generally quite narrow, certainly more narrow than for weight-for-age; therefore, small errors in measuring height have far reaching consequences on the correctness of those two scores.)

Similarly, the selection of socioeconomic indicators of future nutritional status is a subject of debate. The predictive power of the traditionally used factors--income, mother's education, family size, etc.--is not good enough to support the withholding of program services from potential participants.

2) Auxiliary Benefits to Targeting - The mere existence of a targeting scheme may have ancillary positive effects on a nutrition program. The perception in a community of the purposes of intervention can be enhanced or modified through targeting. This, in turn, can bolster a nutrition education component by focusing attention on the underlying problem. (The undifferentiated distribution of food commodities might be perceived as politically motivated; the introduction of targeting on nutritional grounds reinforces the knowledge of the existence of a nutrition problem and the need to act in order to alleviate that problem.) The more a targeting scheme emphasizes the nutritional problem, the more it will support educational objectives.

Similarly, some targeting strategies force contact between a preschooler or a pregnant/lactating mother and a health professional. In most untargeted take-home feeding programs, any member of the family can go to the distribution center to pick up the food. In a targeted program, where the presence of the preschooler or mother is a prerequisite for receiving the food due to the need to qualify (for example, in a strategy based on anthropometrics), a liaison between a health professional and the targeted individuals is automatically arranged.

1.4.2 A MORE DETAILED DEFINITION OF COSTS

We have already noted two primary costs associated with the general notion of targeting:

a) the exclusion of some needy individuals due to the imposition of targeting rules, and

b) the direct monetary costs associated with the implementation of the targeting scheme, including the cost of extending benefits to those who do not need food aid.

The magnitude of the "cost" of excluding some individuals is related to the objectives of the program designers. The magnitude of the monetary cost of targeting is dependent largely on the infrastructure in the designated program area and the mesh between targeting activities and related program inputs. In comparing specific targeting schemes in a contextual analysis, other cost factors serve to differentiate alternative possibilities.

1) Timing and the Curative-Preventive Dilemma - The timing of service delivery is, in many cases, associated with the response to treatment. If administered early during the onset of nutritional decline in preschoolers, supplementary feeding may reverse unfavorable trends. However, the same supplement may prove to be ineffective in reversing the decline if malnutrition is well advanced and/ or there are complications due to the presence of infectious disease. Of course, the likelihood of such complications is, itself, a function of the nutritional state of the individual. Similarly, early dietary supplementation for pregnant women may give adequate time for the necessary caloric boost over the duration of the pregnancy. This relationship between timing and response suggests that the costs of alternative strategies may vary with the location of the program objectives on the curative-preventive continuum.

2) Auxiliary Costs to Targeting - One subtle cost associated with some targeting schemes is the diversion of field staff from other service oriented activities to support the necessary data collection and analysis for the implementation of the targeting rules. When children are weighed, en masse, at a health center, the staff can become overburdened with the weighing activity and be unable to

pause and assist mothers and children with their unique, personal problems. Similarly, the collection of socio-economic data might detract from the service delivery function performed by the field staff. (If additional staff are hired, that represents a cost.) Clearly, periodicity of data collection is related to the degree of diversion--the more frequent the data collection activity, the greater the diversion.

A second cost associated with some targeting schemes is the loss of otherwise qualifiable participants due to their unwillingness or inability to participate in the screening procedure. If the weighing of a preschooler is a prerequisite for inclusion in a program, quite often the sickest children are excluded merely because they cannot attend the weighing sessions.

1.4.3 INCLUSION AND EXCLUSION ERRORS--DEFINED

In our view, the most important concept in the assessment of targeting strategies is the fact that any strategy excludes some needy potential participants and includes some individuals who would fare quite well in the absence of intervention. Because of their overwhelming importance, let us formally define the errors which give rise to this concept.

a) Exclusion Error - The rate at which needy individuals are barred from a program due to a flaw in the targeting scheme.

b) Inclusion Error - The rate at which individuals without need are included in a program due to a flaw in the targeting scheme.

The best targeting scheme is the one that, given the explicit objectives of the program, excludes the fewest needy individuals while including the fewest number of non-needy individuals. Unfortunately, as we shall see in the next chapter, most targeting strategies with a small exclusion have a large inclusion error and vice versa. In

theory, one should be able to find an optimal strategy which simultaneously holds both errors to relative minimums. In practice, no such strategy exists. (In a sense, these errors behave much like Type I and Type II errors in statistics--if one is kept to a minimum, it is at the expense of the other.)

The availability of longitudinal data from assorted nutrition interventions around the world offers a unique opportunity to explore the exclusion and inclusion errors for a variety of targeting strategies in different cultural settings and in areas with different underlying prevalences of malnutrition.

2 ANALYSIS

2.1 IDENTIFICATION OF TARGETING STRATEGIES

From the three fundamental targeting strategies introduced in Section 1, namely, targeting geographically, targeting to families, and targeting to individuals, we can make operational a variety of strategies, plausible in the field, which permit us to clearly identify inclusion and exclusion errors and probe the broader issue of program cost effectiveness in the context of targeting. To do so (see Table 2-1), we select strategies that restrict targeting only to all at-risk individuals in a program's service area or to all at-risk individuals in selected villages within the service area. To target more "narrowly," individuals of a certain age cohort believed to be at extreme risk are chosen. Typically, preschoolers older than 6 months and younger than 24 months or 36 months were selected for testing. On the other hand, the larger at-risk population, all preschool-age children for example, can be screened strictly for those in need, i.e., diagnosed as malnourished by a composite anthropometric measure such as weight-for-age. We very often see older preschoolers who are chronically malnourished but not acutely malnourished. For this reason, using weight-for-age measurements, preschoolers under 24 months or 36 months who are malnourished form realistic target populations.

The concept of selecting individuals as social program beneficiaries by their family's socioeconomic status has a long tradition in Western countries. For nutritional programs in developing countries, this concept has been transplanted and, although not implemented to any

TABLE 2-1

LIST OF TARGETING STRATEGIES

Population to Target
• Preschoolers to 60 months
• Preschoolers of age 7 to 24 months
• Preschoolers of age 7 to 36 months
• Preschoolers who are diagnosed as malnourished (less than 75% of NCHS standard)
• Preschoolers of age 7 to 24 months who are malnourished
• Preschoolers of age 7 to 36 months who are malnourished
• Preschoolers in families determined to be at extreme risk by socioeconomic indicators
• Preschoolers in villages in which the average nutritional status is less than 75 percent, or in villages in which 5 percent or more preschoolers are 3rd degree malnourished (i.e., Once a village is selected by these criteria, all preschoolers in that village are targeted.)
• Preschoolers who failed to gain weight from one month to the next
• Preschoolers who failed to gain weight for two consecutive months

considerable extent, has appeared in the literature.[13] Although the identical socioeconomic strategy cannot be replicated in each data set, strategies are tested using many of the socioeconomic indicators most often discussed in

[13]See for example, Austin and Zeitlin, pp. 28-29 for a list of at-risk factors for supplementary feeding programs; and "Guidelines on the At-Risk Concept and the Health of Young Children," International Union of Nutritional Sciences Report, American Journal of Clinical Nutrition, Vol. 30, No. 2, 1977.

the literature as useful in identifying malnourished or high-risk individuals (e.g., individuals in families in which an infant has died, in families of low economic status, in families in which the mother is very young or relatively old, or in families with many children).

Last, we test targeting strategies employing weight trend criteria for program entry. Specifically, failure of a child to gain weight from one month to the next or for two consecutive months make up the two strategies of this type. Proponents of screening preschoolers by a weight gain/weight loss criterion not only claim a strong preventive orientation but also attest to the procedure's capacity to identify malnourished preschoolers who are in need of rehabilitation (targeting by a weight trend criterion is construed as a preventive orientation in this analysis).

Before describing the data sets used in this analysis, an explanation of how each suppositional targeting strategy is to be tested is in order. The benefit of longitudinal data, allowing us to "track" an individual's change in observed nutritional status, makes for a straightforward analysis and intuitive interpretations of the results. Each test of a targeting strategy can be expressed as a 2x2 contingency table when every individual in the data set is classified as either malnourished or normal at any given time. (A child's weight as a percentage of weight-for-age referenced by the NCHS standard is used as a measure of nutritional status throughout this analysis. A child is classified as malnourished if he is less than 75 percent of the standard, and normal if he is 75 percent of the standard or greater.) Table 2-2 illustrates how any of the strategies may be interpreted. First we see that at time **t** there are a number of malnourished preschoolers ($C_{11} + C_{12} = P$) and a number of normal preschoolers ($C_{21} + C_{22} = 1-P$). At time **t+1**, however, the malnourished group is expressed in

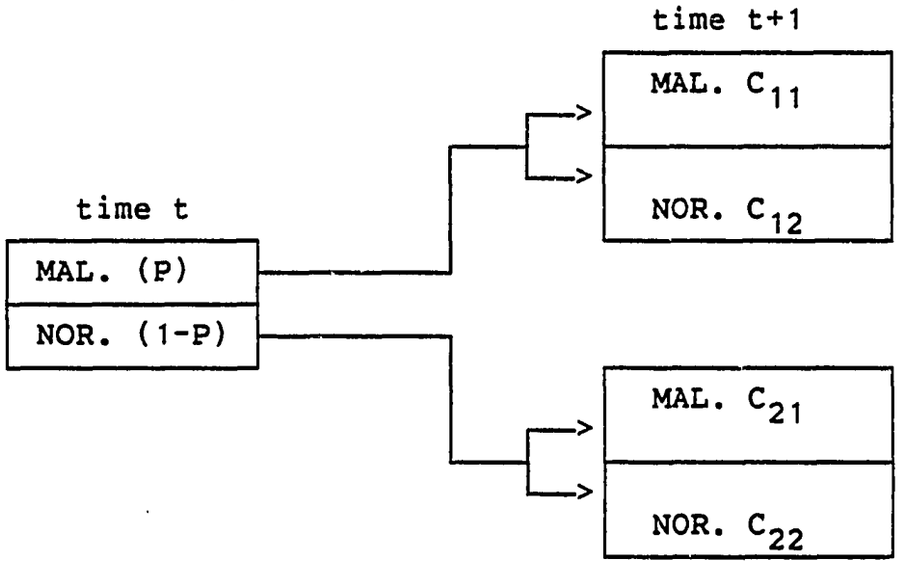
terms of $C_{11} + C_{21}$ and the normal group in terms of $C_{12} + C_{22}$.

TABLE 2-2

ILLUSTRATION OF A TARGETING STRATEGY
AS A 2x2 CONTINGENCY TABLE

		time t+1		
		MAL.	NOR.	
time t	MAL.	C_{11}	C_{12}	P
	NOR.	C_{21}	C_{22}	1-P

B.



We can reconstruct this 2x2 contingency table in a manner reflecting the passage of time. From the graphic representation in Table 2-2, part B, we can see what has happened nutritionally to the proportion of malnourished and proportion of normal preschoolers from time t to time t+1. For the proportion who were malnourished at time t, some may remain malnourished and some may become normal at time t+1. And for the normal group at time t, some may deteriorate

into malnourishment, whereas some may remain normal at time t+1. Such a figure can be constructed for each population selected and excluded by each targeting strategy. (Appendices B, C, D, E, and F to this report include the results for each strategy tested in just this form.)

2.2 DESCRIPTION OF DATA SETS

2.2.1 Kottar (Kanyakumari, India)

We have gathered monthly child weight measurements from July 1976 through July 1977 and socioeconomic data on the families of the preschoolers from a Community Health Development Project (CHDP) in the southernmost district of India, which was responsible for take-home supplementary feeding, nutrition and health education, health care and monthly monitoring of child growth performance. The Kottar data set is a random sample of 40 percent of the registered families in 21 villages from which only one child per family was obtained. The sample comprised 4,133 preschoolers as of July 1977. The project was village oriented and program entry was contingent on family economic status in order to be most beneficial to the poorer families in the region. All children in the Kottar data set participated in the CHDP. Previous analysis has revealed that during the first year following birth, the participant population showed a marked trend of growth failure when the Harvard standard was used. And in addition, participants' nutritional status did not appear related to their age at entry, nor to the length of time they were in the CHDP. However, when age charts were measured from January 1975 to July 1977, there was strong evidence of improvement in nutritional status (see Appendix A for detailed description).

2.2.2 Candelaria

A rural home visitation program begun in 1968 in Candelaria, Colombia has provided this analysis with the same kind of data as Kottar. Although the original data set (census) contains about 700 children in 1968, only 360 cases are available for this time series analysis because of large turnover of families participating in the program. The Promotora Program used health volunteer workers with six months of training to visit families with children less than six years of age every two months. They were responsible for educating on nutrition, hygiene and utilization of health services, as well as collecting data on child weight and height and making referrals for sick children to a Health Service Unit. In the first year of operation, 1968 to 1969, overall malnutrition (1st, 2nd, and 3rd degree) dropped 2.3 percent, the proportion of children who were 1st degree dropped 1.4 percent, and the 2nd degree proportion fell by 0.6 percent. (See Appendix A for detailed description.)

2.2.3 Thailand

The data used for this analysis comes from a rice fortification project conducted in 29 villages (N=1407) in Thailand from 1971 to 1975. Unlike the Kottar and Candelaria projects, the rice fortification project was an experiment with a control group and four treatment groups. Six villages formed a raw control group, six villagers formed a placebo control (no fortified rice) but included day-care centers for preschoolers, five villages received vitamin and iron fortification and day-care centers, seven received vitamin, iron, and amino acid fortified rice plus day care, and five received vitamin, iron and amino acid fortification without day care. Although the children were retarded in growth as compared to middle-class Bangkok children, the study concluded "that no benefits were

observed in children who consumed rice fortified with lysine, threonine, thiamin, riboflavin, vitamin A, and iron two-thirds or more of the time when compared to the entire study population or to children who ate fortified rice less than 10 percent of the time or who never ate fortified rice."[16] The study did not find a high prevalence of infectious disease but found illnesses to be most prevalent in the summer during the monsoon season.

For these reasons our analysis ignores the demarcations set by the previous study, and focuses on data collected at biannual examinations from August 1973 to August 1974. Data on incidence of infectious disease were collected quarterly, so data from July, August, and September of 1973 and 1974 are used to coincide with the biannual exams selected for analysis and the higher prevalence of illness (see Appendix A for detailed description).

2.2.4 Esperança

The data used for this analysis were generated by two surveys (census) conducted twelve to eighteen months apart (1977 to 1979) in four villages near Santarém, the Esperança home base in the Amazon region. Two of the four villages had health posts and two did not. The intervention consisted of the establishment of these two health clinics which were staffed by "barefoot doctors" trained by the Esperança team. The barefoot doctors, drawn from the villages themselves, were responsible for administering simple medical treatment, referring the more seriously ill to the Esperança medical doctors, providing health/nutrition education, and weighing the children. Of the two villages with health posts, one showed considerable improvement as

---

[16]Stanley N. Gershoff, et. al. "Nutrition Studies in Thailand. II. Effects of Fortification of Rice with Lysine, Threonine, Thiamin, Riboflavin, Vitamin A, and Iron on Preschool Children," American Journal of Clinical Nutrition, Vol. 30, No. 7, 1977, p. 1191.

compared with its control when using weight-for-age as a measure of nutritional status. Our knowledge of program activities in the two program villages suggests that the different effect in the villages was a result of a different level of intensity of application of services in the two villages (see Appendix A for detailed description).

In each of the other data sets, except for Thailand, where there was a control group yet no overall program impact, all individuals in the data sets were program participants. In the Esperança data set, 74.3 percent of the cases are from the two program villages. The two villages referred to as controls here were actually slated to receive health posts but at a later date. The two control villages in no way represented excluded areas of a targeting strategy. For these reasons, our analysis uses data only (N=370) from the program villages.

2.2.5 Sri Lanka

The Thriposha Program, a targeted supplementary feeding program integrated into the health care system, has provided us with the data to be used here. Thriposha is a pre-cooked and packaged blend of corn and soya beans fortified with vitamins and minerals. Eligibility was granted to medically selected prenatal and lacatating mothers, infants, preschoolers, and ward patients. Guidelines for the medical selection of pregnant and lactating women were that they be suffering from anemia, having difficulty producing milk while lactating, or showing other clinical signs of nutritional deficiency. Infants and preschoolers suffering from second or third degree malnutrition, exhibiting weight loss or showing other clinical signs of malnutrition were also given Thriposha. The data (from 1980-1981) for the 1,799 children came from a variety of clinic types in rural, urban, suburban, and estate areas. Because medical officers used considerable individual judgment in selecting program

beneficiaries, especially among young children approaching the period of highest nutritional risk, there were many "normal" children at time of entry; hence, inclusion errors may exist. (See Appendix A.)

2.3 ANALYSIS OF TARGETING STRATEGIES

The targeting strategies can be interpreted according to their orientations, which are critical to program effectiveness and efficiency. Table 2-3 classifies the ten strategies according to these dimensions. In analyzing each strategy by its inclusion and exclusion errors, its selected population size, and proportion of excluded malnourished children, we are, in turn, evaluating some of the most fundamental concepts related to targeting: the level of targeting, reliance on anthropometry to identify malnourishment in children, program objectives, either preventive, curative, or both, and the relationship between a preschooler's age and risk of malnourishment. The effort here is to apply our ten suppositional targeting strategies (this often turns out to be as many as the data permit) to data on program participants from different developing countries representing different rates in prevalence of malnutrition, and assess the cost (excluding individuals actually in need or at extreme risk and/or including individuals not in need) and benefit (including individuals in need and/or at extreme risk) of each strategy. From this analysis we hope for a broader understanding of how to target nutritional programs according to these orientations.

2.3.1 Targeting Geographically

With the exception of the Sri Lanka data set, the data represent anthropometric measurements and socioeconomic information on participants in geographically targeted programs. Therefore, by targeting to the preschooler population, we have a facsimile of restricting participation

TABLE 2-3

LIST OF TARGETING STRATEGIES AND THEIR ORIENTATIONS

TARGET POPULATION		Targeting			Anthropometrics required		Preventive	Curative	Age Specific Strategy	
		Geog. only	Family	Ind.	Yes	No			Yes	No
T.1	Preschoolers to 60 months	x				x	x	x		x
T.2	Preschoolers of age 7-24 months		x			x	x	x	x	
T.3	Preschoolers of age 7-36 months		x			x	x	x	x	
T.4	Preschoolers who are diagnosed as malnourished (less than 75% of NCHS standard)			x	x			x		x
T.5	Preschoolers of age 7-24 months who are malnourished			x	x			x	x	
T.6	Preschoolers of age 7-36 months who are malnourished			x	x			x	x	
T.7	Preschoolers in families determined to be at extreme risk by socioeconomic indicators*		x			x	x	x	x	
T.8	Preschoolers in villages in which the average nutritional status is less than 75%, <u>or</u> in villages in which 5% or more preschoolers are 3rd degree malnourished (i.e., once a village is selected by these criteria, <u>all</u> preschoolers in that village are targeted)	x			x		x	x		x
T.9	Preschoolers who failed to gain weight from one month to the next			x	x		x			x
T.10	Preschoolers who failed to gain weight in 2 consecutive months			x	x		x			x

*Socioeconomic strategies are defined separately for each data set.

only geographically. Table 2-4 shows the inclusion and exclusion errors[17] which result from this strategy. Defining the at-risk population as all preschoolers and excluding none from program eligibility leaves us without an exclusion error. The inclusion error, on the other hand, is of considerable magnitude, and apparently fluctuates according to the prevalence rate of malnutrition in each data set. (The prevalence rate among preschoolers for Kottar was 52.5 percent in 1976; for Candelaria, 11.7 percent in 1968; for Thailand, 36.8 percent in 1973; for Esperança, 16.1 percent in 1977; and for Sri Lanka, 42.0 percent in 1980 [65.1 percent in our data because of program targeting to malnourished preschoolers].) It appears that the proportion of individuals who were included in the program yet who would have remained normal without the intervention increases sharply as the prevalence rate decreases.

---

[17]In any at-risk population selected for treatment there are individuals who do not actually need to be treated. These are individuals who will not deteriorate to a malnourished state if left untreated. We can assess this proportion of the targeted population only if it is assumed that the prevalence rate has not changed due to program impact. When this assumption is unrealistic, the proportion of individuals who have remained normal from one year to the next will also reflect the program's benefits and inflate the proportion unless other forces counteract the program's benefits. Therefore, the calculated inclusion error is accurate only when we can control for program impact; otherwise the error is distorted.

Because we cannot distinguish between what change in recipients' nutritional status is attributable to the interventions and what change is attributable to other forces in the community, the possible distortion in this error is corrected by adjusting for the observed change in prevalence of malnutrition over time. For each targeting strategy in which an inclusion error exists, the percentage of change in prevalence is calculated and multiplied by the percentage of targeted individuals who remained normal over time. This figure is then added to or subtracted from the error rate to account for the change in prevalence. (The same procedure is followed for adjusting exclusion errors.)

TABLE 2-4

GEOGRAPHICALLY TARGETED PRESCHOOLER POPULATIONS: ERRORS OF INCLUSION AND EXCLUSION

TARGET STRATEGY: ALL PRESCHOOLERS IN THE SERVICE AREA					
	DATA SET				
	KOTTAR	CANDE-LARIA	THAILAND	ESPERANÇA	SRI LANKA
Error of Inclusion[1]	33.2%	83.4%	55.5%	76.6%	22.0%
Error of Exclusion[2]	0.0	0.0	0.0	0.0	0.0

[1] Proportion of preschoolers included in the targeted populations who actually did not need the intervention.

[2] Proportion of preschoolers excluded from the targeted population who actually needed the intervention.

2.3.2 Targeting by Age Cohort

We know that older preschoolers, although malnourished by the composite weight-for-age measure, are often chronically malnourished (stunted) but not acutely malnourished (wasted), and, therefore, not at extreme risk. There is also evidence that as a child gets older, the risk of death diminishes for a given nutritional status. Kielman and McCord found in their study of "the effects of the interaction of nutrition and infection in fourteen villages of Punjab, North India . . . that malnutrition contributes to the deaths of most infants below 80% of the Harvard weight-for-age median and to most deaths of those aged 12-36 months and below 70% of that standard."[18] Table 2-5 displays the results for two strategies, namely, targeting

[18] Arnfried A. Kielman and Colin McCord, "Weight-for-Age as an Index of Risk of Death in Children," The Lancet, June 10, 1978, pp. 1247-1250.

to preschoolers 7 to 24 months of age and to preschoolers 7 to 36 months of age. As the table shows, the two strategies are comparable. Again, inclusion errors are relatively high because young preschoolers who are "normal" are not screened out of participation by anthropometry. Nonetheless, both strategies exclude preschoolers, both younger and older, who deteriorate into malnourishment over time. In Kottar, where the prevalence is high, the proportion excluded who deteriorate rises sharply when the target population is extended to 36 months. (The reader should remember that the proportions used in this analysis are proportions of groups which are, in turn, proportions of larger sub-populations in a community. Therefore, the proportions we have called inclusion and exclusion errors or malnourished in an excluded population are relative to the increase or decrease in their respective larger sub-populations. A proportionate increase is not necessarily an increase in absolute numbers.) However, the proportion of preschoolers who were malnourished yet excluded by age decreased markedly. From these error rates and those related to geographic targeting we see that a partially preventive orientation and disuse of anthropometry for screening may lead to considerable errors of inclusion, especially in areas of lower prevalence. We also see that targeting by age does not catch all preschoolers at extreme risk and misses many malnourished children, especially in areas of higher prevalence (as measured by weight-for-age).

2.3.3 Targeting by Anthropometry

Weight-for-age is a commonly used composite measure of malnutrition in preschool-age children. A program that screens individuals by anthropometry restricts its benefits to rehabilitating individuals, as opposed to intervening to prevent malnutrition, thereby lowering the incidence rate. As we have defined an inclusion error here, targeting preschoolers by weight-for-age will not permit entry of

TABLE 2-5

PRESCHOOLER POPULATIONS TARGETED BY AGE COHORT: ERRORS OF INCLUSION AND EXCLUSION

	DATA SET				
TARGET STRATEGY	KOTTAR	CANDE-LARIA	THAILAND	ESPERANÇA	SRI LANKA
ERRORS OF INCLUSION(%)					
7-24 mos.	30.2	82.4	51.1	66.5	24.6
7-36 mos.	30.2	84.1	54.2	71.0	23.6
ERRORS OF EXCLUSION(%)					
<7-24 mos.>[1]	9.4	5.3	7.5	6.7	10.5
<7-36 mos.>	20.1	7.5	6.4	6.3	10.1
EXCLUDED POPULATION(%)					
<7-24 mos.>	24.9	56.4	71.2	70.8	53.9
<7-36 mos.>	18.9	42.5	48.8	50.0	25.4
MALNOURISHED IN EXCLUDED POPULATION(%)[2]					
<7-24 mos.>	60.6	14.4	37.0	11.8	69.5
<7-36 mos.>	34.2	13.1	38.2	10.3	72.7

[1] [< >] should be interpreted as less than and greater than when applied to populations excluded from a program.

[2] Proportion of individuals in the excluded population who did not meet the entry criterion but were actually malnourished.

"normal" preschoolers. This eventuality could only occur in theory, since weight-for-age is an imperfect measure of nutritional status and mistakes are made in field protocol (i.e., in practice some preschoolers would be misclassified as malnourished when they were actually normal or normal when actually malnourished). Anthropometric misclassification aside, Table 2-6 shows that the errors of inclusion when targeting to malnourished preschoolers are zero and that no malnourished are excluded from the selected population. Of course, the size of the excluded population

is considerably larger than in the previous strategies (in this strategy the size of the target population is equal to the prevalence rate for each data set). The price to be paid for an inclusion error of zero and "catching" all the malnourished, is a rise in the exclusion error in absolute terms at all prevalence rates and a rise proportionally in areas of higher prevalence as well. One could have anticipated such results. We should expect to find excluded from a program that screens individuals by anthropometry in an effort to rehabilitate those already suffering from malnutrition, a considerable proportion of preschoolers at extreme risk who actually deteriorate into malnourishment when left untreated. (We should note that the exclusion error, if not adjusted for program impact, would be deflated, since all were actually participants in an intervention.)

Because the program in Sri Lanka t..rgeted to certain groups within the preschoole. 'tion, the inclusion and exclusion errors requi.. unique interpretation. For this reason the analysis does not address test results from the Sri Lanka data set. The need for a special interpretation is witnessed in Table 2-6. We see that when targeting anthropometrically an exclusion error of 49.7 percent appears. This finding suggests that when medical officers used their discretion in selecting preschoolers for treatment, their judgment was quite reliable (i.e., the preschoolers who were normal by weight-for-age measurement were at extreme risk and actually deteriorated into malnutrition).

2.3.4 Targeting by Age and Anthropometry

To combine the rationales for targeting by age and anthropometry, we envision targeting to preschoolers 7 to 24 months old who are malnourished or to preschoolers 7 to 36 months old who are malnourished. As Table 2-7 shows, a

TABLE 2-6

PRESCHOOLER POPULATIONS TARGETED BY ANTHROPOMETRY (WEIGHT-FOR-AGE): ERRORS OF INCLUSION AND EXCLUSION

TARGET STRATEGY: PRESCHOOLERS WHO ARE 2ND OR 3RD DEGREE MALNOURISHED				
DATA SET				
KOTTAR	CANDELARIA	THAILAND	ESPERANÇA	SRI LANKA
ERRORS OF INCLUSION(%)				
0.0	0.0	0.0	0.0	0.0
ERRORS OF EXCLUSION(%)				
20.1	6.4	13.2	6.3	49.7
EXCLUDED POPULATION(%)				
47.5	88.3	63.2	83.9	29.8
MALNOURISHED IN EXCLUDED POPULATION(%)				
0.0	0.0	0.0	0.0	0.0

supplementary feeding program would still benefit from not feeding any normal preschoolers who would remain so without receiving the supplement. In areas of higher prevalence (Kottar and Thailand), targeting more "narrowly" leads to a larger proportion of excluded preschoolers who have deteriorated into malnourishment, and a substantial number of preschoolers who were malnourished at the time the strategies were applied. The table also reveals that in the areas of lower prevalence (Candelaria and Esperança) the target populations are less than 10 percent of the preschooler population (slightly less than their rates of prevalence). The very modest increase in target population size in lower prevalence areas experienced when targeting to preschoolers by anthropometry (refer back to Table 2-6) seems justifiable in the face of the malnourished

preschoolers missed when restricting eligibility to certain age cohorts who are malnourished.

TABLE 2-7

PRESCHOOLER POPULATIONS TARGETED BY AGE COHORT AND ANTHROPOMETRY (WEIGHT-FOR-AGE): ERRORS OF INCLUSION AND EXCLUSION

	DATA SET				
TARGET STRATEGY	KOTTAR	CANDE-LARIA	THAILAND	ESPER-ANÇA	SRI LANKA
ERRORS OF INCLUSION(%)					
7-24 mos. & mal.[1]	0.0	0.0	0.0	0.0	0.0
7-36 mos. & mal.	0.0	0.0	0.0	0.0	0.0
ERRORS OF EXCLUSION(%)					
<7-24 mos.> or normal	17.8	6.1	10.3	5.7	16.1
<7-36 mos.> or normal	19.5	6.2	11.0	5.8	19.4
EXCLUDED POPULATION(%)					
<7-24 mos.> or normal	64.5	96.1	89.6	93.6	72.3
<7-36 mos.> or normal	54.0	93.9	81.2	90.4	53.3
MALNOURISHED IN EXCLUDED POPULATION(%)					
<7-24 mos.> or normal	26.5	8.1	29.4	8.9	51.8
<7-36 mos.> or normal	12.0	5.9	22.7	5.7	34.6

[1] Malnourished is defined as 2nd or 3rd degree malnourished by Gomez' classifications (i.e., less than 75 percent of NCHS standard).

2.3.5 Targeting by Socioeconomic Indicators

Table 2-8 enumerates the results from targeting by socioeconomic indicators of families with preschoolers at extreme risk of malnourishment. Unlike the other suppositional strategies tested where they are identical across data sets, each socioeconomic strategy is unique for each data set. Similarities are deliberate, but an effort

was also made to take advantage of the wealth of information at the family level in each data set.

First, the test shows that the selected populations absorb almost the entire preschool-age population, with the exception of Thailand, where the selected population is 62.1 percent. Because of this indiscriminate behavior, no malnourished are excluded in areas of lower prevalence. In Kottar, however, where the prevalence is highest, 44.4 percent of the excluded population is malnourished despite the fact that the excluded population represents less than 4 percent of the preschool age population. Many of the malnourished were also missed in Thailand.

It is apparent from our socioeconomic strategies that either the areas in which the nutritional programs lie are relatively homogeneous, or the appropriate socioeconomic indicators of nutritional status in these areas of the world have not been found. In Esperança, the selected population amounts to 98.3 percent of the total preschooler population, in Candelaria the selected population is 88.6 percent, and in Kottar, 96.1 percent. A third possibility as to the failure of these tests to discriminate between the malnourished preschoolers and those at extreme risk and normal preschoolers lies in the strategies themselves. In what combination the socioeconomic criteria should be used to identify needy individuals is not known. As the criteria were used here, an individual needs to be included in only one socioeconomic category to be targeted. Conceivably, a program could require qualification on a number of the criteria for program entry.''

''CSF, in an unpublished study, has tested a socioeconomic model for predicting nutritional status in the Kottar data set and found such a model to be a poor predictor.

TABLE 2-8

PRESCHOOLER POPULATIONS TARGETED BY SOCIOECONOMIC AT RISK INDICATORS: ERRORS OF INCLUSION AND EXCLUSION

TARGET STRATEGY: SOCIOECONOMIC AT-RISK INDICATORS				
DATA SET				
KOTTAR[1]	CANDELARIA[2]	THAILAND[3]	ESPERANÇA[4]	SRI LANKA[5]
ERRORS OF INCLUSION(%)				
33.0	81.3	53.6	73.9	24.2
ERRORS OF EXCLUSION(%)				
14.4	4.7	6.2	0.0	11.9
EXCLUDED POPULATION(%)				
3.9	11.4	37.9	1.7	30.0
MALNOURISHED IN EXCLUDED POPULATION(%)				
44.4	0.0	36.7	0.0	71.2

[1] Preschoolers 7 to 24 mos.; or in families with 4 or more siblings; or in families in which at least 1 sibling has died; or in families with low economic status (≤2000 Rs. per year); or in families where the mother has no schooling; or in families where the mother is less than 20 years old or over 40 years old.

[2] Preschoolers 7 to 24 mos.; or in families larger than 5; or in families in which at least 1 sibling has died; or in families with low economic status (<600 pesos per year); or in families where the mother is illiterate or can read and write only; or where the mother is less than 20 years old, or 40 or over.

[3] Preschoolers 7 to 24 mos.; or of birth order >4; or with mothers aged <20 or >40; or in families with >3 siblings; or in families in which a child aged 12 to 60 mos. has died.

[4] Preschoolers of an estimated birth weight <2.5K.; or in families in which an infant ≤one year old has died; or with mother <20 to >40 at child's birth; or of birth spacing ≤18 mos. to next child; or in families where the mother worked outside the house after birth; or of birth order >6; or in families of low socioeconomic status; or in families where the mother has had only primary education.

[5]Preschoolers 7 to 24 mos.; or with mother <20 or ≥40; or in families with 4 or more children; or in families with 3 or more preschoolers; or of birth order ≥4.

2.3.6 Targeting by Village

The Kottar data set allows us the opportunity to select villages on the basis of lower average nutritional status and relatively high presence of 3rd degree malnutrition. Once a village is selected, all preschoolers would receive the intervention. Such a strategy in an area of high prevalence seems reasonable on two accounts: one, the synergistic relationship malnutrition has with infectious disease makes feeding all at-risk individuals in a village, rather than a select few, more beneficial; and two, it could prove a more feasible strategy for reaching the "most needy" (3rd degree malnourished) who are often the most difficult to reach (i.e., such a strategy might improve program accessibility in hard-to-reach rural areas).

In Table 2-9 the errors and excluded population statistics are shown. Interestingly, the target population uniquely (unique to Kottar data set) shows an increase in the prevalence rate from 51.2 percent to 65.3 percent, whereas the excluded population shows a decrease from 53.2 percent to 41.1 percent. A possible interpretation of this phenomenon is that the program intervention was inadequate to effect an improvement in nutritional status or prevent deterioration into malnourishment in these villages where the problem was most critical.

2.3.7 Targeting by Weight Trend Criteria

Monthly weight measurements of preschoolers are available only from the Kottar data set. The rationale for targeting by weight trend criteria is relatively straightforward: a preschooler who fails to gain weight over

TABLE 2-9

PRESCHOOLER POPULATION TARGETED BY VILLAGE SELECTION IN THE KOTTAR DATA SET: ERRORS OF INCLUSION AND EXCLUSION

TARGET STRATEGY	DATA SET KOTTAR (HIGH PREVALENCE)[1]
Preschoolers in villages in which the average nutritional status is <75%; or with a percentage of 3rd degree malnourished ≥5%	ERRORS OF INCLUSION(%) 24.8 ERRORS OF EXCLUSION(%) 9.8 EXCLUDED POPULATION(%) 64.8 MALNOURISHED IN EXCLUDED POP.(%) 53.2

[1] The prevalence rate in July of 1976 for the Kottar service area was 52.5% and a year later, 49.7%. The population selected by this strategy (9 villages) uniquely shows an increase in the prevalence rate from 51.2% to 65.3%; whereas the excluded population (12 villages) shows a decrease from 53.2% to 41.1%.

a specific period of time is at extreme risk of malnourishment. It could also be argued that such a screening procedure will identify preschoolers already malnourished, assuming malnourished preschoolers do not gain weight over a month or two, or if they do, they are stunted but not wasted.

Table 2-10 shows us that in this area of high prevalence weight trend criteria screen out relatively well normal preschoolers who would remain normal without the intervention. For screening procedures that are so positively preventive, they miss a relatively large proportion of preschoolers who deteriorated over time. By weight-for-age measures, both weight trend strategies excluded large proportions of malnourished preschoolers. (Whether or not these proportions of malnourished in the excluded populations are chronically malnourished, acutely malnourished, or both, remains at issue, as it does for any of the targeting strategies.)

TABLE 2-10
PRESCHOOLER POPULATIONS TARGETED BY WEIGHT TREND CRITERIA IN THE KOTTAR DATA SET: ERRORS OF INCLUSION AND EXCLUSION

TARGETING STRATEGY	
Preschoolers who failed to gain wt. from 1 mo. to the next	Preschoolers who failed to gain wt. for 2 consecutive mos.
ERRORS OF INCLUSION(%)	
23.1	16.4
ERRORS OF EXCLUSION(%)	
14.0	14.6
EXCLUDED POPULATION(%)	
67.1	79.0
MALNOURISHED IN EXCLUDED POPULATION(%)	
48.5	45.3

NOTE: Included in failure to gain weight is "zero" weight gain.

3 PROGRAM COSTS

3.1 FRAMEWORK

Determining the costs of an entire nutrition program, or of a particular targeting strategy, is not at all straightforward. In this study, time and resources constraints forced us to utilize already existing data relating to ongoing or proposed programs. Our approach, therefore, is to begin with a framework for structuring a cost study and then proceed to a consideration of specific cost elements.

3.1.1 Perspectives on the Framework

The perspective from which costs are viewed is all important in quantifying their magnitude. For nutrition programs in developing countries, costs are generally borne by some combination of the implementing agency, by such as a PVO or governmental agency, by USAID, either directly or through a PVO, and by the family of the beneficiary receiving food. These costs are both out-of-pocket and in the form of foregone opportunities. Most cost data described in the literature focus upon out-of-pocket expenditures viewed from the perspective of only one of the funding agencies. Rarely are costs combined from more than one of the funders and only occasionally are the costs of the beneficiaries considered. In no instance are the foregone opportunity costs of alternative uses of time considered--either with respect to the implementing agency or to the beneficiary. For instance, from the perspective of the beneficiary, a cost associated with participating in a take-home feeding program is both the out-of-pocket cost

of getting to and from the center as well as the foregone opportunity of the time spent while on the visit. For the purposes of this cost study, we will ignore opportunity costs because of their context-specific nature but will reflect their importance in the ensuing policy recommendations.

3.1.2 Recurring vs. Non-recurring Costs

Most budgets require segregation of recurring and non-recurring cost components. Recurring costs are those which are related to ongoing program operations and generally but not always vary in relation to the magnitude of the activities. Non-recurring costs are for components which require purchase or acquisition at the onset of a program but, once acquired, can be used over an extended period of time. Food and personnel costs are recurring, while costs for equipment such as weighing scales and vehicles are non-recurring. The distinction between recurring and non-recurring is necessary for budget purposes and often helpful for project planning, but it must be recognized that this distinction is not always clear-cut. Many cost elements have both characteristics. Equipment can break down unless maintained regularly, or storage costs can have both a non-recurring component for construction of the facility and a recurring component for providing watchmen.

3.1.3 Fixed vs. Variable Costs

Some costs, whether they be recurring or non-recurring, vary with the level of services being provided and are therefore termed variable costs. Other costs are set, at least within certain bounds of program variation and are therefore termed fixed. Any one cost element can have both a fixed and a variable component. For instance, shipping and handling costs vary in relation to volume of shipments but not necessarily in <u>direct</u> proportion to volume. Some

costs, such as a leased storage space, can continue regardless of volume. Over a long time period all costs are variable and within a very short time period most costs are fixed. Therefore the time period over which the analysis is being conducted determines both the nature of the cost element and whether it should be treated as fixed or variable.

3.1.4 Marginal vs. Total Costs

Almost all nutrition programs which contain a feeding component are imbedded in other ongoing activities under implementation by the host country government or a private voluntary organization. Therefore, when costs are being defined, a decision must be made about whether to include the entire cost of an element or only the portion relating to the new or extended activity. Generally, marginal costs are most useful in an analysis, but at times total costs should be considered.

Costs of implementing any given targeting strategy are heavily dependent upon the already existing infrastructure--whether it be the host country logistical system available for distributing a commodity or the local health care system in which the feeding program is to be imbedded. We shall return to this issue in a later section dealing with country scenarios.

3.2 COST ELEMENTS ASSOCIATED WITH IMPLEMENTING A TARGETED FEEDING PROGRAM

Table 3-1 is an enumeration of cost components associated with implementing a targeted feeding program. Five major categories are further divided into forty-one subcategories. While it would be possible to subdivide further, the relative advantages diminish. The right-hand columns indicate whether cost components are recurring, non-recurring or both.

TABLE 3-1
ENUMERATION OF COST ELEMENTS ASSOCIATED WITH IMPLEMENTATION OF A TARGETED FEEDING PROGRAM

COST ELEMENTS	RECURRING COST COMPONENT(A)	NON-RECURRING COST COMPONENT(B)
A. COMMODITY COSTS		
1. Cost of commodity at port of embarkation in U.S.	A	
2. Ocean freight costs to recipient country	A	
3. Indigenous commodity costs (if any)	A	
4. Vitamin and/or mineral additives (if any)	A	
B. CENTRAL & REGIONAL PROCESSING & HANDLING COSTS		
1. Cost of unloading at port of recipient country	A	
2. Handling and storage costs at port of disembarkation	A	B
3. Fumigation expenses	A	
4. Bagging and/or rebagging costs	A	
5. In-country processing costs	A	B
6. Spoilage & losses expenses	A	
7. Security expenses	A	
C. COSTS OF DISTRIBUTION TO LOCAL SITE		
1. Regional handling expenses - loading, unloading, transfer	A	
2. Rail shipping costs	A	
3. Truck shipping costs	A	B
4. Storage costs at regional distribution points	A	B
5. Local distribution to feeding site	A	
6. Security expenses	A	
7. Spoilage & losses at regional storage facilities	A	
8. Losses incurred during shipment	A	
D. LOCAL FIELD-LEVEL PROGRAM COSTS		
1. Commodity handling expenses		
a) Storage expenses at site	A	B
b) Spoilage and damage at site	A	
c) Local handling to point of distribution to beneficiary	A	
2. Local program expenses		
a) Educational materials - growth charts, educational materials, etc.	A	B
b) Supplies - record keeping materials, etc.	A	B
c) Medicine & vacines	A	
d) Equipment costs		
(1) Scales		B
(2) Birth weight scales		B
(3) Furniture		B
(4) Transportation - bicycles, motor scooters, motor bikes, cars, pickups, etc.	A	B
(5) Other		B
(e) Physical facility expenses	A	B
(f) Personnel		
(1) Field workers' salaries & honoraria	A	
(2) Training cost		B
(3) Supervisors' expenses	A	
(4) Per diem costs	A	
(5) Local management expenses	A	
3. Costs of surveys for determining prevalence and at riskness	A	B
E. OVERALL ADMINISTRATIVE & MANAGEMENT EXPENSES		
1. In-country A & M expenses incurred by implementing organization	A	
2. In-country A & M expenses incurred by Government of recipient country	A	
3. A & M expenses of implementing organization - U.S.-based office	A	
4. Audit expenditures	A	

In order to determine the costs of any given program or the cost component associated with a particular targeting strategy, one must first determine the perspective from which the analysis is to be conducted, decide whether marginal or total costs should be used, and then subdivide according to recurring and non-recurring costs. If alternative levels of activity are to be considered, distinctions must be made between fixed and variable costs.

We now turn to the issue of identifying each of the major categories of costs associated with a targeted feeding program.

3.2.1 Commodity Costs

Commodity costs for twelve different programs were obtained from the literature in order to assess the range of cost variation at the field level. Table 3-2 indicates that there are substantial differences in annual cost per child, ranging from $6.68 to $16.64 for take-home programs and from $8.00 to $70.58 for on-site feeding. One can be quite certain that the actual range, worldwide, is substantially greater than that shown by this sample. Reasons for this variation include differences in type of commodity, supplement size, extent of in-country processing, and method of computing costs. For instance, some cost estimates include ocean freight at invoice costs, while others exclude freight or value it at a non-subsidized world rate.

An alternative and perhaps more appropriate method of valuation would be to use the local market value of the gifted commodity instead of total costs. When the supplement provides an incentive for participation in a health and/or education program, the greater the local market value, the stronger the incentive. There is substantial anecdotal evidence that program beneficiaries carefully weigh the "net return" to their family when making a decision about participation.

TABLE 3-2

ESTIMATED COSTS OF FEEDING PROGRAMS

A. TAKE-HOME PROGRAMS				
Country	Target age in months	Total cost per year per child	Food cost/ year	Percentage of total reported costs
India[1]	6-36	1500	11.60	77%
Colombia[2]	0-60	24.95	13.41	54%
Dominican Republic[2]	0-60	15.24	10.34	68%
Pakistan[2]	0-60	23.51	16.64	70%
Morocco[3]	24-60	41.90	-	-
Sri Lanka[4]	6-60	11.14	6.68	60
Sri Lanka[5]	6-60	9.04	7.47	83%
B. ON-SITE PROGRAMS				
India Tamil Nadu	0-60	14.48	10.69	75%
Costa Rica[2]	0-60	94.54	70.58	74%
India Ahdhra Pradesh[1]	6-72	10.70	8.00	75%
India Narangwal[1]	6-60	38.70	-	-
Tunisia[1]	6-72	25.30	-	-

[1]Beaton, April 1982 (1976 U.S. dollars)

[2]Anderson, 1981 (1976 U.S. dollars)

[3]An Evaluation of PL480 Title II in Morocco, Washington, D. C., Robert Nathan Associates Inc., 1979 (1976 U.S. dollars)

[4]An Evaluation of PL480 Title II Programs in Sri Lanka, Washington D.C., Robert Nathan Associates Inc., 1978 (1976 U.S. dollars)

[5]Sri Lanka - 1982. Each beneficiary in the program received two 750 gm. packages per month or 18 Kgs. per year. Assuming on a conversion rate of Rs. 21 per U.S. dollar the annual cost was 18 x 2.2 x 4.795/21= $9.042/beneficiary (1982 U.S. dollars)

3.2.2 In-Country Processing, Storage and Shipping Costs

Sections B and C of Table 3-1 enumerate the elements associated with in-country processing, storage and distribution to the local site. Included in these costs are unloading and storage at port of entry, processing costs such as rebagging, fumigation, and blending, spoilage and other losses, transportation to regional facilities, and storage prior to shipment to feeding site. These costs vary in relation to the nature of the infrastructure available for carrying out the function, the distance which must be traveled, and the degree of competitive forces in the marketplace exerting restraint upon the price of services. Each of the specific cost elements can vary dramatically due to the aforementioned context-specific determinants. For instance, in a recent analysis of selected programs in Africa, the transportation cost per ton-kilometer varied from $.10 to $.49.[20] Variation of this magnitude is not unusual in virtually all other cost components.

Because so much of this variation in cost is due to the level of development of storage and transportation infrastructures, the nature of existing infrastructure becomes an important program design criterion. Similarly, the most appropriate targeting strategy is also affected by existing infrastructures. If the cost of outreach to new areas is relatively low, then it is acceptable for the payoff in terms of reaching a higher proportion of at-risk populations to be smaller. On the other hand, if the cost of outreach is very high, then the relative payoff must be substantial. This is to say that if the difference in malnourishment prevalence rate between covered regions and a proposed new region is small, the costs of moving to the new region must also be small. But if the difference in

---

[20] Outreach Grant Project Evaluation, International Science & Technology Institute Inc., Washington, D.C., Jan. 1983.

prevalence rates is large, a geographic extension can be warranted even if the costs of extending services are high. In a later section of this report we shall classify country situations into twelve distinct scenarios and provide more detailed information on relative payoff for each category of targeting strategy.

3.2.3 Local Field-Level Program Costs

Section D of Table 3-1 enumerates eighteen cost elements incurred at the local level. Again, we have found each element to be of extremely variable in cost depending upon local conditions. For instance, if there are secure and well-built storage facilities, spoilage and other commodity losses will be minimal and security expenses will be low. If there is an existing health care program, the marginal cost of a feeding component is relatively low in comparison to a "stand-alone" food distribution program. Targeting based upon anthropometrics is relatively low-cost if there is a "road to health" card education program in place but quite high if it must be implemented from scratch.

In order to determine range of variation, estimates of cost by broad category were obtained from the literature. When budgets were presented by these sources in both recurring and non-recurring cost categories, the non-recurring cost items were annualized based upon an appropriate depreciation schedule. Appendix G contains a synopsis of each case presented in a uniform manner (Tables 3-3 through 3-8). Since on-site and take-home programs vary substantially in design, the two types of programs are segregated for purposes of summary. Table 3-9 is a summary showing the range in cost for each broad category expressed as a percentage of total reported cost. Only take-home programs were summarized in this table. Estimates are based upon case studies, and when appropriate upon other analyses which reported data on cost by category. Commodity

TABLE 3-9
RANGE IN COSTS BY CATEGORY EXPRESSED AS A PERCENTAGE OF TOTAL REPORTED COSTS (TAKE-HOME PROGRAMS ONLY)

COST CATEGORY	RANGE IN PERCENTAGE OF TOTAL COST	RANGE MIDPOINT (PERCENTAGE)
1. Commodity costs at U.S. point of embarkation, ocean shipping, and commodity cost of indigenous raw materials (recurring cost)[1].	42-83	62
2. In-country processing costs (if any), storage at port, and transportation from port to local distribution point (recurring cost)[3].	4-50[2]	27
3. Local field level program costs:		
a) Educational materials and other supplies (recurring costs)[1].	2-12	7
b) Local facility and equipment costs (non-recurring costs)[5].	2-?[6]	2
c) Personnel for local implementation (recurring costs)[7].	8-42	25
d) Other local costs including local transportation, administration and management (recurring costs)[8].	2-?	2
4. Overall administrative and management expense incurred by the implementing agencies, both governmental and non-governmental.[9]	4-6	5

[1]For some purposes of analysis it may be more appropriate to value the commodity at local market price rather than total cost.

[2]Rough estimate of upper bound of costs in Upper Volta case example. Outreach Grant Project Evaluation, International Science and Technology Institute, Inc., Washington D. C., 1983.

[3]These estimates are often understated due to the gifting of storage space and to source processing expenses. Many host countries bear the cost of shipment to the feeding site, which makes the cost difficult to estimate. More important still, these costs are dependent upon the existing type of transportation infrastructure, the distances traveled, and the volume of shipments.

[4]While these costs are primarily recurring, there is generally a small component of non-recurring cost associated with development of training materials.

[5]Costs for facilities and equipment which are already in existence at the local level are often understated,. because some already exist at the local level. For the purposes of synthesizing annual costs as a percentage of the total, we have assumed a life of 3 years for non-recurring materials and 7 years for equipment such as vehicles, refrigerators, furniture and weighing scales.

[6]Insufficient data to provide even a rough upper bound estimate.

[7]While personnel costs are primarily recurring, initial training is non-recurring. Estimates with a non-recurring training cost component are amortized a three-year life for the purpose of synthesizing annual costs.

[8]These local costs are often understated due to the presence of an already existing activity and volunteered time.

[9]These costs are also generally understated due to volunteered effort and inclusion in other budgets.

costs vary between 42 percent and 83 percent. In-country processing, distribution, and storage vary from between 4 and 50 percent, while other cost elements have similar potential for variation. Local field-level program costs are determined both by the nature of the program and by whether the costs are borne by the reporting organization. We suspect that the variations experienced worldwide are substantially higher than those provided from the limited number of case studies which we were able to obtain from the literature.

Perhaps the most important finding from this analysis is the difficulty in inferring costs of program components from experiences in other settings. The contextual setting in which the program is embedded and the answer to the questions raised at the beginning of this chapter determine the outcome. Given this condition, a useful approach may be to utilize Table 3-1 as a checklist to help identify cost elements but to draw upon specific information from the country and local setting to determine the actual values.

One further level of detail may be useful when deciding upon program design and the specifics of a targeting strategy. Table 3-10 is an enumeration of the specific cost elements which could be incurred in the implementation of a socioeconomic or anthropometric targeting strategy. It is provided as a checklist which may be helpful in ensuring that all appropriate costs are identified. In any real seting, some of the elements might be avoided.

TABLE 3-10

COST ELEMENTS ASSOCIATED WITH THE IMPLEMENTATION OF A SOCIOECONOMIC OR ANTHROPOMETRIC TARGETING SCHEME

COST ELEMENTS
SOCIOECONOMIC TARGETING
1 Survey design, test and retest 2 Survey forms, supplies, etc. 3 Surveyor training expenses 4 Survey personnel costs 5 Field supervision 6 Out-of-pocket transportation and/or per diem costs 7 Beneficiary selection expenses: analysis of survey, presentation of results to community, etc. 8 Recurring expenses at selected time intervals
ANTHROPOMETRIC TARGETING
1 Determination of appropriate anthropometric standard 2 Determination of proper cut points for selected standard 3 Design and printing of growth charts 4 Preparation and production of educational materials 5 Purchase of scales and related equipment 6 Training of weight takers and recorders 7 Facility for storage of equipment and records 8 Recurring personnel expenses a)weight takers (at least 2 per weight station) b)recorders (at least 1 per weight station) c)field level supervisory staff d)road to health card educators 9 Modification of cut point or other targeting criteria as target populations change in composition

4 TARGETING SCENARIOS

In selecting a targeting scheme, intervenors committed to the reduction of malnutrition must consider the relationship of several design parameters and a variety of contextual factors. Foremost among the design parameters are the stated purposes of the intervention, especially its position with regard to prevention versus cure, and the type of staff designated to deliver services. (Medical professionals, for example, are capable of using an array of health diagnostics generally unavailable to laymen.) Foremost among the contextual factors are the underlying prevalence of malnutrition, the quality of the physical infrastructure for moving and storing food commodities and other supplies, and the on-site "human" infrastructure to direct the dissemination of commodities and services.

4.1 CONTEXTUAL FACTORS

In this chapter, we consider the logic of targeting given a series of scenarios regarding these three contextual factors. Table 4-1 identifies twelve possible scenarios defined by the permutations of these factors.

TABLE 4-1: INTERVENTION SCENARIOS

NO.	PREVALENCE	LOGISTICS INFRASTRUCTURE	ON-SITE INFRASTRUCTURE
1	High (uniform)	Minimal	Minimal
2	High (uniform)	Substantial	Minimal
3	High (uniform)	Minimal	Substantial
4	High (uniform)	Substantial	Substantial
5	High-low	Minimal	Minimal
6	High-low	Substantial	Minimal
7	High-low	Minimal	Substantial
8	High-low	Substantial	Substantial
9	Low (uniform)	Minimal	Minimal
10	Low (uniform)	Substantial	Minimal
11	Low (uniform)	Minimal	Substantial
12	Low (uniform)	Substantial	Substantial

To help unify our discussions of these scenarios, let us consider the implications of each factor, taken alone, for the design of a targeting scheme.

4.1.1 Prevalence

The underlying prevalence of malnutrition is indicative of the degree to which discriminating targeting is needed. In high prevalence areas, one can afford to be less exacting in targeting. Where there is widespread malnutrition, so many individuals need assistance or, in preventive programs, are likely to need assistance at some future time, that rigorous targeting is unnecessary if not unadvisable. In contrast, in low prevalence areas, one cannot afford to distribute services without discriminating among potential recipients because so many unneedy people will be covered. (Phrased in terms of the "tip of the iceberg" concept, if the tip is high as indicated by the high prevalence, the underlying problem is large and widespread.)

Thus, in situations marked by a high prevalence of malnutrition, a limited amount of resources should be directed toward the implementation of rigorous targeting. However, in situations where malnutrition is less rampant, it pays to invest resources on locating those truly in need. In situations where there are sub-areas afflicted with serious malnutrition, one should identify those sub-areas but not invest too heavily in distinguishing among residents of those sub-areas with regard to need.

4.1.2 Logistical Infrastructure

The logistical infrastructure is indicative of the cost of widespread geographical penetration. In regions lacking infrastructure, the costs of shipping, storage, and management are sometimes extremely high. This suggests strongly that it may be cost-effective to saturate small, accessible areas, even if some individuals at low risk are

included in the participating population. Where infrastructure exists, one can afford to discriminate within small sub-areas because the costs of moving into adjacent areas is within reason.

4.1.3 On-Site Infrastructure

The existence of a good local organization, be it governmental, quasi-governmental or naturally inherent in the community, makes discriminating targeting possible. If such organization is lacking, the intervenors must perform many functions themselves, generally at great cost, or forego them altogether.

More than the first two, this contextual factor is subject to change as part of the intervention. That is, the on-site infrastructure is as much a design element as a contextual factor. If the infrastructure exists, as it does when a supplementary feeding program is appended to an existing and functioning health system, the intervenor need not invest in creating that infrastructure. Where it does not exist, the intervenor is faced with a critical choice regarding the allocation of resources--a choice between expanding the service area or enhancing the on-site capabilities in a limited area.

4.2 SCENARIOS

In light of this "introduction", we consider targeting in the circumstances defined by each scenario.

SCENARIO 1 - High (uniform) prevalence, minimal logistical infrastructure and minimal on-site infrastructure.

Scenario 1 represents the most difficult combination of factors for intervention--a large, widespread problem in the absence of support systems to facilitate intervention.

Typically, this scenario persists in the remote rural regions of many developing nations.

The combination of high prevalence and minimal infrastructure reinforces the notion that rigorous targeting is inappropriate. As an alternative, we suggest that costs be minimized and control (supervision) be maximized through the slow, well-planned expansion of the program. At first, due to the lack of local infrastructure to support either anthropometric or socio-economic targeting, it might be best to serve all preschoolers and pregnant and/or lactating mothers in those villages designated as participating. In areas with minimal infrastructure, one should anticipate the lack of quantitative data to guide the village selection process. Due to the high prevalence, the expert opinion of knowledgeable officials might suffice to guide village selection--one need not allocate valuable resources on the collection of data because the benefits of having data are, at best, marginal.

After a program has been operating in a village for a period of time, one could introduce more selective targeting strategies in accordance with program objectives. If one objective of the program, either directly stated or implied, is the development of a local infrastructure, selective targeting might be introduced village by village as each proves its capability for implementing the chosen strategy. For example, the introduction of a weighing program might be delayed until the new local organization proves its competence in handling the distribution to all preschoolers.

Under this scenario, geographic expansion should always be deliberate so that the logistics of transporting, storing and distributing food commodities and other services can be "solved" in all program villages. Program designers should accept the fact that instant solutions to logistics problems and/or the overriding problem of malnutrition are most

difficult to conceive and implement in areas with minimal infrastructure.

SCENARIO 2 - High (uniform) prevalence, substantial logistical infrastructure and minimal on-site infrastructure.

Scenario 2 describes a situation which might arise in locations where roadways or railways have been built but where social service development and/or government organization has been slight. This is especially common in places where small settlements grow rapidly into villages because of their very proximity to a road or railway. Often, in this case, governmental and quasi-governmental service agencies cannot mobilize resources quickly enough to keep pace with rapid urbanization. Scenario 2 might also occur in places where the population retains its predominantly rural configuration even in the face of rail and/or roadway development.

Here, as with scenario 1, one might anticipate a general lack of quantitative data for the specification of geographical targeting rules. (Generally, the availability of such data is positively correlated with the degree of on-site infrastructure.) Again, the cost of creating the infrastructure to generate data is not worth incurring due to the high (uniform) prevalence of nutritional deficiency--where the problem is widespread, one need not worry too much about finding the needy. In this case, the informed judgment of medical personnel may be the best available data source.

However, because of the existence of good logistical infrastructure, the costs of distributing and storing food commodities and other materials will be less and more resources should be available to bolster the local infrastructure as part of the intervention. A trade-off exists between expansion of on-site infrastructure in relatively few locations and geographic expansion. If the

former option is pursued, anthropometric targeting (strategies 8 through 10) becomes feasible and should be considered for implementation in selected villages which have proven their ability to carry out such strategies.

SCENARIO 3 - High (uniform) prevalence, minimal logistical infrastructure and substantial on-site infrastructure.

We believe scenario 3 to be a rare occurrence--the development of on-site infrastructure generally lags behind the development of logistical infrastructure. The exception is in small projects, often run by benevolent non-government organizations, where representatives of the organization take up residence in a small but remote area. Such programs are most frequently operated independent of government; however, clever entrepreneurs often facilitate the extension of government programs in their regions.

Under this scenario, the costs of bringing food commodities and other supplies to the remote locations served are large relative to the costs of identifying the most needy. Therefore, in contrast to high prevalence scenarios 1 and 2, discriminating or rigorous targeting based on anthropometrics and/or socioeconomics is called for. If the on-site team has medical competence, we urge that anthropometrics and medical diagnoses be used in targeting. Otherwise, due to the unique relationship between service provider and participant which so often develops in this case, the knowledge of the service provider regarding socioeconomics and/or behavioral practices of the individual particpants can be used.

SCENARIO 4 - High (uniform) prevalence, substantial on-site and logistical infrastructure.

Scenario 4 is also quite rare. Presumably, if infrastructure is well developed, the area is well developed and malnutrition should be rare. Exceptions include urban

poverty zones (for example, the resettlement barrios on the outskirts of major Latin American cities) or segments of countries whose governments have supported the development of social services more than economic development (for example, in Sri Lanka). In the urban poverty zone, there is likely to be a high turnover of participants and also high migration within the program area itself. People enter the zone already malnourished and retain that state until they assimilate into the urban way of life.

Due to the highly developed infrastructure, the costs of moving and storing commodities as well as the cost of implementing selective targeting schemes should be relatively low. In the urban poverty zone, a highly targeted scheme based on anthropometrics is likely to yield the greatest benefit--the benefit of helping displaced families through their rural to urban transition.

SCENARIO 5 - High-low prevalence, minimal logistical infrastructure and minimal on-site infrastructure.

Scenario 5 is typical of places where nature is relatively benign so that landholders are capable of subsistence existence but the landless live with a more precarious life style. The minimal infrastructure is indicative of limited government activity and/or general progress toward economic development throughout the area.

Unlike scenario 1, this scenario is conducive to preliminary efforts to gather data (or use existing data) to inform the targeting scheme. For example, an anthropometric survey might be launched to identify the high prevalence sub-areas (villages) in the overall program region. However, like scenario 1, the program should be designed to proceed slowly, developing adequate infrastructure as it expands geographically. Emphasis should be placed on serving high prevalence villages or sub-villages in their

entirety with relatively little emphasis on targeting within the high prevalence zones.

SCENARIO 6 - High-low prevalence, substantial logistical infrastructure and minimal on-site infrastructure.

Scenario 6 is commonly found in countries where transportation and communication links have been well established between major urban centers. Some sub-areas retain conditions leading to undernutrition while others, in more favorable environmental or economic circumstances, overcome those adverse conditions. Also, the development associated with the logistical infrastructure benefits segments of the society while other segments remain unaffected. This creates pockets of economic and nutritional well-being in otherwise harsh environments.

As with all the high-low prevalence scenarios, an effort to identify the high prevalence zones, at the outset, is likely to prove beneficial. If these zones tend to be more distant from transportation and storage centers, targeting should proceed as in scenario 2--but only in the high prevalence zones. If the zones are uniformly distributed throughout the region, the possibility for more rapid geographic expansion of program services in a highly targeted environment should be exploited.

SCENARIO 7 - High-low prevalence, minimal logistical infrastructure and high on-site infrastructure.

Scenario 7 is rarely encountered. The circumstances which give rise to high on-site infrastructure and minimal logistical infrastructure (see scenario 3) are such that high prevalence scenarios are more likely than high-low areas under this scenario. If this scenario is encountered, preliminary targeting, probably in the form of an

anthropometric survey done by the on-site staff, would identify those zones where resources are most needed.

SCENARIO 8 - High-low prevalence, substantial on-site and logistical infrastructure.

Scenario 8 is common to situations where the benefits of economic development are not uniformly realized by a population. Those segments of the population in a position to capitalize on development usually make up the low prevalence areas.

From a design perspective, this scenario offers an unusual set of choices. On the one hand, one could pursue the dissemination of the benefits of development to the high prevalence zones; on the other, one could proceed toward the prevention and cure of malnutrition through health/nutrition interventions other than supplementary feeding. The former, if it works, might eliminate the need for the latter.

The presence of a strong all-around infrastructure makes it feasible to consider a highly targeted service delivery system. Targeting of this type is probably best achieved using anthropometrics tempered by other data available through the on-site infrastructure.

SCENARIO 9 - Low prevalence, minimal logistical and on-site infrastructure.

Scenario 9 is rarely encountered by nutrition intervenors. Where the environment is inordinately favorable, families flourish despite the general lack of infrastructure. Such environments do not require outside intervention.

If the scenario is encountered, the situation is probably one where malnutrition is linked to poor "nutritional practice" by some members of the community. This suggests targeting resources based on anthropometrics and using any commodity resources for curative purposes.

The intervention should include a nutrition education component designed to enable the relatively few families suffering from poor nutrition to learn how to utilize their resources fully to promote better nutrition.

SCENARIO 10 - Low prevalence, substantial logistical infrastructure and minimal local infrastructure.

This scenario does not differ greatly from scenario 9. The existence of a good logistical infrastructure makes it somewhat less expensive to move commodities and materials to the sites; however, the emphasis of the program should be the education of the poorly nourished on utilizing their resources.

SCENARIO 11 - Low prevalence, minimal logistical infrastructure and substantial local infrastructure.

Upon encountering this scenario, intervention planners should attempt to ascertain the role played by the on-site infrastructure in reducing the prevalence of malnutrition. If the role is positive, the planner should assist the people making up that infrastructure in continuing what they are already doing. Highly targeted services can quite easily be distributed through an effective local organization. If the on-site infrastructure is playing a more neutral role, this scenario is essentially the same as scenario 9.

SCENARIO 12 - Low prevalence, substantial logistical and on-site infrastructure.

Low prevalence and strong infrastructure is indicative of a situation where intervention may be inappropriate. Except for highly targeted services to those who cannot break out of their shell of poverty in the face of a full support system, individuals in this setting do not need external assistance. If there is any place where

sociceconomic targeting (however informal) is helpful, it is in this scenario.

5 SUMMARY OF FINDINGS AND POLICY IMPLICATIONS

5.1 Regardless of which targeting strategy is selected and no matter how well the scheme is implemented, there is a surprisingly large percentage of children who are not included in the program but who should have been based upon their ensuing nutritional status. We call this an error of exclusion. Depending on the local conditions and the targeting strategy employed, this exclusion error can be as high as 20.1%.

5.2 Similarly, regardless of the targeting strategy, there is a significant number of children included in the program who, in retrospect, probably did not need the services provided by the program. We call this an error of inclusion. Depending on the local conditions and targeting strategy employed, this inclusion error was as high as 84.1%.

5.3 Perhaps the most meaningful measure of any given targeting strategy is its error of exclusion (missed at-risk children) taken together with its error of inclusion (included children, not at-risk).

5.4 Results show that the most effective targeting strategy depends heavily on the amount of malnutrition in the population. When the amount (prevalence) is high, strategies which try to discriminate among families or among children within a particular community are less effective. On the other hand, when prevalence is low, the reverse is true.

5.5 Another critical determinant of the best targeting strategy is the amount of existing infrastructure in the region. If there is an ongoing program which is to receive supplementary feeding, targeting to individual children is

more likely to be reasonable. The reason for this tendency is the relatively high cost of implementing a "stand-alone" targeting strategy.

5.6 Finally, the nature of the stated objectives of the local program, especially the relative emphasis between prevention and cure, influences the selection of the most appropriate targeting strategy. Use of anthropometrics is most appropriate for curative programs and child age is most appropriate for preventive programs. In neither instance is socioeconomic targeting, using those variables most often available to program designers and/or implementers, very helpful. Finally, in all cases, geographic targeting based on existing data and/or existing knowledge of a region is a useful first step.

5.7 Results of the cost analysis show that there is an extremely wide range of variation in relative cost within each category. For instance, commodity costs represent anywhere from 42 to 83 percent of the total program cost. Similarly, transportation, storage and handling costs can vary from 4 to 50 percent of the total (Table 3-9, page 55). Variation in cost is due in part to supplement distribution distance and size and method of feeding but perhaps more importantly to the amount of infrastructure available for distribution and local program operation. For instance, in some cases in Africa, transportation cost per ton-kilometer varies fivefold--between $.10 and $.49.

5.8 Two tables which enumerate program cost elements in general, and targeting strategy costs in particular, are provided to help program planners include all relevant costs (Table 3-1, page 50, and Table 3-10, page 57).

5.9 In order to embrace cost considerations, local conditions and the efficacy of different targeting

strategies, twelve distinct scenarios were formulated. These scenarios encompass all possible situations which could be found in a country: high to low malnutrition prevalence, minimal to substantial logistical infrastructure and minimal to substantial on-site infrastructure. For each scenario, suggestions are made regarding the most appropriate targeting strategies (pages 60 through 68).

5.10 Beyond the aforementioned specific recommendations there are two universal recommendations which may have especially significant policy implications.

- It is perhaps self evident that the most appropriate and cost-effective strategy varies dramatically depending upon the stated program goals and objectives, the specific observed rate of malnutrition, the country, the state of existing logistical infrastructure, and the status of on-site infrastructure. It may therefore be quite inappropriate to have specific guidelines which do not respond to these local, context specific conditions.

- The second general implication which can be derived from this study is an outgrowth of the large exclusion errors which were observed in the analysis phase of the study. To define at-risk populations as only those who have already been identified as malnourished ignores the dynamic nature of conditions in the developing world. Rather, at-risk populations should include those young children who may not be malnourished but who, because of age and environmental conditions, have a high likelihood of becoming malnourished.

APPENDIX A.

APPENDIX A.

KOTTAR

The Kottar Social Service Society (KSSS), founded in 1962, is a volunteer agency affiliated with the Catholic Church in the diocese of Kottar. This diocese is located in the Kanyakumari District of the State of Tamil Nadu in the southern tip of India.

The entrepreneurial drive behind KOTTAR is the presence of a Belgian priest and sister who make their permanent home in the district. As a result of this primary identification with the study area, the pace of the project has been slower and community involvement has been greater than in projects where the primary change agents devote only a portion of their lives to intervention. Much of the time since 1962 has been spent in community embedding. The KSSS tries to work out strategies to promote development with villages which show some interest in working with the Society.

In 1972, the KSSS created its Community Health Development Program (CHDP), which includes a take-home supplementary feeding program, health and nutrition education, and some primary health care, including immunizations. The CHDP covers more than 38,000 preschool children in 124 villages. Many of the participating villages have participated in other types of interventions. A potters' cooperative was formed, and an outgrowth of its financial success has been a potters' housing cooperative. Fishing villages have experimented with larger boats and net weaving cooperatives. The KSSS has attempted to organize

people to plant cactus in areas subject to soil erosion, to build tube wells to level out fluctuations in water availability, and to reconstruct roads destroyed by floods.

There has been concern on the part of the founders of the project that their presence is too critical a component of the intervention; that is, durability will not be achieved until local people are trained to provide the organizational skills and the bridges to the outside world now provided by the Belgian clergy. (Many of the KSSS activities utilize outside resources found by the father and sister in the developed world.) At this time, they are working to achieve this durability.

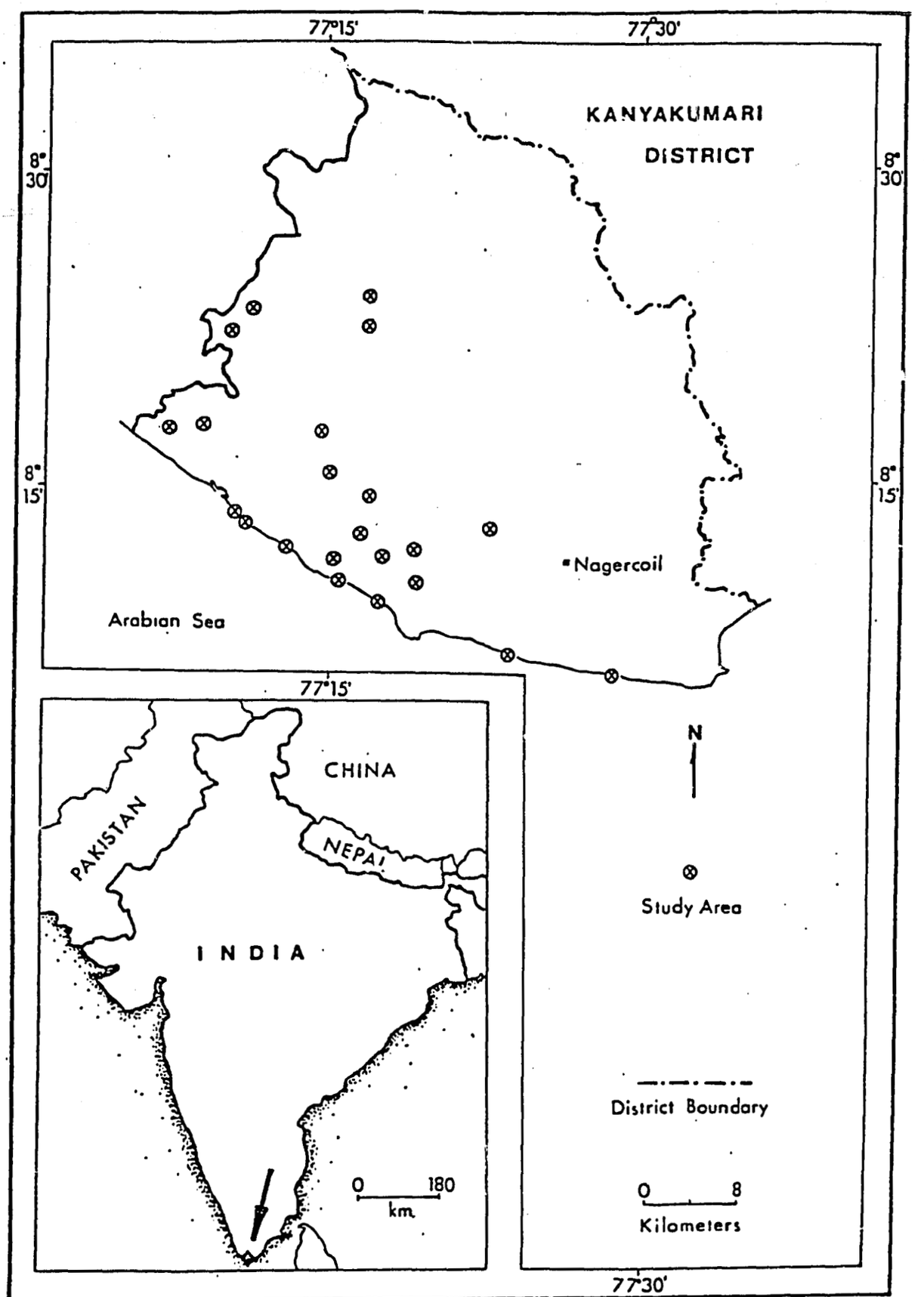
Kottar - Data

The data describing the Kottar intervention come from a survey done with funding from the Rockefeller Foundation and CSF by Dr. John Osgood Field, formerly of the International Nutrition Planning Program at MIT and now at the Nutrition Institute of Tufts University. The survey was administered in 1977 and consisted of health and weight histories of approximately 4,000 children (taken from weight cards kept as part of the CHDP) and cross-sectional survey of socioeconomic information on the families of these children.

The data were keypunched at MIT and a tape containing the card images was provided by Dr. Field to facilitate analysis at Community Systems Foundation. The process of preparing the data for analysis proved to be far more complex than anticipated due to keypunching and coding problems. It was therefore especially helpful to be able to utilize the data base management system for facilitating the next stages of analysis.

First, using a unique FORTRAN computer program written especially to perform these tasks, the longitudinal data were extracted from the surveys, cleaned, and expanded by the addition of several variables computed from the raw

KSSS PROGRAM - KANYAKUMARI, INDIA



Community Systems Foundation

data. These variables included the percent of standard scores using the local standard, the Harvard standard, and the NCHS-CDC standard. The cleaning process reduced the number of records containing at least one error from 25 percent to 2 percent. The final data file contained weight and health time series for 4,075 children--a total of 79,687 observations.

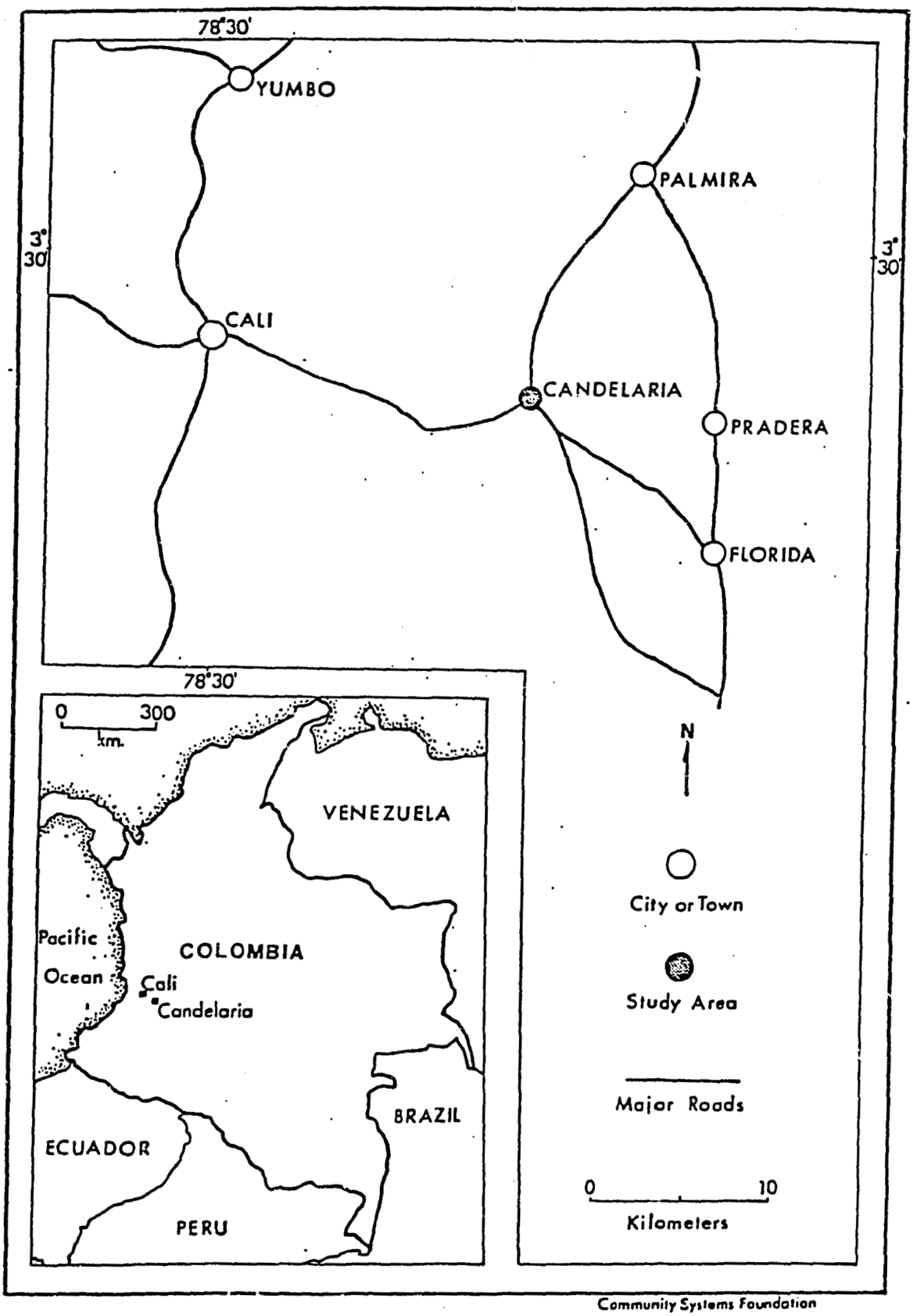
Similarly, special FORTRAN programs were compiled to process the cross-sectional portion of the data set. Whereas 40 percent of the interviews contained some error at the start, again only 2 percent of the interviews could not meet the test for errors after cleaning.

Both the longitudinal and cross-sectional data files were incorporated into the MICRO data base management system. To reduce both the complexity of the analysis and the costs of data processing, a subset of the data set was assembled including weight-health observations on the children from only six time periods. These periods were six months apart, starting in January of 1975 and concluding with June 1977, the month of the survey. This subset of the data set was passed to the MIDAS statistical system for analysis.

CANDELARIA AND CANDELARIA REVISITED

The city of Candelaria, Colombia, has had health-related interventions since 1958, when the Board of the Faculty of Medicine at the Universidad del Valle in Cali decided to establish a rural health center there for teaching purposes. The Promotora Program (1968-1974) which generated the data used in our project is a step in this longer "life-cycle," an addition to an ongoing set of activities initiated by the faculty of the University. Forerunners of the Promotora Program included the establishment of a rural health center in 1958, a nutrition recuperation center in 1962 (which existed for two years),

PROMOTORA PROGRAM - CANDELARIA, COLOMBIA



Community Systems Foundation

an outpatient treatment program including food supplementation (which replaced the recuperation center), and municipal sewer and water programs.

The Promotora Program represents an effort by the medical community in Cali to reach out into the homes of rural residents, rather than treat only those who visited a medical facility. When it began, the presence of the medical contingent was already accepted in Candelaria; there remained the embedding of the new program into the community. The strategy adopted was the training and use of volunteers from Candelaria as the home visitors. The tasks of the volunteers included provision of nutrition education, hygiene education, education on the utilization of other existing health services, data gathering, and referrals to the appropriate health service facility. This direct participation of community members increased the program's acceptability, while at the same time freeing the more highly skilled health care personnel for tasks more appropriate for those skills. The program remained viable for six years. In 1974, the government took over the staffing of the health center in Candelaria and the Promotora visits were phased out.

Candelaria - Data

The data in Candelaria consist of time series data on the anthropometric measurements, some morbidity information, and a rich collection of family socioeconomic variables. Eighteen hundred families participated at some time during the six-year period of the program, providing a total of 9,800 observations on 1,051 children.

In what to us is a unique activity in the nutrition field, the population of Candelaria was resurveyed in 1976, two years following program termination. The resurvey was administered to participants and nonparticipants in the program (most nonparticipants were new families and in-

migrants). It included the gathering of anthropometric and socio-economic data.

THAILAND

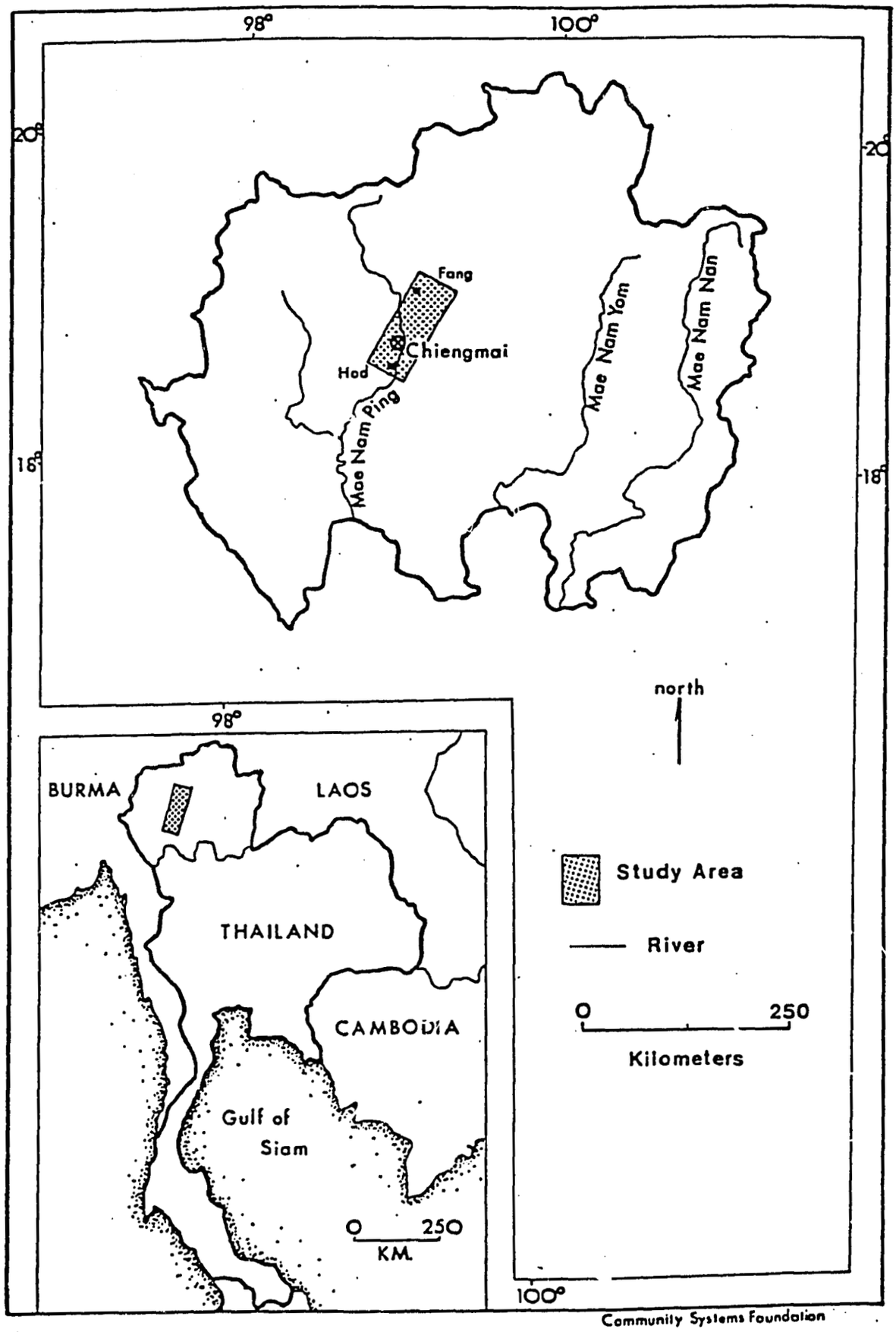
The Thailand Rice Fortification Project, conducted by Drs. Stanley N. Gershoff and Robert D. McGandy of the Harvard School of Public Health, was more of a research study than an intervention--a study to measure the health benefits to be derived from the fortification of rice with lysine, threonine, thiamin, riboflavin, vitamin A, and iron. At the time of the project's conception (1968), scientists were arguing the issue of the wisdom and efficacy of large-scale protein fortification. This was a field study to provide more evidence for that debate.

The Chiang Mai region of Thailand was selected because the study area had to: (1) have a population that derived the bulk of its calories from rice; (2) provide evidence of protein malnutrition; and (3) have infectious disease not so rampant as to obviate the beneficial effects of the program. Although the main component of the program was rice fortification, day-care centers were constructed in some villages to demonstrate the good intentions of the intervenors, and a small-scale education program was conducted in the villages to secure the cooperation of the villagers. These last components provided the community embedding components for the study. The study was terminated in January of 1975 (it was actually begun in 1971) without any scaling-up.

Thailand - Data

Children from the 29 villages were given physical examinations twice a year--once in the dry season after harvest and once in the monsoon season. Anthropometrics plus some biochemical tests were made, and clinical observations were systematically recorded. Hand x-rays were

RICE FORTIFICATION PROGRAM - CHIANG MAI, THIALAND



Community Systems Foundation

taken yearly and morbidity data were collected starting in 1972. (The data are the most extensive medical data available to CSF.)

The 29 villages were divided into five groups, with each group receiving a different combination of fortification and/or day care centers. One group was designated as a pure control, one as a placebo control with day care centers, two with different types of fortification and day care centers, and the fifth with just fortification.

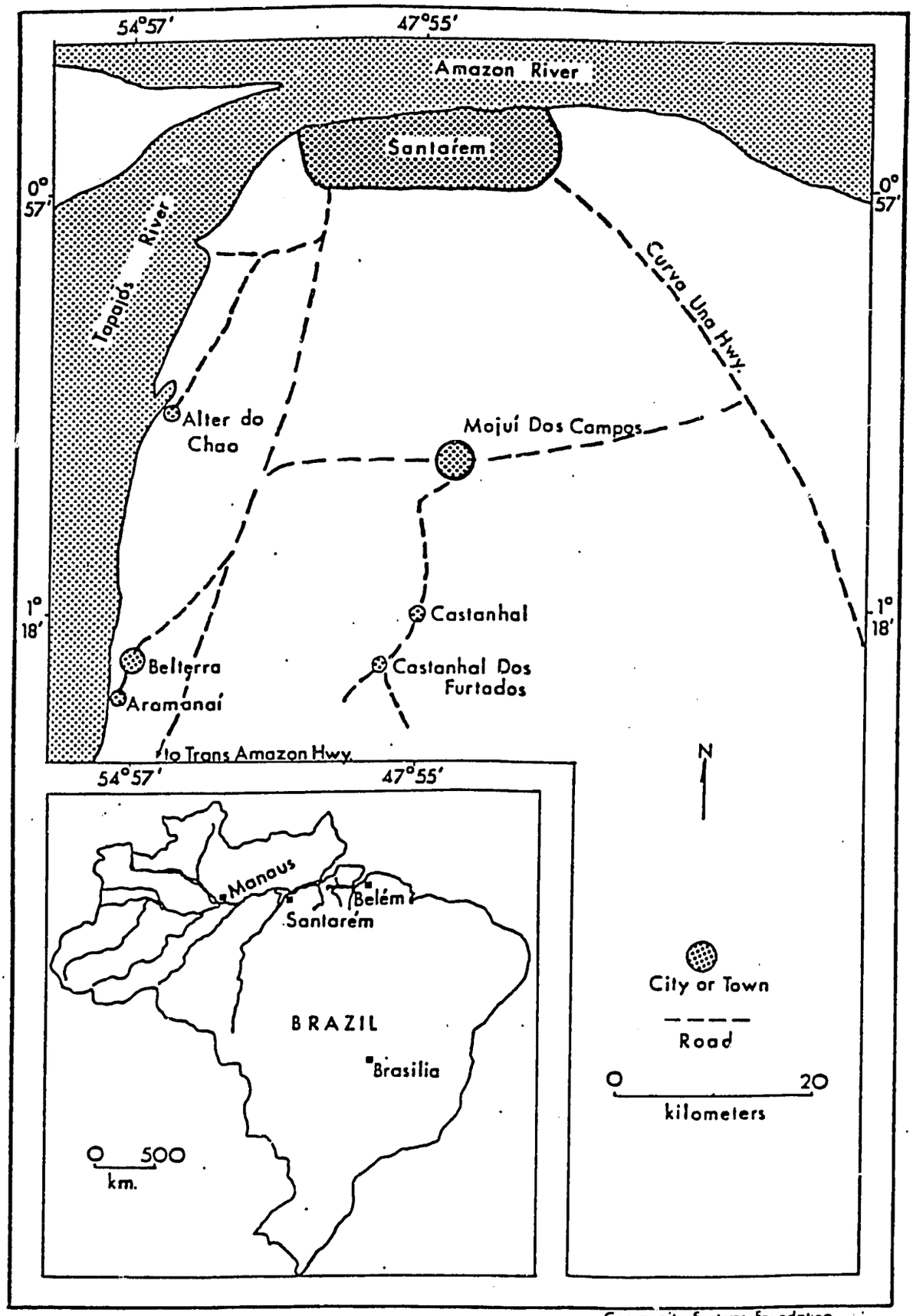
ESPERANÇA

Esperança is a private, non-profit organization whose primary goal has been the provision of basic health care to a population living in northern Brazil's central Amazon River basin. Because of marked discontinuities in the tenure of the primary change agents who have contributed to the Esperança effort, the intervention has passed twice through the life cycle stages and is currently sustaining a high level of activity, including an expansion of services to many more rural villages in the region.

The original program was initiated by the late Father Luke Tupper who, as the only priest-doctor in the Franciscan Order, traveled in the Amazon by whatever means he could devise, providing medical care to the isolated river communities. His recognition of the need for outside resources, particularly to establish a massive immunization program, prompted the formation of Esperança, Inc. in Phoenix, Arizona, in 1970. In 1972, Father Luke opened a medical clinic in Santarém on land donated by the Franciscan Order, and Esperança bought a boat which was converted to a medical hospital and brought to the Amazon in May 1974.

The project was essentially dormant until January 1977. At that time, under a new director, Dr. Harry Owens, the program experienced a rebirth. The medical clinic reopened under the direction of Dr. Fred Hartman. This program

ESPERANCA PROGRAM - SANTARÉM, BRAZIL



Community Systems Foundation

rebirth included the addition of a more "preventive" program component for Esperança. This component stressed early treatment of diarrhea, oral rehydration, reduction of parasites, regular weighing of children and/or home visits of children under six, and the holding of general education programs. A nutrition rehabilitation center was opened in Santarém to provide intensive care to third-degree malnourished children who "lived" at the center until they recovered. An ambulatory program for other malnourished children and their families was also established. Finally, an outreach program in two communities, Mojui dos Campos (pop. 3,000) and Alter do Chao (pop. 800), was started. These two communities were chosen because of community-initiated requests for Esperança medical services. The outreach programs were similar to the ambulatory program in Santarém--consultations with a visiting doctor or the trained "barefoot" doctor manning a health post, regular child weighings, and an education program.

In June of 1978, Dr. Hartman left Brazil. Dr. Owens was also no longer on-site. As a result, the outreach programs--the Esperança component of most interest to this project--went into a "durability" stage characterized by stagnation. Particularly in Mojui dos Campos, the larger and more poorly organized village, the activities of the health post were sporadic and infrequent. In the smaller village, Alter do Chao, the program continued to operate as anticipated.

One year later, Dr. Owens returned to Brazil with a public health specialist, Steve Alexander, to pump renewed life into the existing program. The resources for this activity came from a grant from PACT to "scale-up" the outreach program to cover eighteen villages for two years. Additional health posts were opened and more health workers trained.

Esperança - Data

As part of its initial outreach program, the Esperança staff administered an extensive epidemiological survey of all children in Mojui dos Campos and Alter do Chao in 1977 and 1978. The survey was taken for three reasons: (1) to obtain baseline data for diagnosing community problems; (2) to obtain baseline data for measuring program impact; and (3) to identify and describe communities to serve as a "laboratory" for students at the University of Para.

The survey was administered in four villages--the two program villages and two other "control villages." Initially, interviews were done in Mojui and the two control villages. The request for Esperança services from Alter do Chao some six months later led to its inclusion in the program. This inclusion of Alter do Chao as both a program and survey site resulted in a neat experimental design pairing two inland villages, Mojui and Castanhal, and two coastal villages, Alter do Chao and Aramanai. The intention of the Esperança staff was to resurvey the same villages two more times at intervals spanning five years.

The first resurvey, conducted in May of 1979, was jointly administered by Esperança staff and staff from Community Systems Foundation (CSF). Eighteen months had elapsed between surveys for three of the four villages, while only twelve months had passed for Alter do Chao. The resurvey questionnaire contained more detail than the original; however, care was taken to preserve comparability between the two. Both included socioeconomic, family history, medical, and anthropometric data.

The data were keypunched and entered directly into the data base management system, MICRO. The MICRO system facilitates the merger of survey and resurvey data into a single data base for comparative analysis, and will enable Esperança to add to the data base easily in the future. Errors were removed from the data by using the facilities of

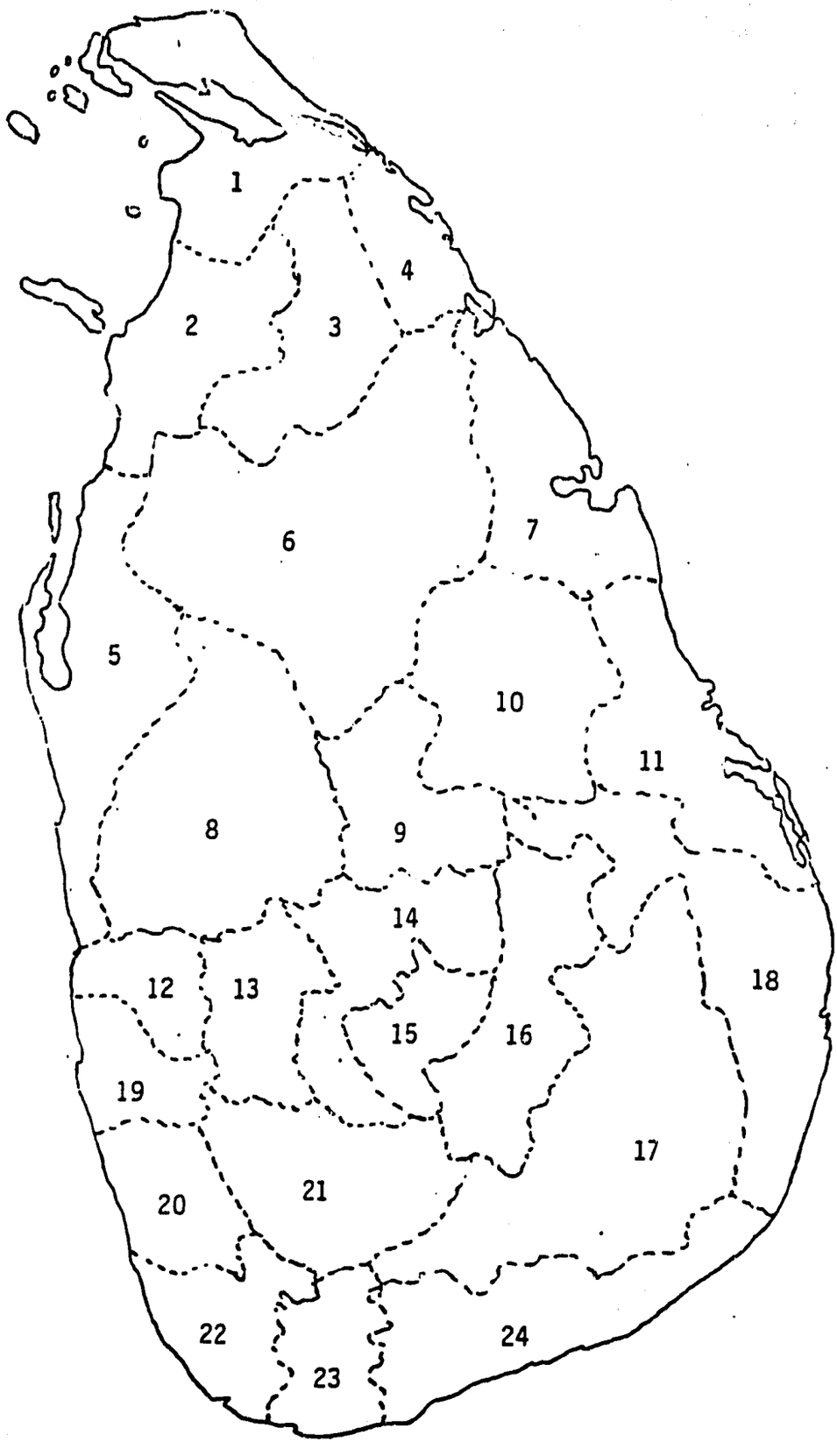
the data base management system. Variables with "illegal" codes could not be entered into the system until they were corrected, and consistency checks using the MICRO command set were done to locate inconsistent entries in related questions. Finally, subsets of the data set were constructed using MICRO. These were passed to the statistical system, MIDAS, for analysis.

SRI LANKA

The reader is referred to Nutrition Programs in Sri Lanka Using U.S. Food Aid: An Evaluation of P.L. 480 Title II Programs, by William D. Drake, et al., October 1982, Community Systems Foundation in coordination with the U.S. Agency for International Development, Contract Number AID/SOD/PDC/0262-I-05-1010-00.

A map of Sri Lanka showing its districts follows this page.

MAP OF
SRI LANKA



Districts

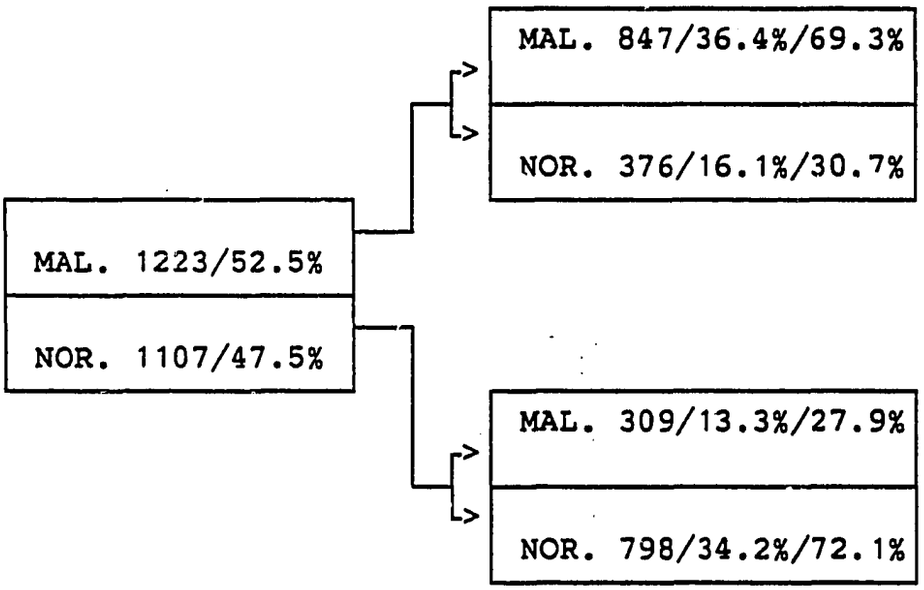
1. Jaffna
2. Mannar
3. Vauniya
4. Mullaitivu
5. Puttalam
6. Anuradapura
7. Trincomalee
8. Kurunagala
9. Matale
10. Polonnaruwa
11. Batticoloa
12. Gampaha
13. Kegalle
14. Kandy
15. Nuwara Eliya
16. Badulla
17. Monaragala
18. Amparai
19. Colombo
20. Kalutara
21. Ratnapura
22. Galle
23. Matara
24. Hambantota

APPENDIX B.

TARGETING STRATEGIES FOR KOTTAR DATA SET

T_1. SELECTED POPULATION = (100%)

•Preschoolers to 60 months

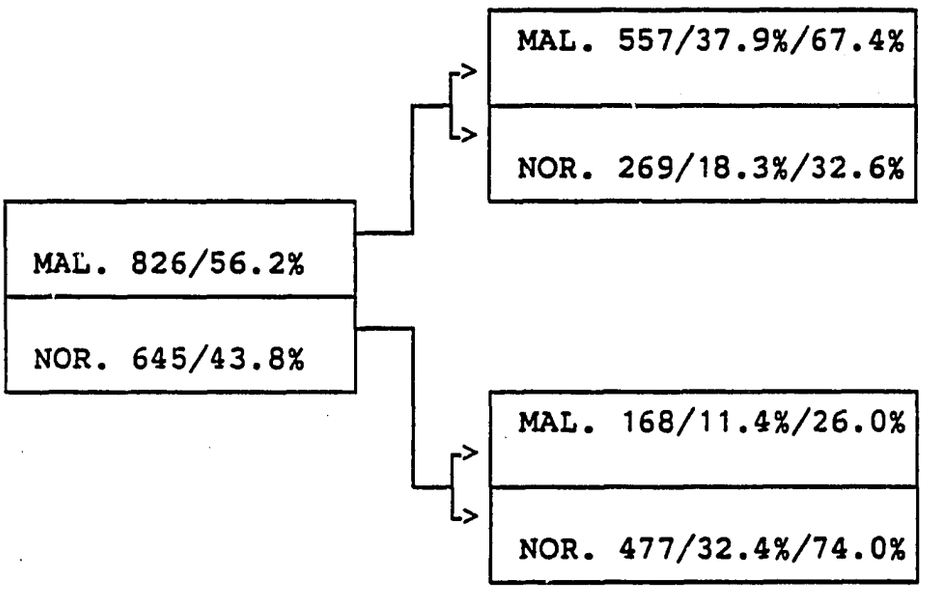


Note: The first number represents the actual number of individuals in any particular category of the sample; the first percentage represents the proportion of selected (or excluded) population; the second percentage represents the proportion derived from its respective proportion (indicated by arrows) the previous year.

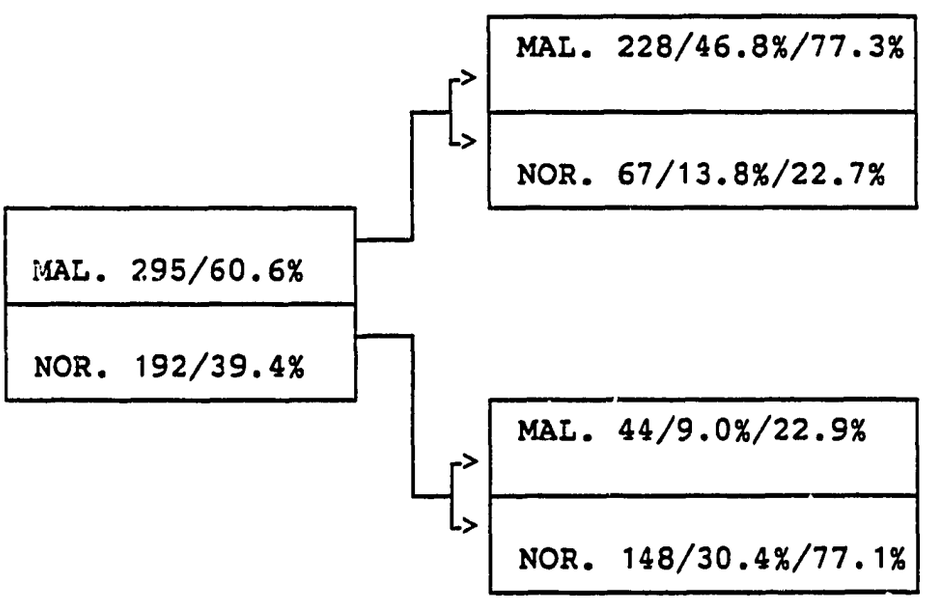
- The NCHS/CDC standard is used exclusively for referencing weight-for-age measurements.
- Malnourished indicates Grade II or Grade III by Gomez classification.
- Normal indicates Grade I or Normal by Gomez classification.

T_2. SELECTED POPULATION = (75.1%)

- Preschoolers of age 7 to 24 months.

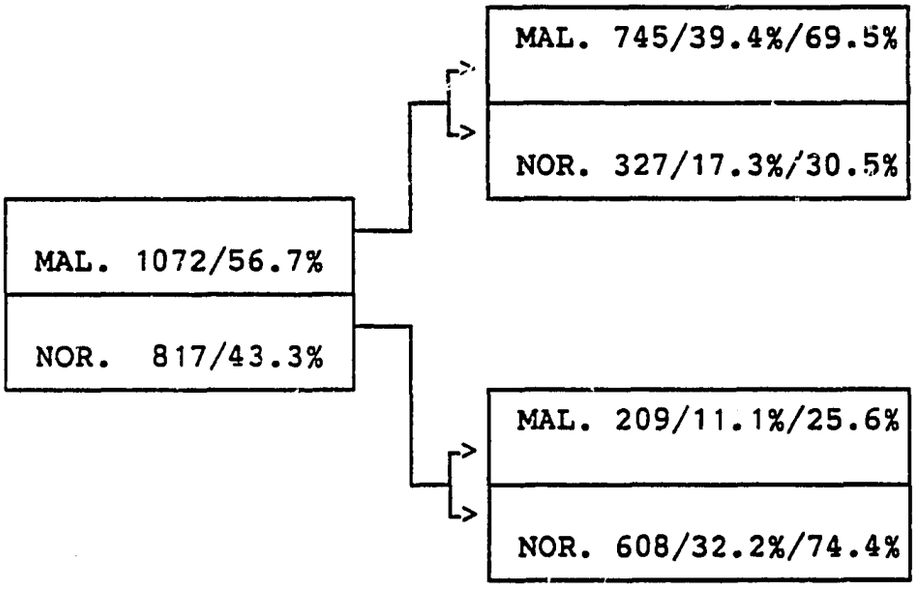


EXCLUDED POPULATION:

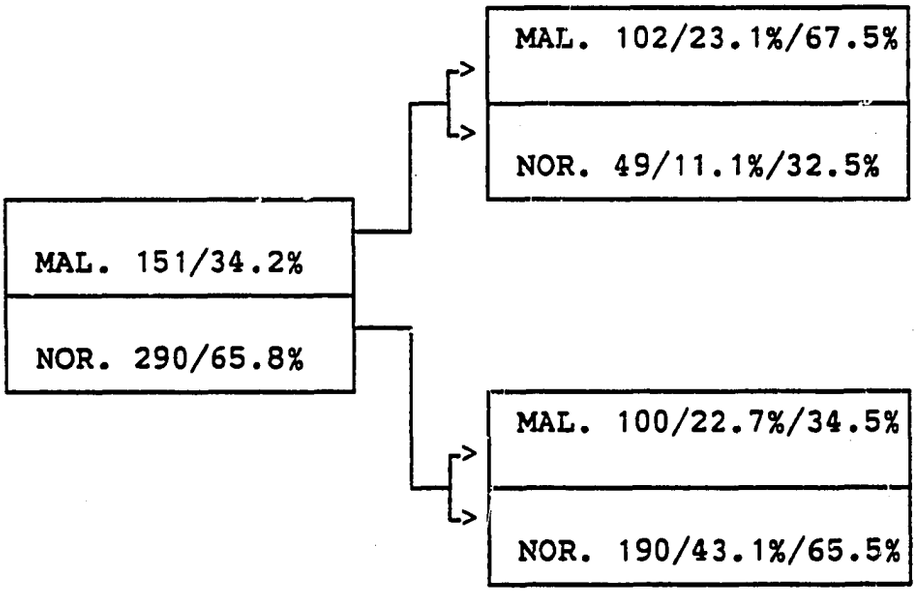


T_3 SELECTED POPULATION= (81.1%)

•Preschoolers of age 7 to 36 months

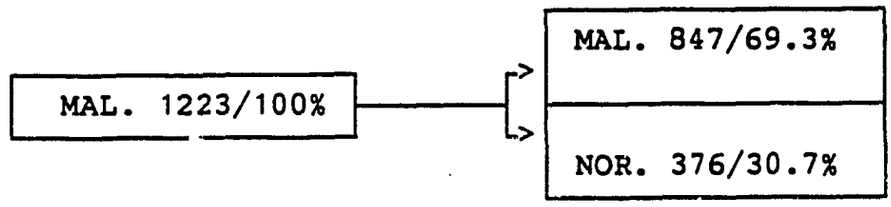


EXCLUDED POPULATION:

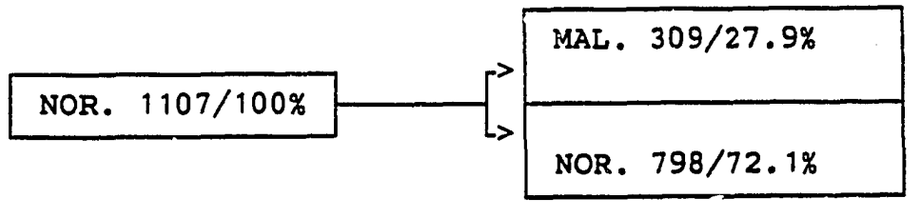


T_4. SELECTED POPULATION= (52.5%)

•Preschoolers who are diagnosed as malnourished (less than 75% of NCHS standard)

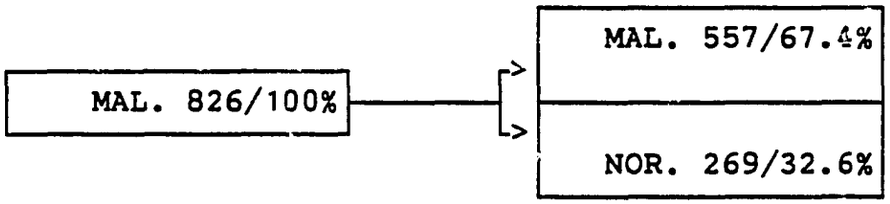


EXCLUDED POPULATION:

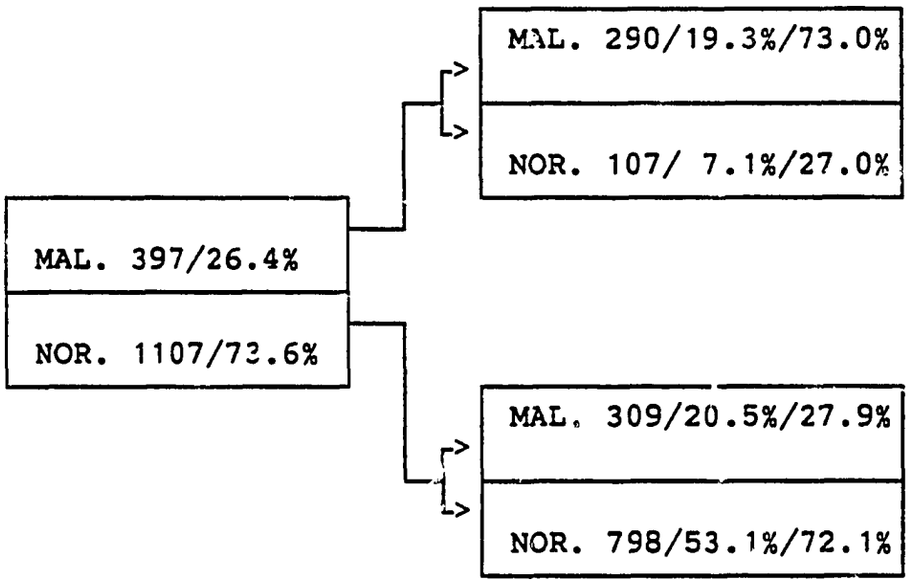


T_5. SELECTED POPULATION = (35.5%)

- Preschoolers of age 7 to 24 months who are malnourished

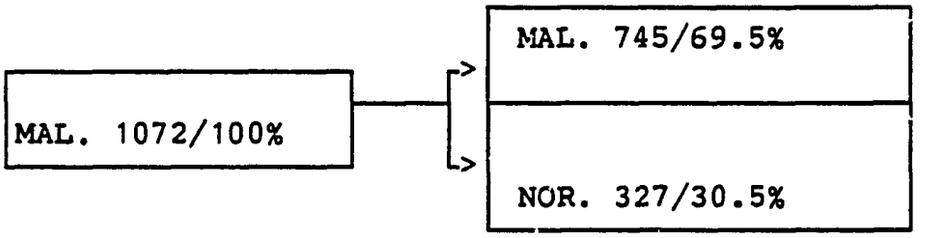


EXCLUDED POPULATION:

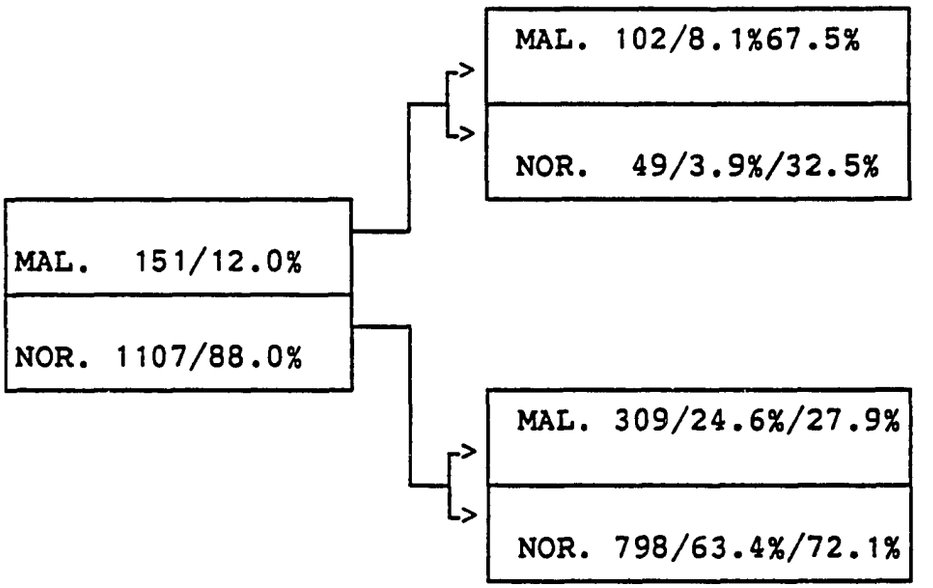


T_6. SELECTED POPULATION= (46.0%)

- Preschoolers of age 7 to 36 months who are malnourished

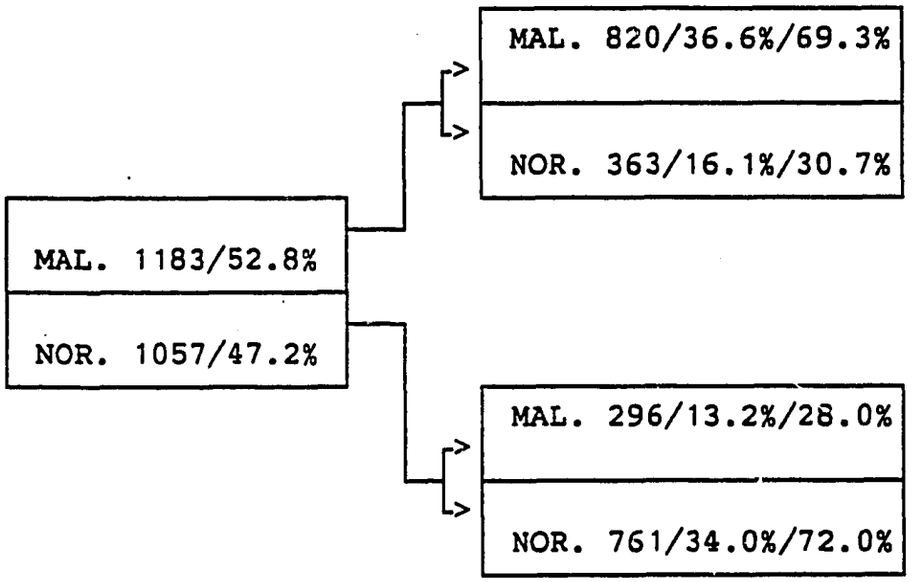


EXCLUDED POPULATION:

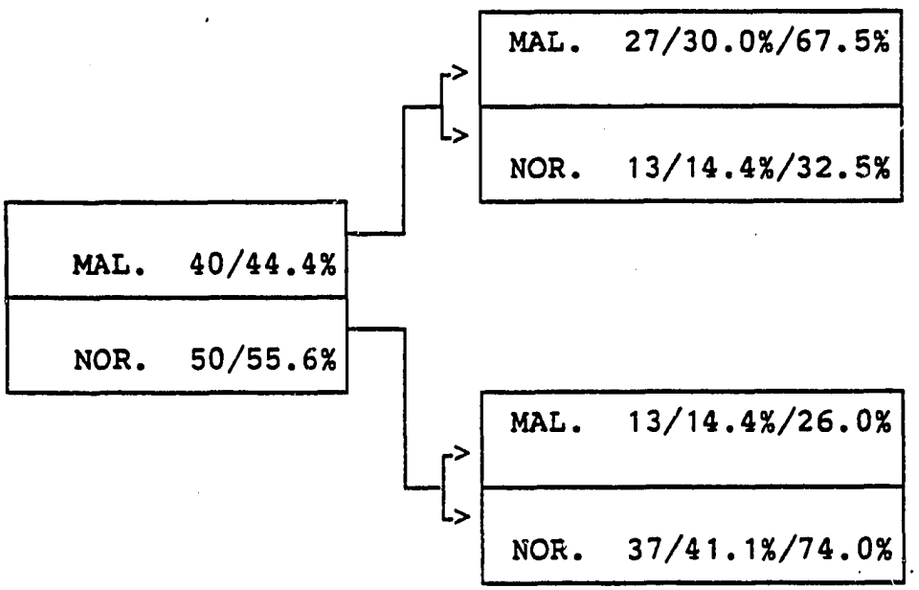


T_7. SELECTED POPULATION = (96.1%)

- Preschoolers in families determined to be at extreme risk by socioeconomic indicators

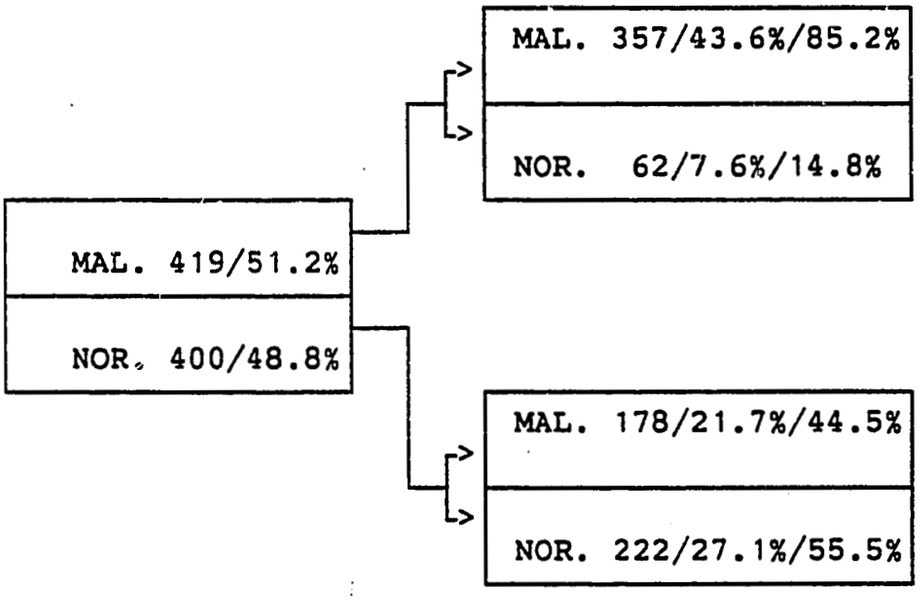


EXCLUDED POPULATION:

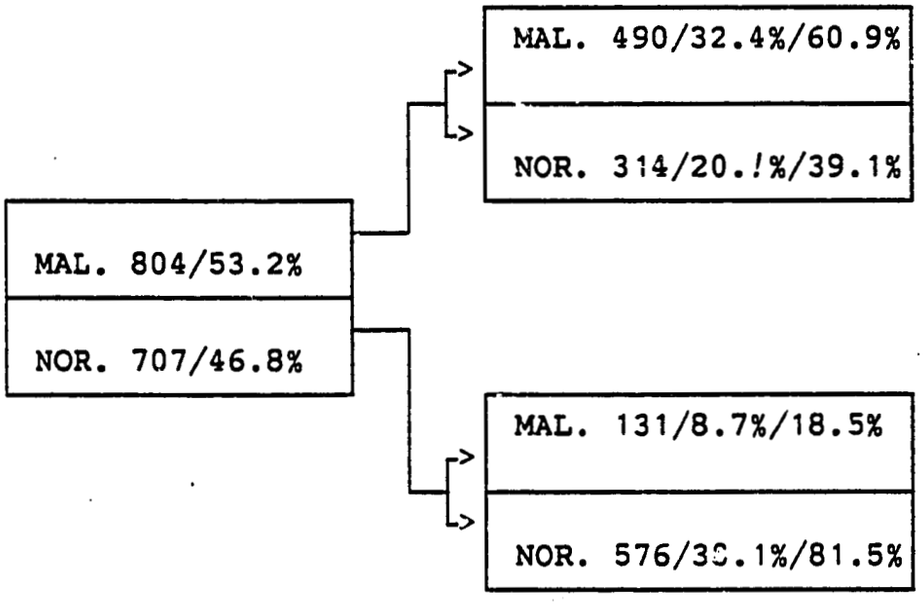


T_8. SELECTED POPULATION = (35.2%)

•Preschoolers in villages in which the average nutritional status is less than 75%, or in villages in which 5% or more preschoolers are 3rd degree malnourished (i.e., Once a village is selected by these criteria, all preschoolers in that village are targeted.)

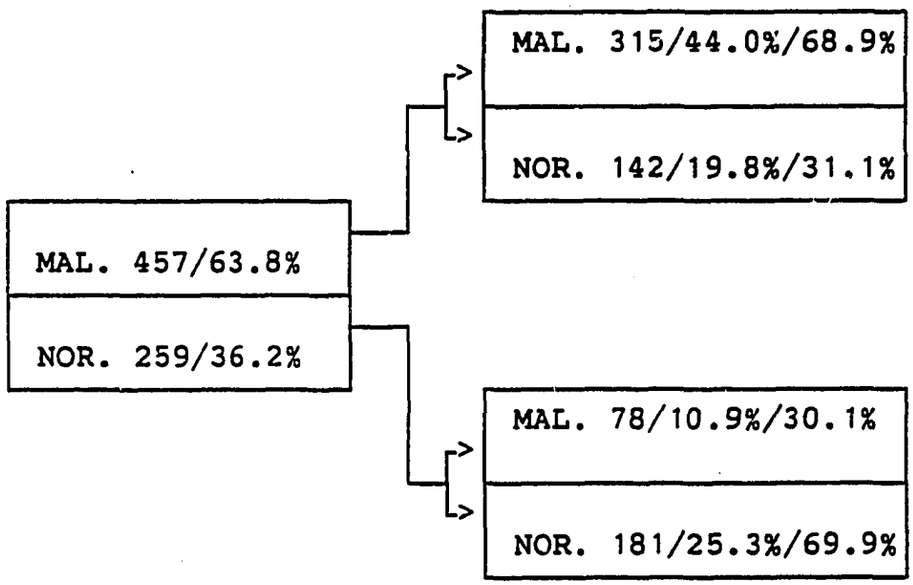


EXCLUDED POPULATION:

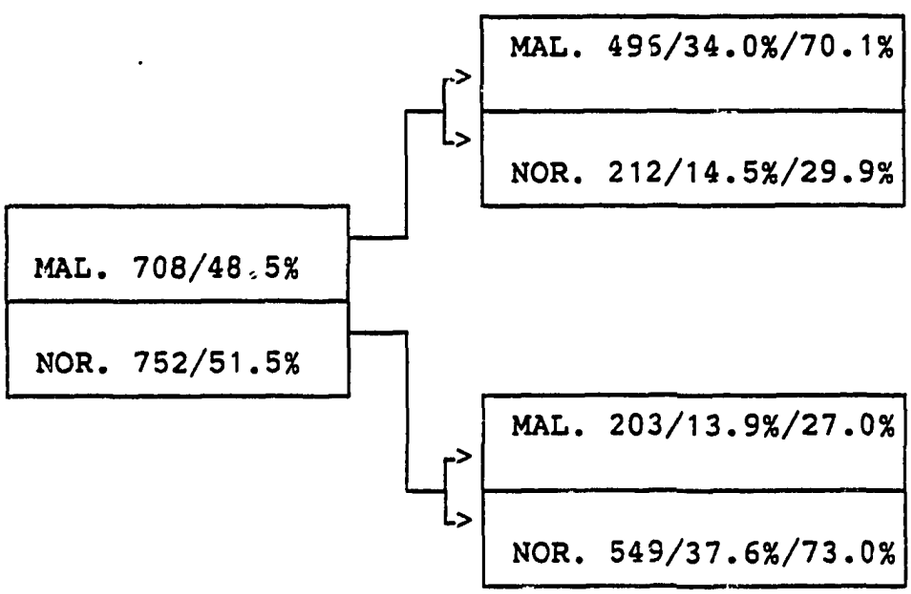


T_9. SELECTED POPULATION = (32.9%)

•Preschoolers who failed to gain weight from one month to the next

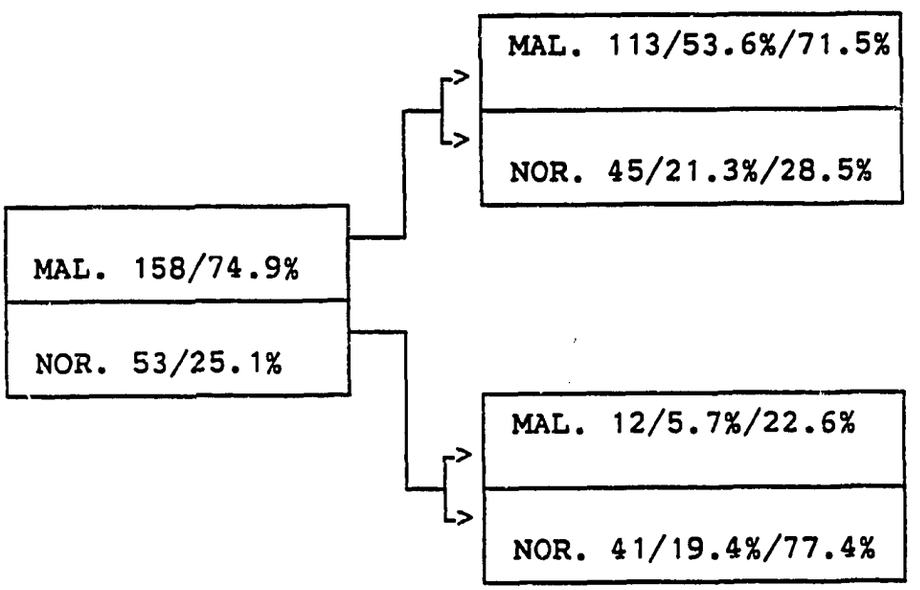


EXCLUDED POPULATION:

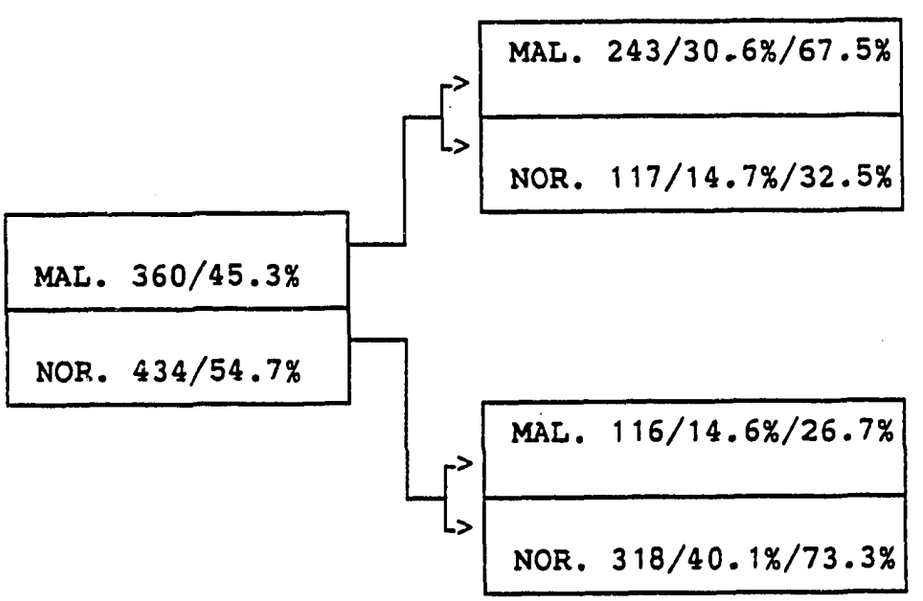


T_{10}. SELECTED POPULATION = (21.0%)

- Preschoolers who failed to gain weight in 2 consecutive months.



EXCLUDED POPULATION:

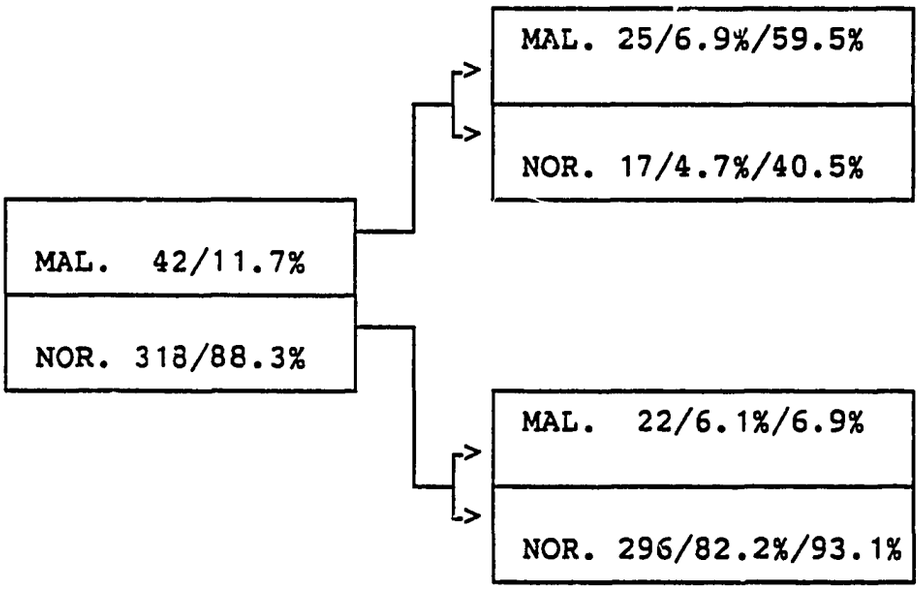


APPENDIX C.

TARGETING STRATEGIES FOR CANDELARIA DATA SET

T_1. SELECTED POPULATION = (100%)

•Preschoolers to 60 months

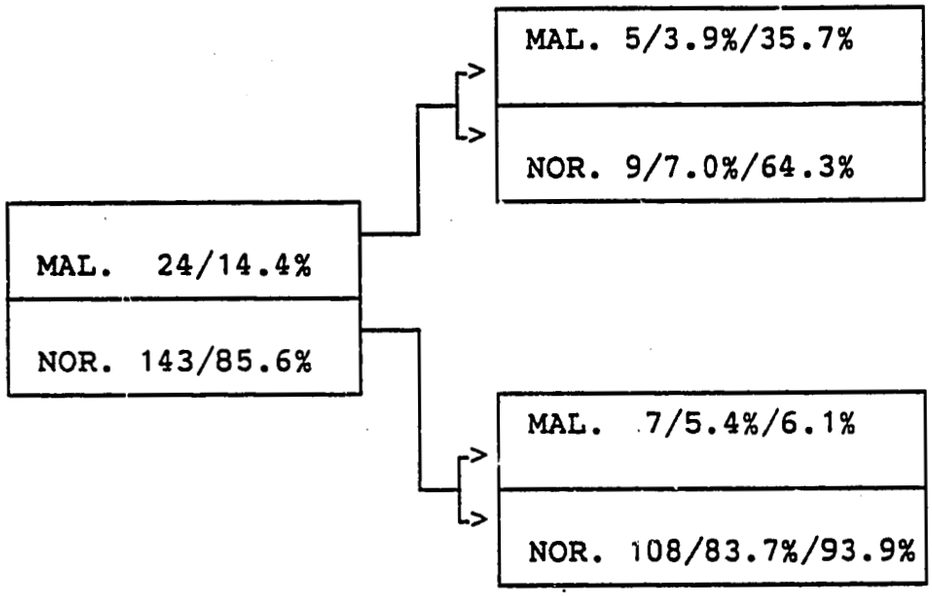


Note: The first number represents the actual number of individuals in any particular category of the sample; the first percentage represents the proportion of selected (or excluded) population; the second percentage represents the proportion derived from its respective proportion (indicated by arrows) the previous year.

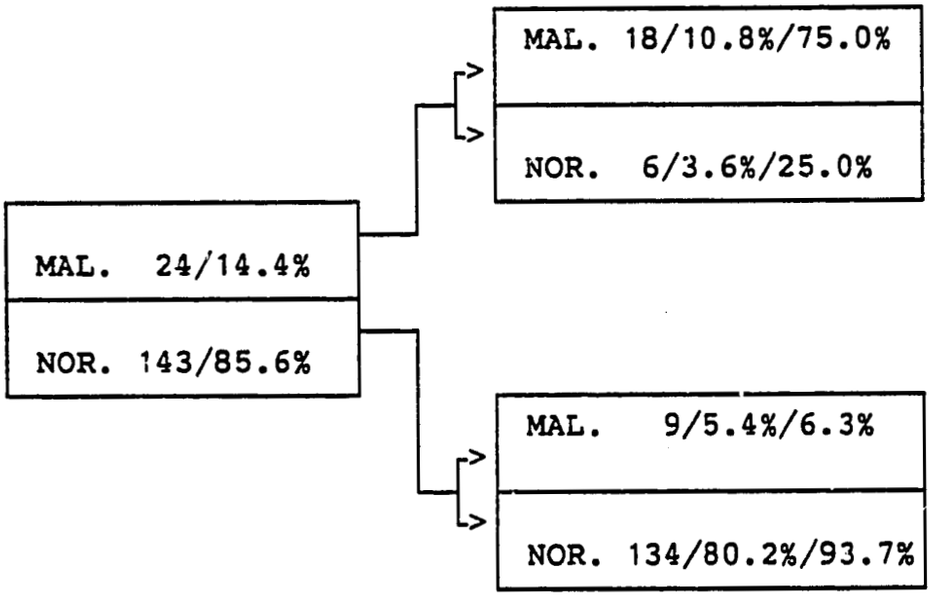
- The NCHS/CDC standard is used exclusively for referencing weight-for-age measurements.
- Malnourished indicates Grade II or Grade III by Gomez classification.
- Normal indicates Grade I or Normal by Gomez classification.

T_2. SELECTED POPULATION = (43.6%)

•Preschoolers cf age 7 to 24 months.

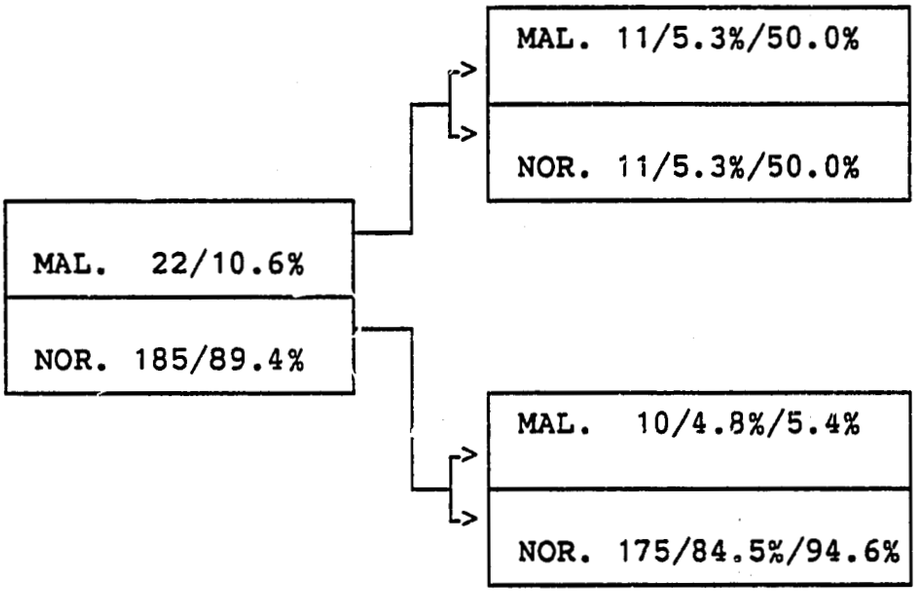


EXCLUDED POPULATION:

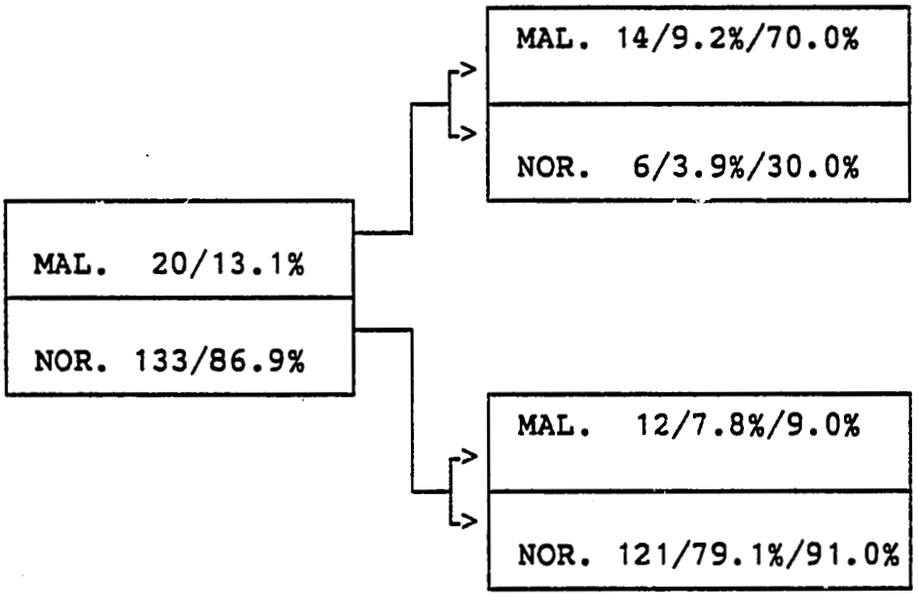


T_3 SELECTED POPULATION = (57.5%)

- Preschoolers of age 7 to 36 months

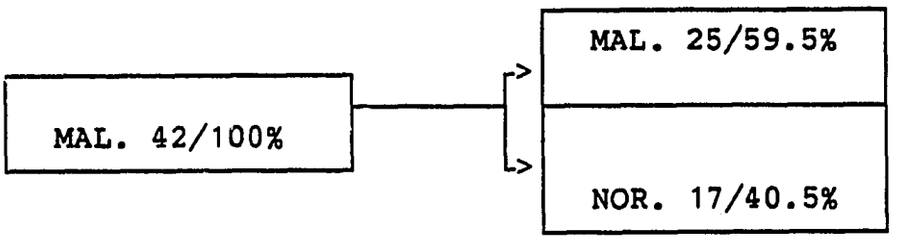


EXCLUDED POPULATION:

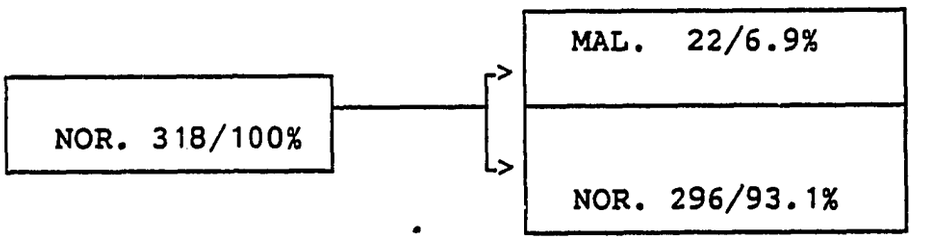


T_4. SELECTED POPULATION= (11.7%)

•Preschoolers who are diagnosed as malnourished (less than 75% of NCHS standard)

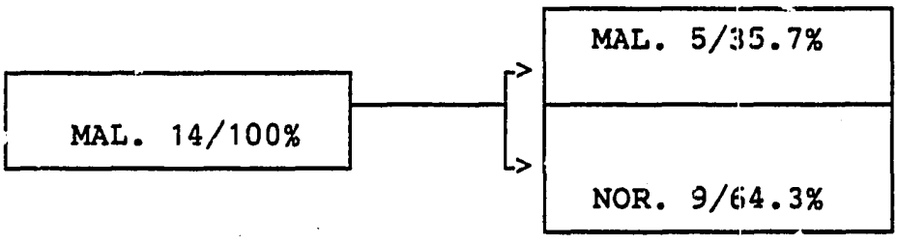


EXCLUDED POPULATION:

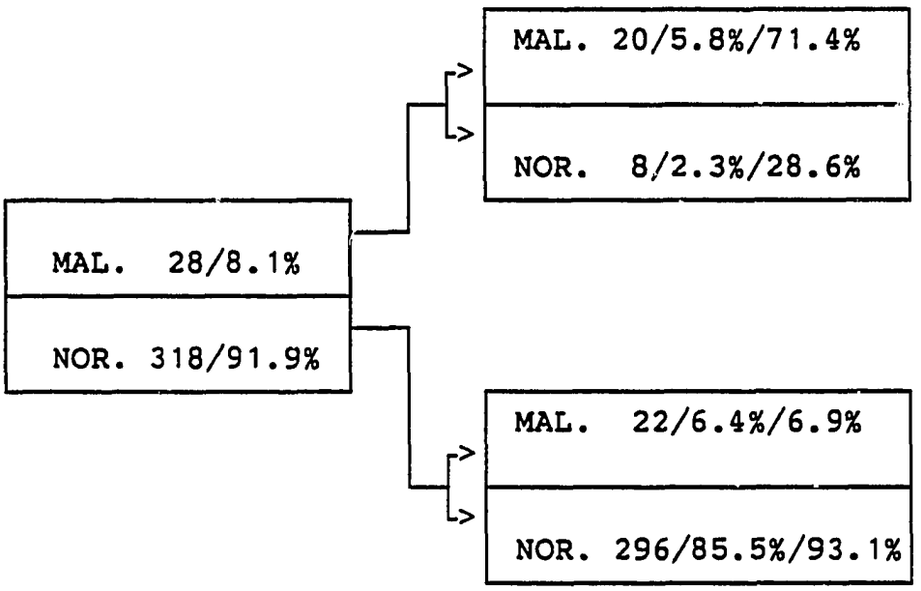


T_5. SELECTED POPULATION = (3.9%)

•Preschoolers of age 7 to 24 months who are malnourished

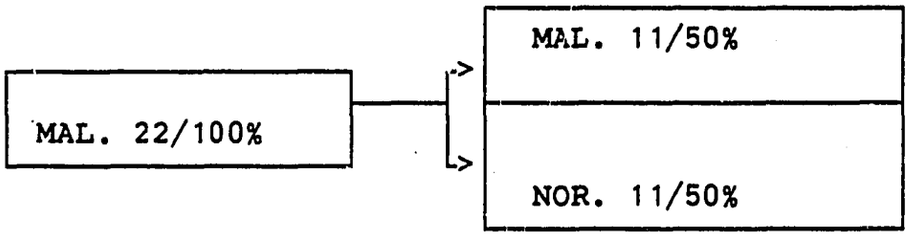


EXCLUDED POPULATION:

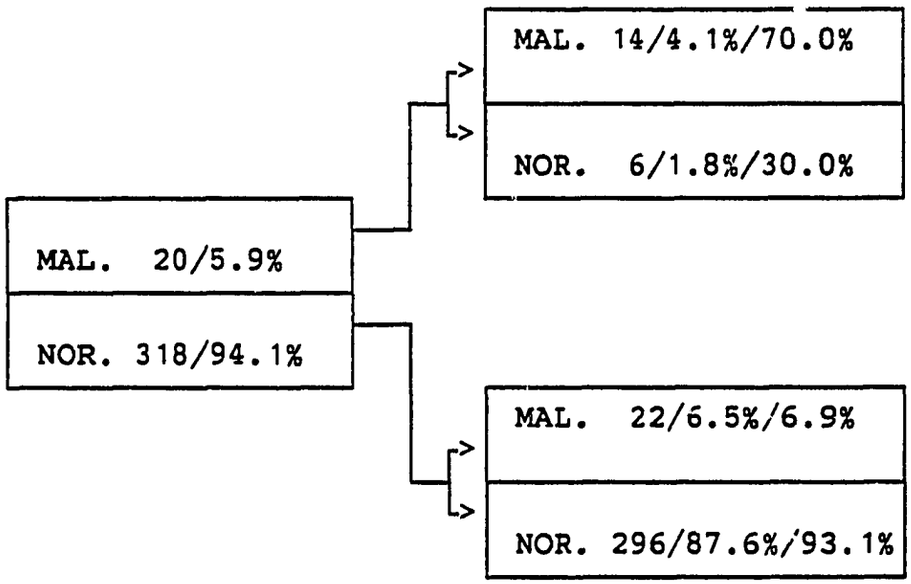


T_6. SELECTED POPULATION= (6.1%)

- Preschoolers of age 7 to 36 months who are malnourished

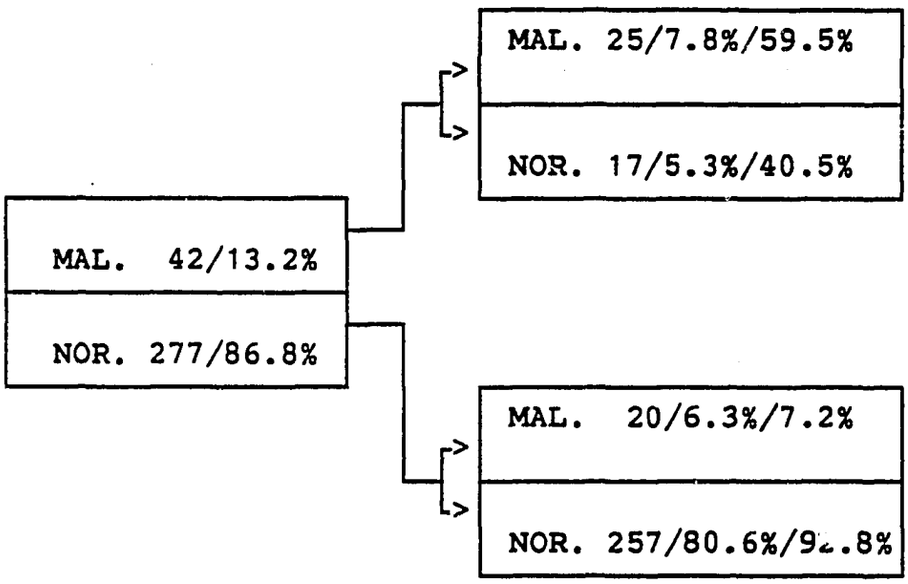


EXCLUDED POPULATION:

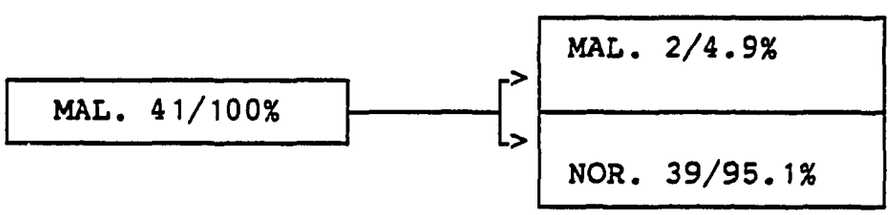


T_7. SELECTED POPULATION = (88.6%)

- Preschoolers in families determined to be at extreme risk by socioeconomic indicators



EXCLUDED POPULATION:

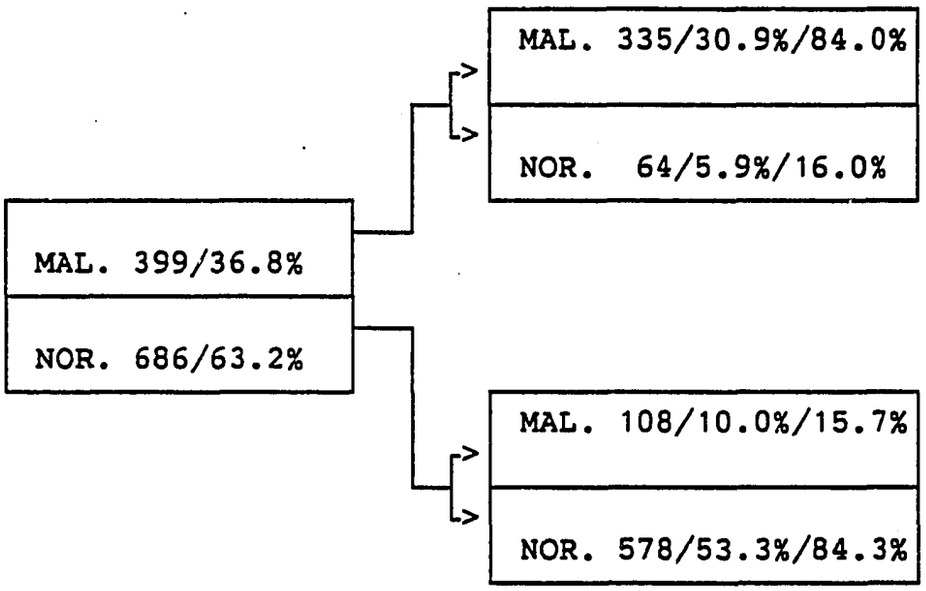


APPENDIX D.

TARGETING STRATEGIES FOR THAILAND DATA SET

T_1. SELECTED POPULATION = (100%)

•Preschoolers to 60 months

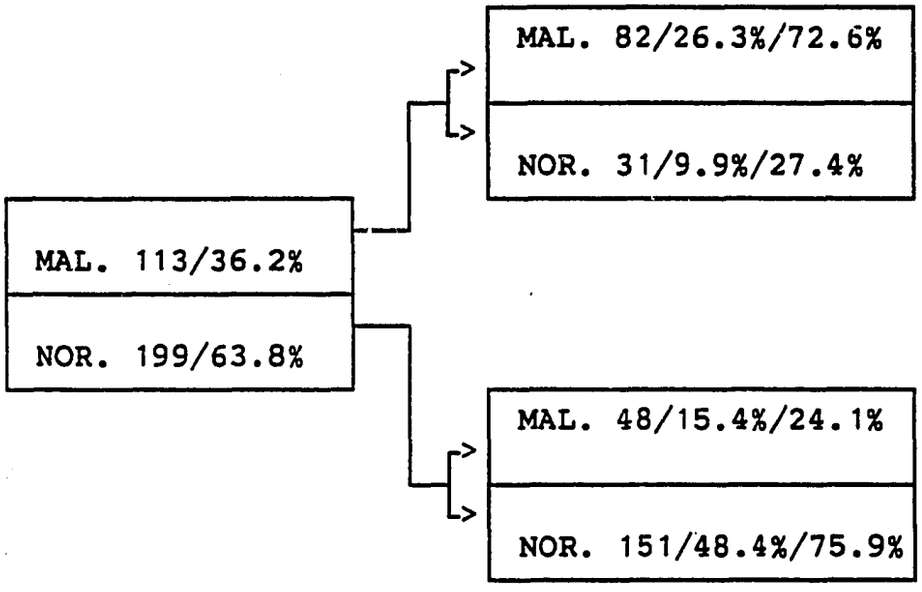


Note: The first number represents the actual number of individuals in any particular category of the sample; the first percentage represents the proportion of selected (or excluded) population; the second percentage represents the proportion derived from its respective proportion (indicated by arrows) the previous year.

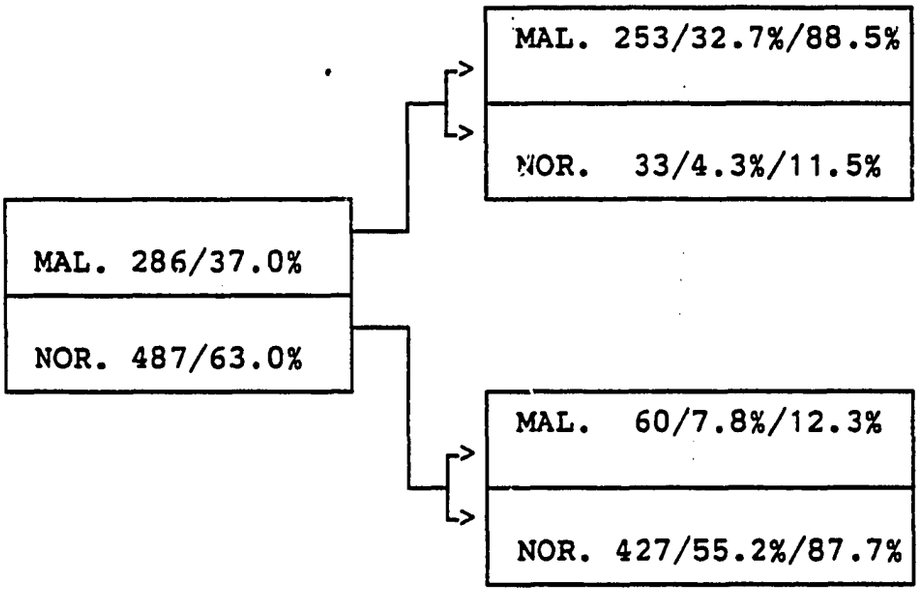
- The NCHS/CDC standard is used exclusively for referencing weight-for-age measurements.
- Malnourished indicates Grade II or Grade III by Gomez classification.
- Normal indicates Grade I or Normal by Gomez classification.

T_2. SELECTED POPULATION = (28.8%)

- Preschoolers of age 7 to 24 months.

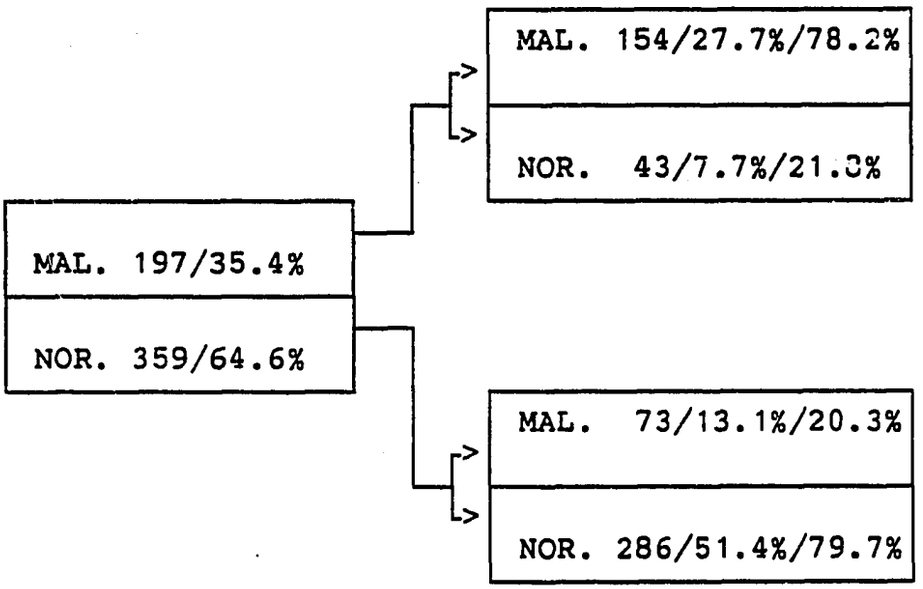


EXCLUDED POPULATION:

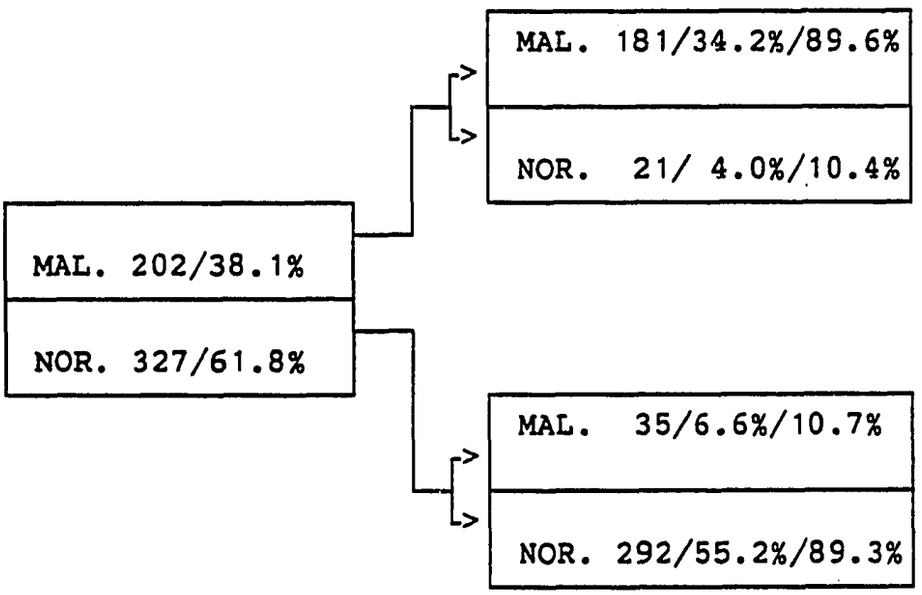


T_3 SELECTED POPULATION= (51.2%)

•Preschoolers of age 7 to 36 months

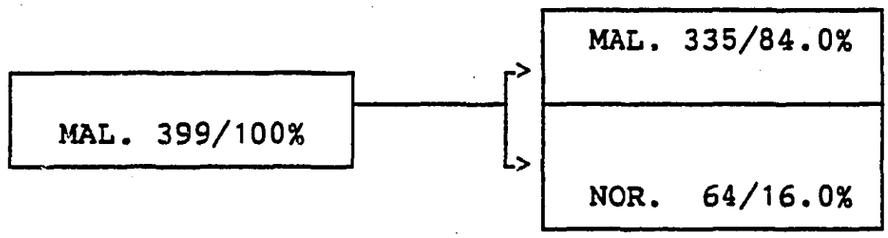


EXCLUDED POPULATION:

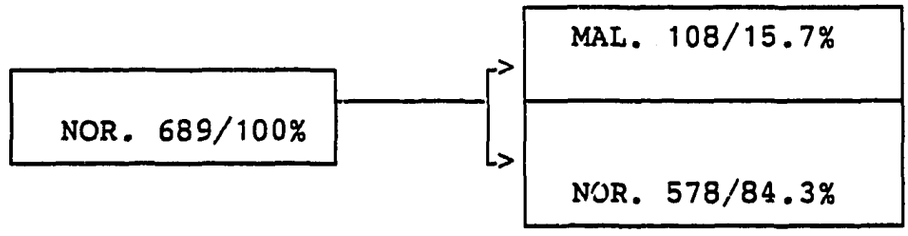


T_4. SELECTED POPULATION = (36.8%)

•Preschoolers who are diagnosed as malnourished (less than 75% of NCHS standard)

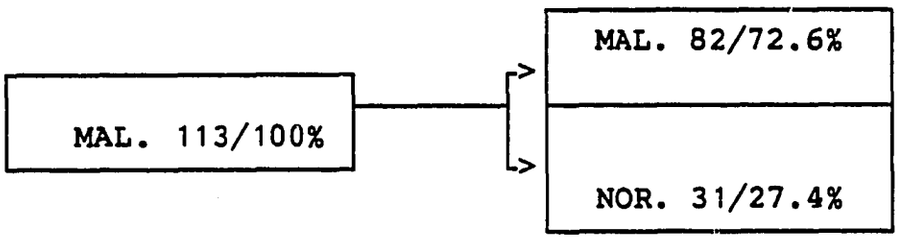


EXCLUDED POPULATION:

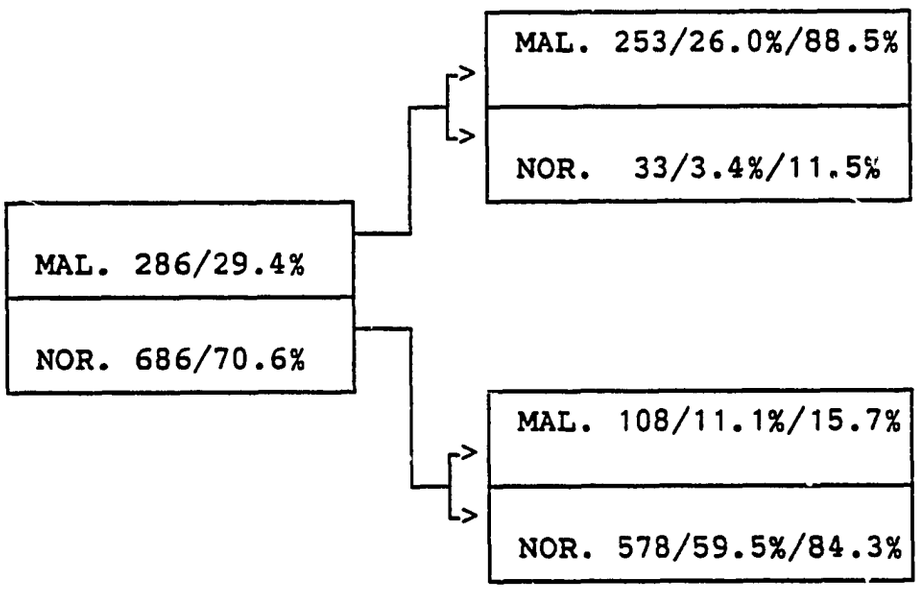


T_5. SELECTED POPULATION = (10.4%)

- Preschoolers of age 7 to 24 months who are malnourished

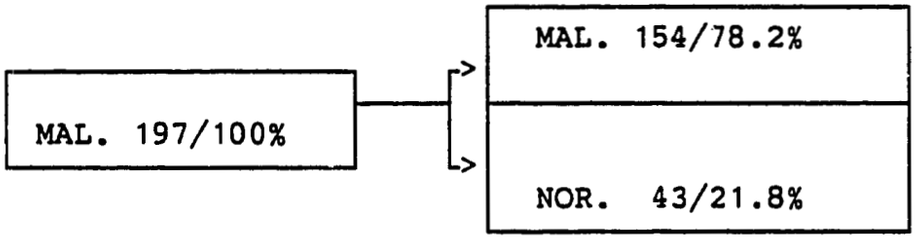


EXCLUDED POPULATION:

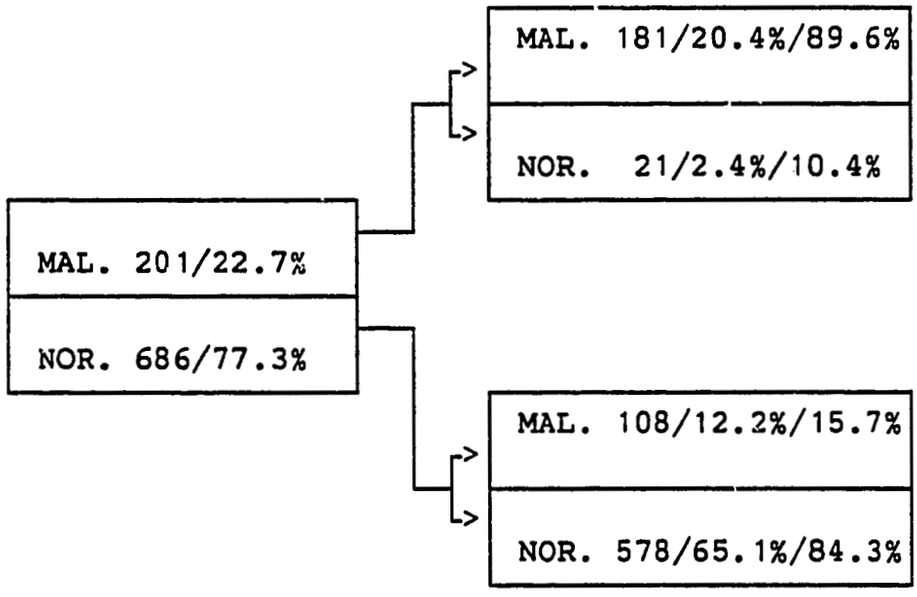


T_6. SELECTED POPULATION= (18.2%)

- Preschoolers of age 7 to 36 months who are malnourished

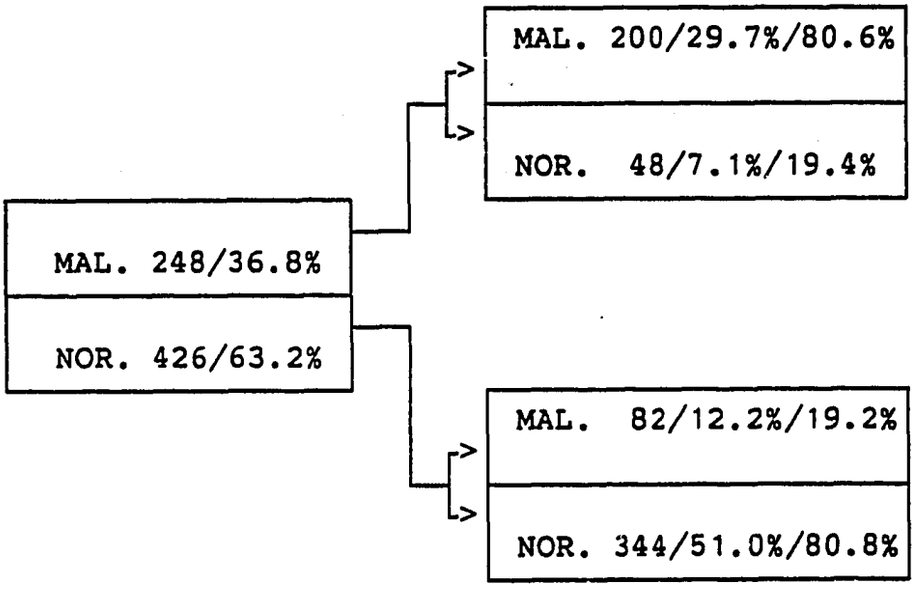


EXCLUDED POPULATION:

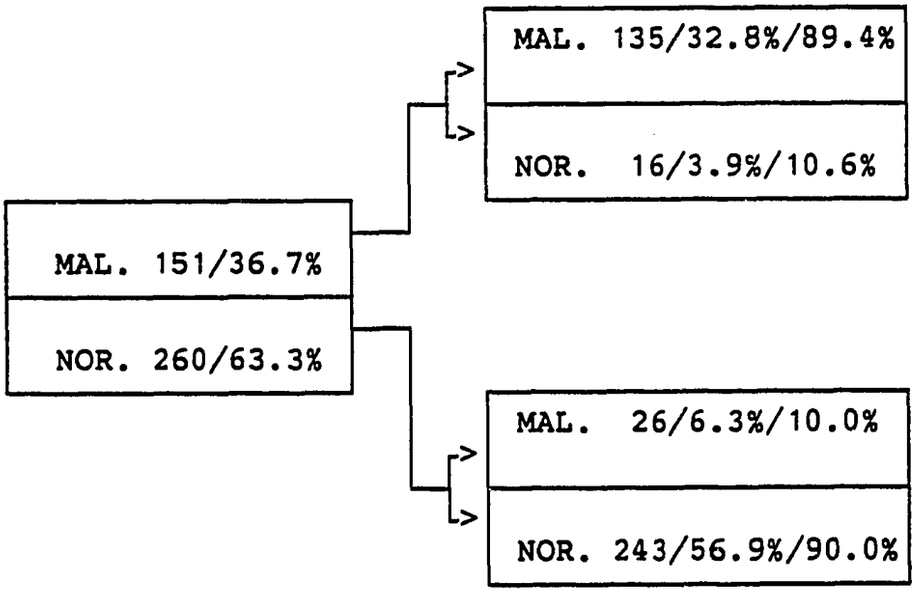


T_7. SELECTED POPULATION = (62.1%)

- Preschoolers in families determined to be at extreme risk by socioeconomic indicators



EXCLUDED POPULATION:

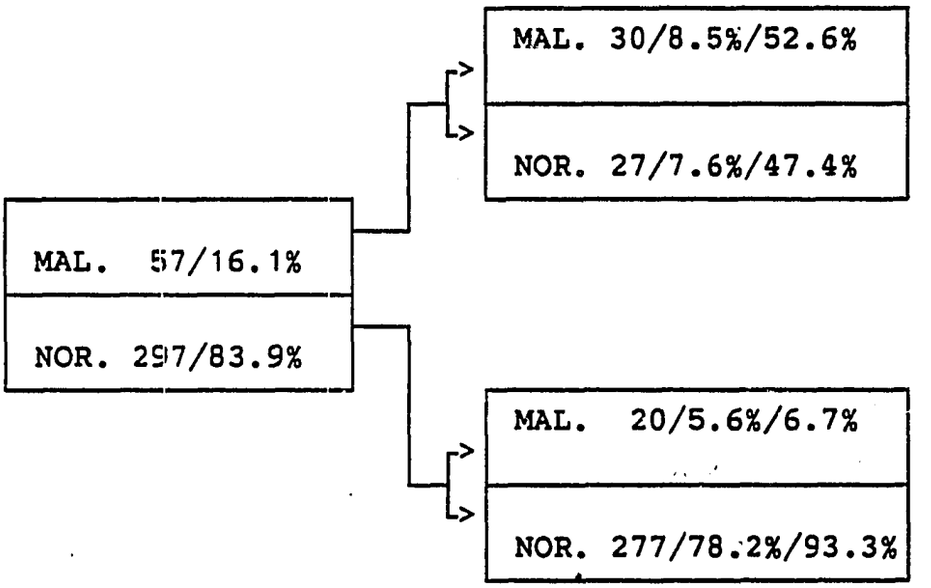


APPENDIX E.

TARGETING STRATEGIES FOR ESPERANÇA DATA SET

T_1. SELECTED POPULATION = (100%)

•Preschoolers to 60 months

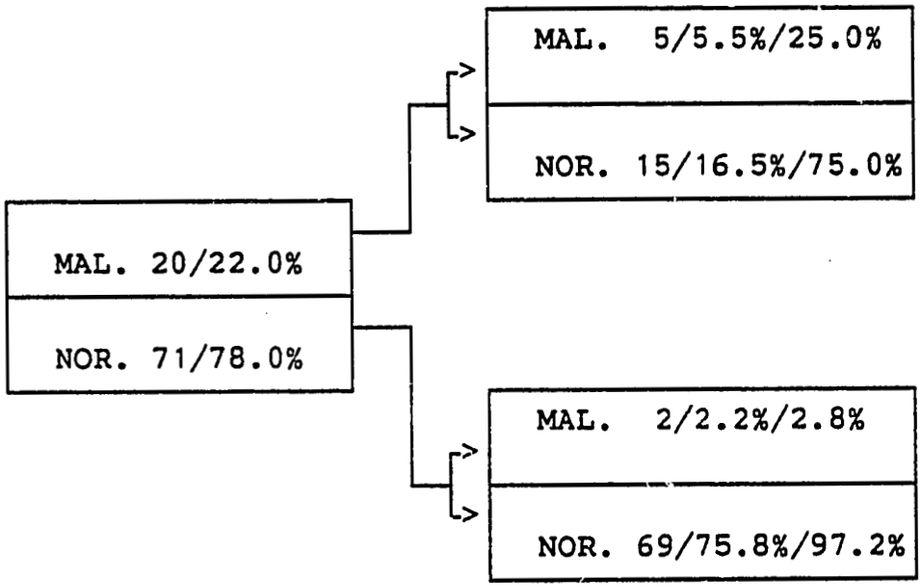


Note: The first number represents the actual number of individuals in any particular category of the sample; the first percentage represents the proportion of selected (or excluded) population; the second percentage represents the proportion derived from its respective proportion (indicated by arrows) the previous year.

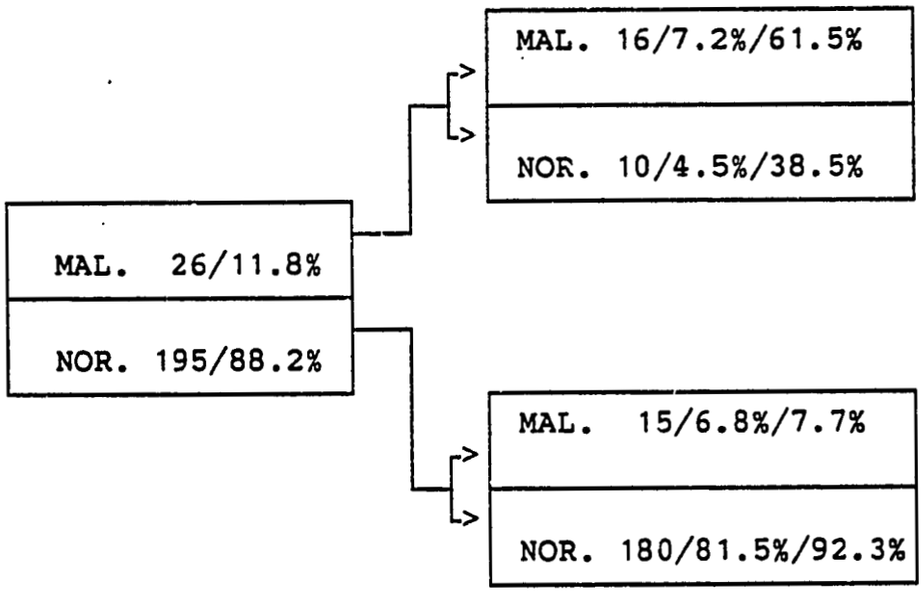
- The NCHS/CDC standard is used exclusively for referencing weight-for-age measurements.
- Malnourished indicates Grade II or Grade III by Gomez classification.
- Normal indicates Grade I or Normal by Gomez classification.

T_2. SELECTED POPULATION = (29.2%)

- Preschoolers of age 7 to 24 months.

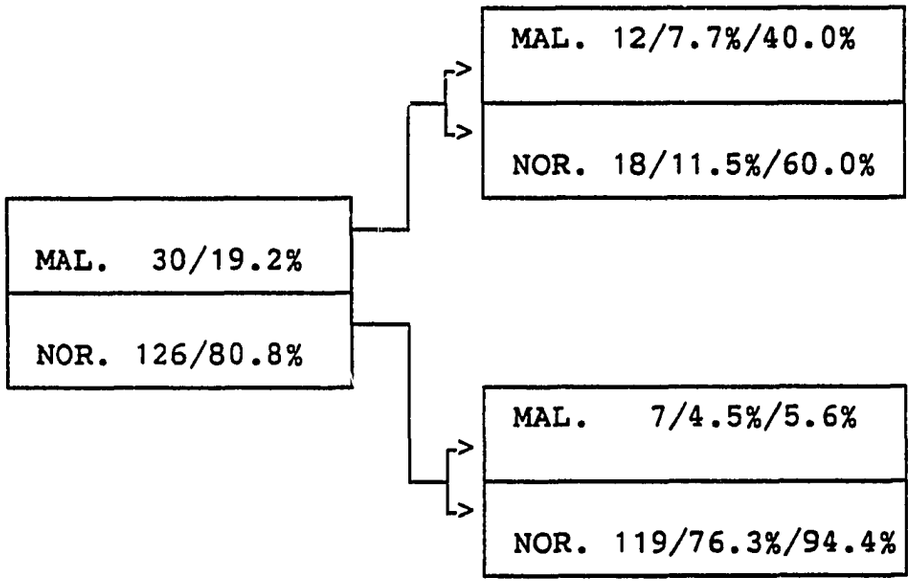


EXCLUDED POPULATION:

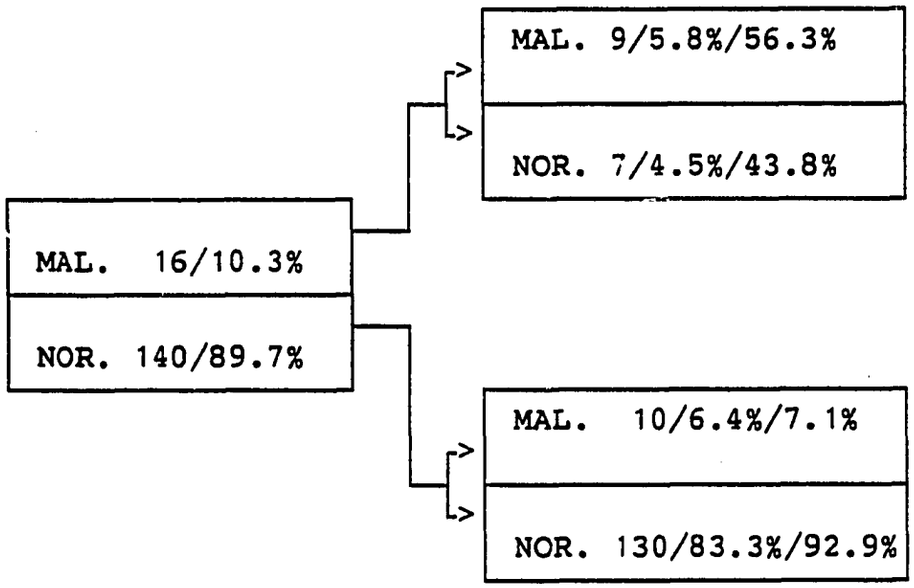


T_3 SELECTED POPULATION = (50.0%)

•Preschoolers of age 7 to 36 months

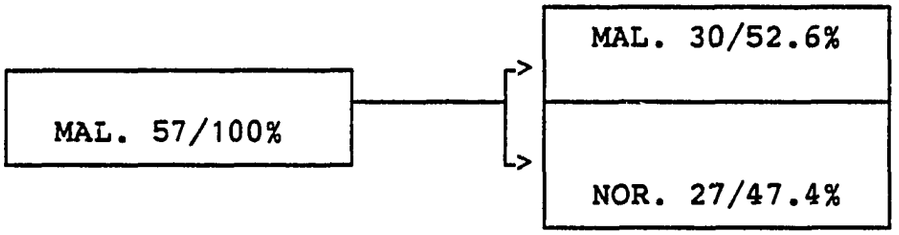


EXCLUDED POPULATION:

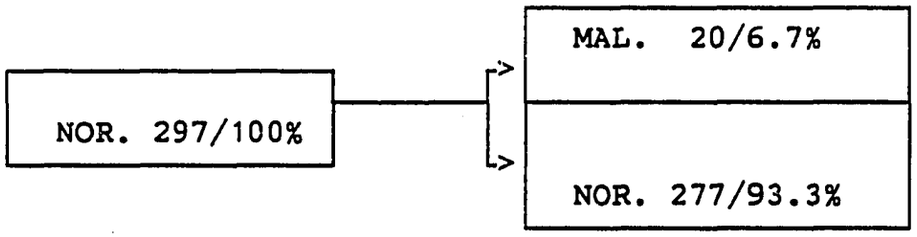


T_4. SELECTED POPULATION = (16.1%)

•Preschoolers who are diagnosed as malnourished (less than 75% of NCHS standard)

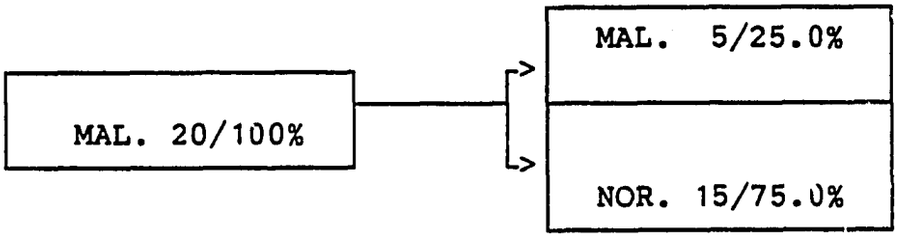


EXCLUDED POPULATION:

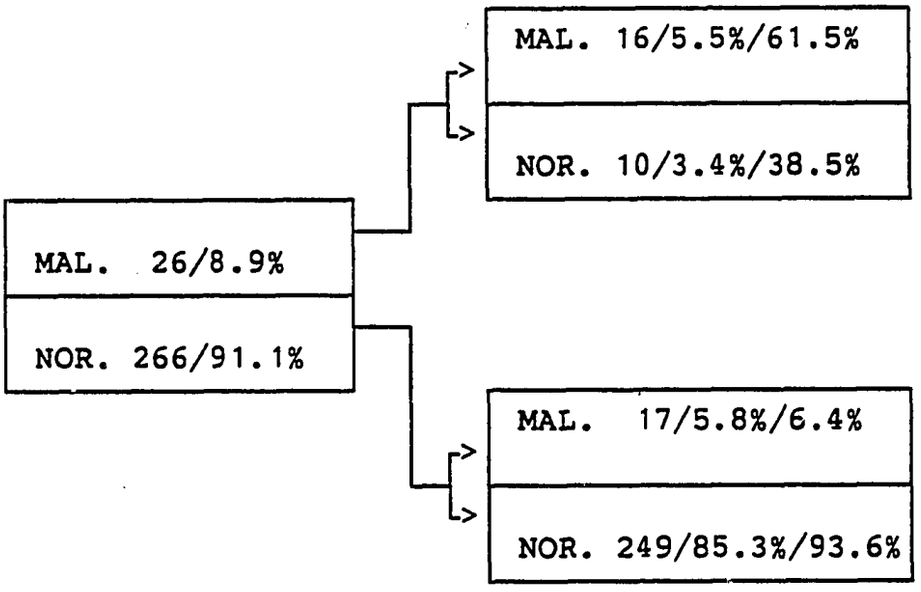


T_5. SELECTED POPULATION = (6.4%)

- Preschoolers of age 7 to 24 months who are malnourished

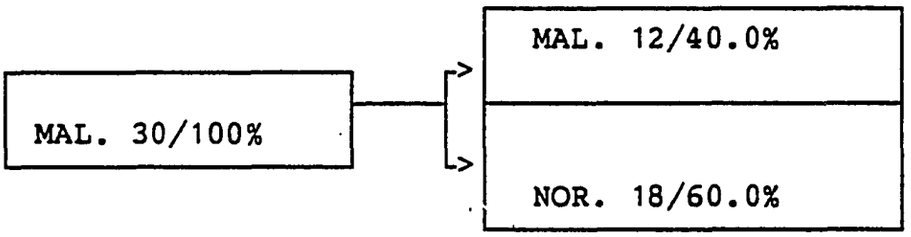


EXCLUDED POPULATION:

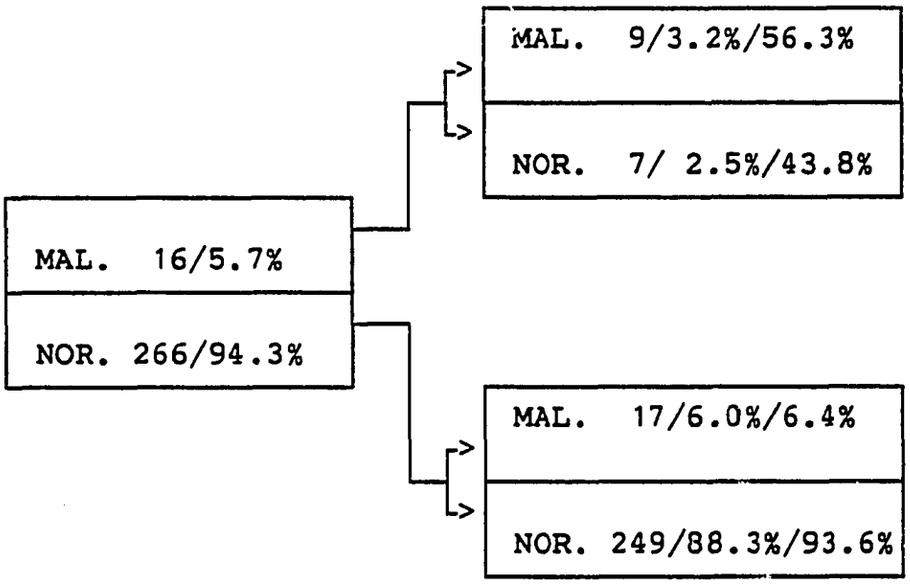


T_6. SELECTED POPULATION= (9.6%)

- Preschoolers of age 7 to 36 months who are malnourished

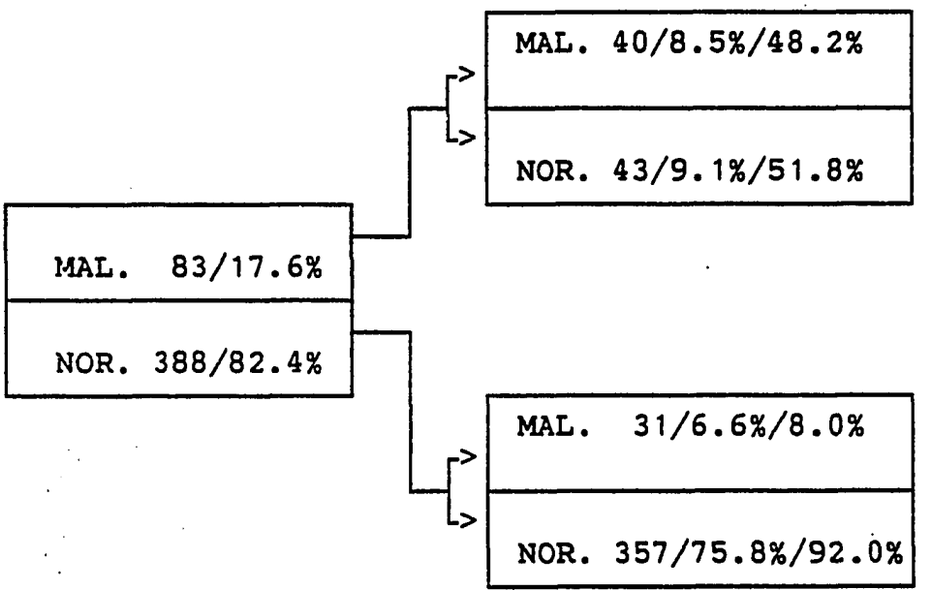


EXCLUDED POPULATION:

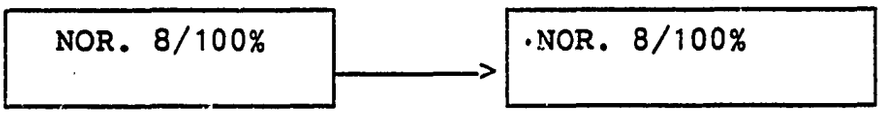


T_7. SELECTED POPULATION = (98.3%)

- Preschoolers in families determined to be at extreme risk by socioeconomic indicators



EXCLUDED POPULATION:

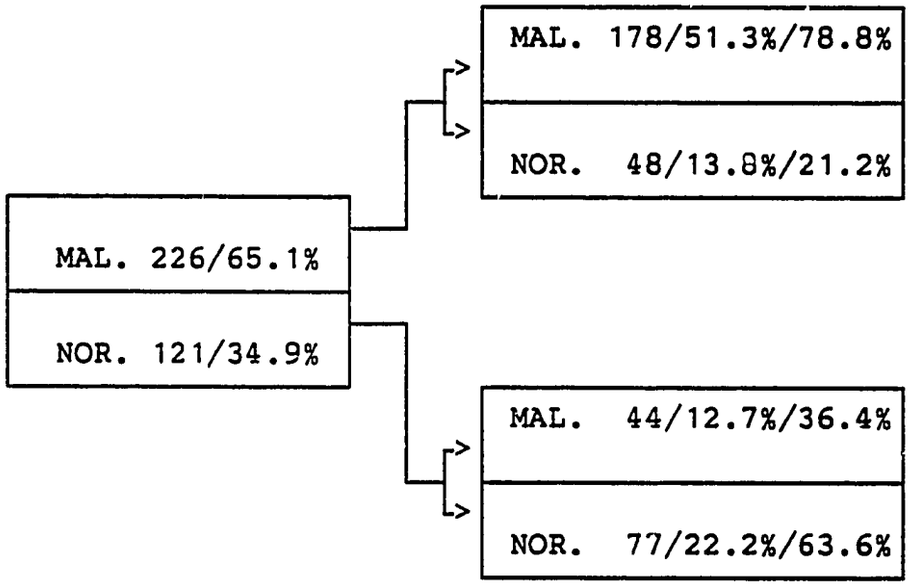


APPENDIX F.

TARGETING STRATEGIES FOR SRI LANKA

T_1. SELECTED POPULATION = (100%)

•Preschoolers to 60 months

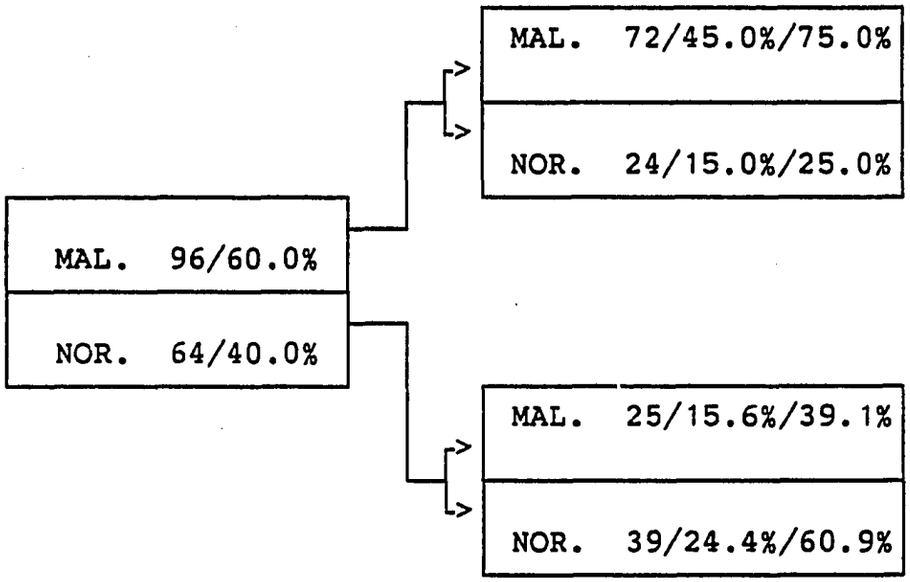


Note: The first number represents the actual number of individuals in any particular category of the sample; the first percentage represents the proportion of selected (or excluded) population; the second percentage represents the proportion derived from its respective proportion (indicated by arrows) the previous year.

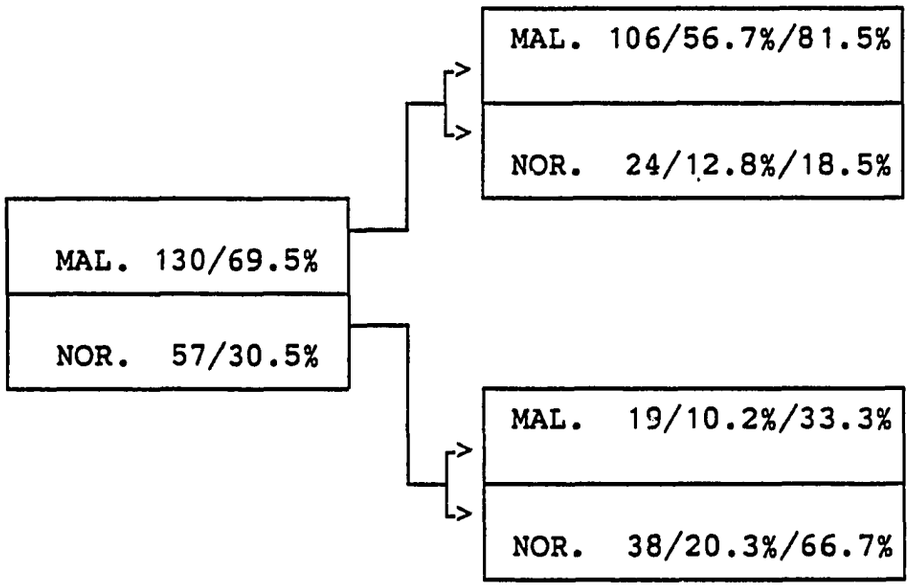
- The NCHS/CDC standard is used exclusively for referencing weight-for-age measurements.
- Malnourished indicates Grade II or Grade III by Gomez classification.
- Normal indicates Grade I or Normal by Gomez classification.

T_2. SELECTED POPULATION = (46.1%)

•Preschoolers of age 7 to 24 months.

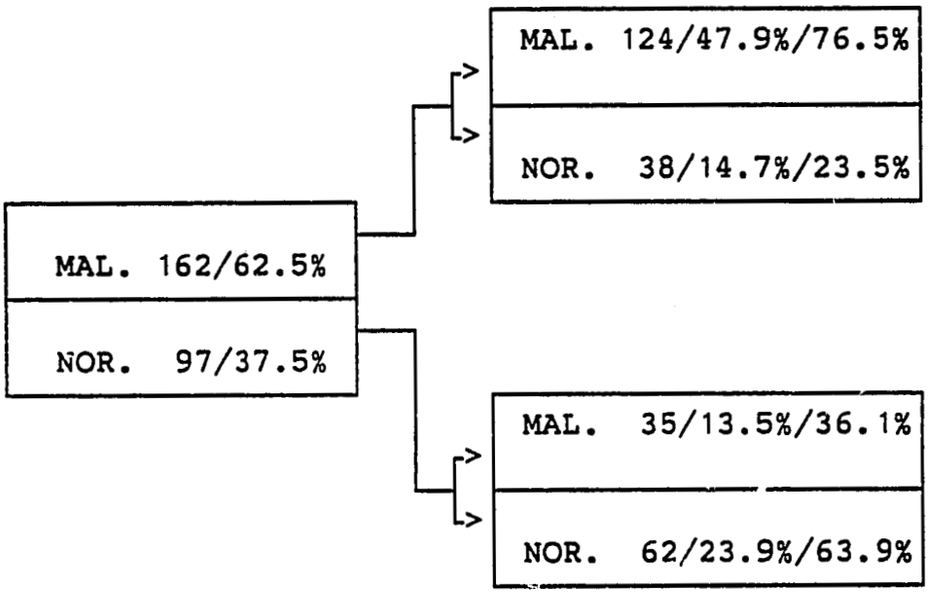


EXCLUDED POPULATION:

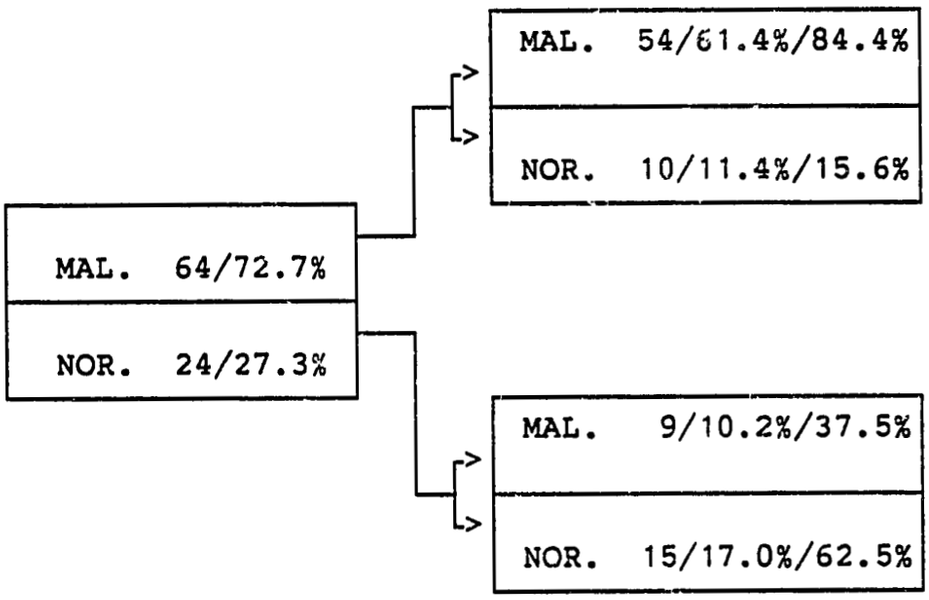


T_3 SELECTED POPULATION = (74.6%)

- Preschoolers of age 7 to 36 months

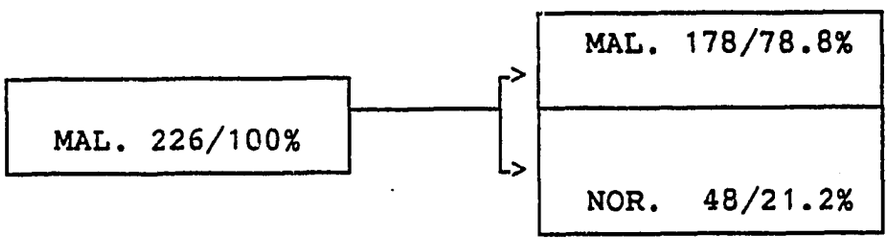


EXCLUDED POPULATION:

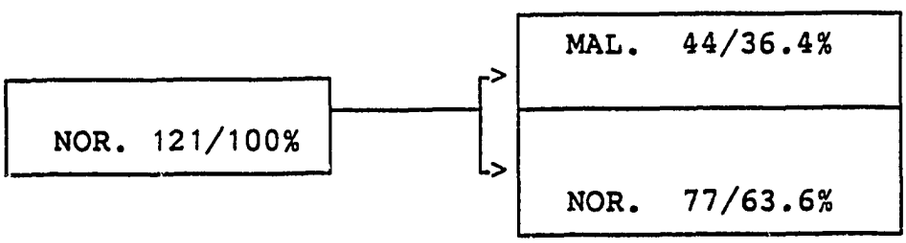


T_4. SELECTED POPULATION = (70.2%)

•Preschoolers who are diagnosed as malnourished (less than 75% of NCHS standard)

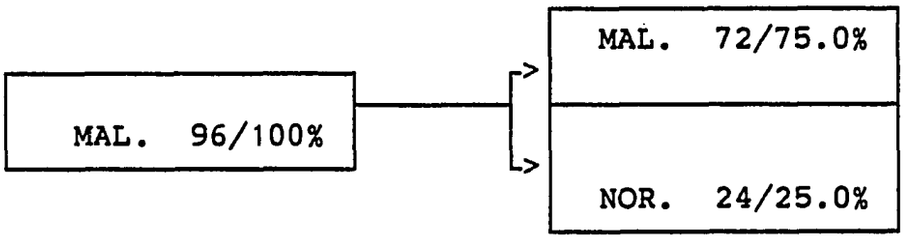


EXCLUDED POPULATION:

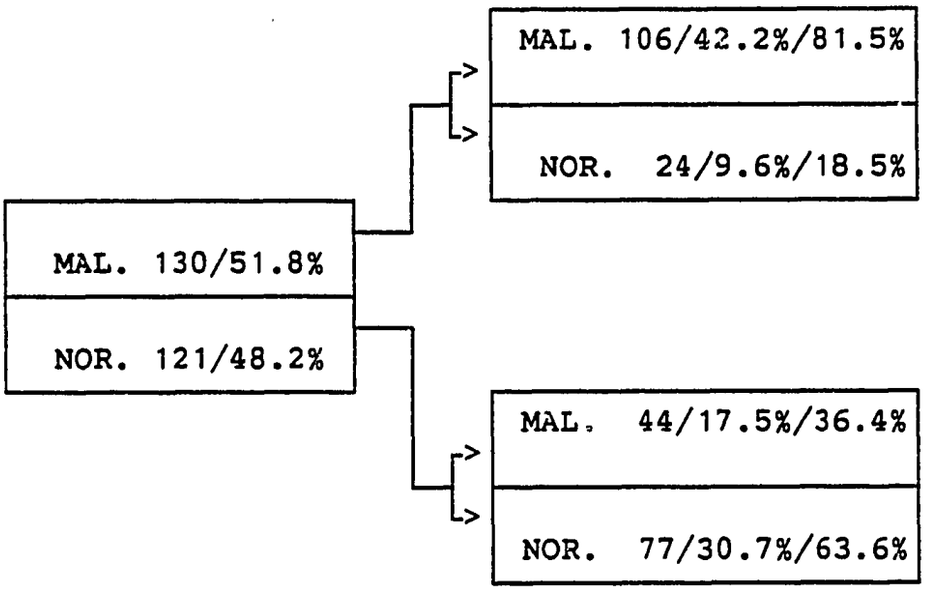


T_5. SELECTED POPULATION = (27.7%)

- Preschoolers of age 7 to 24 months who are malnourished

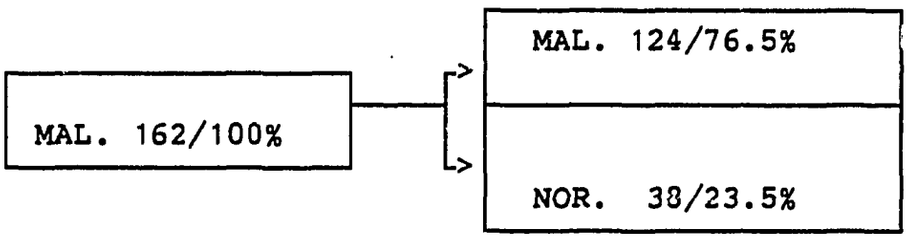


EXCLUDED POPULATION:

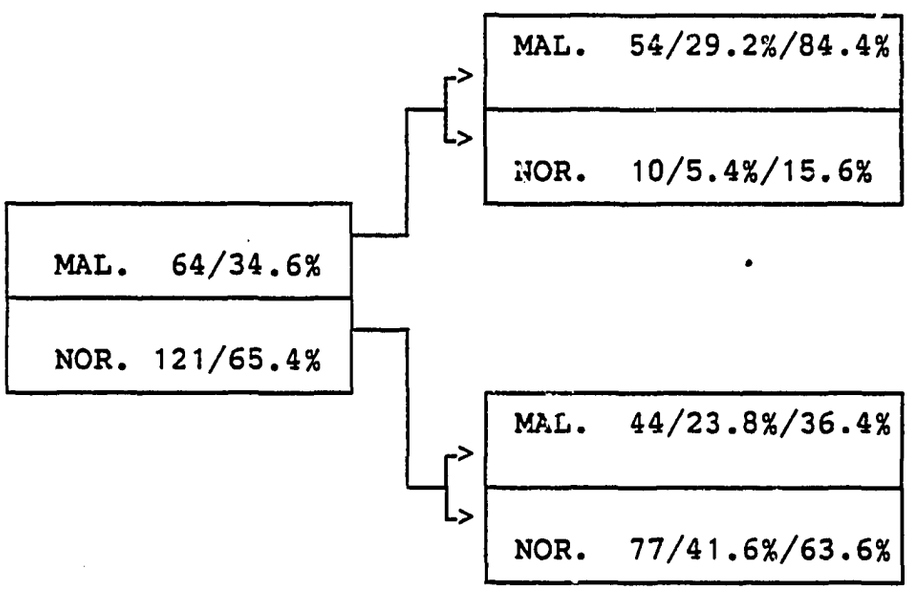


T_6. SELECTED POPULATION = (46.7%)

- Preschoolers of age 7 to 36 months who are malnourished

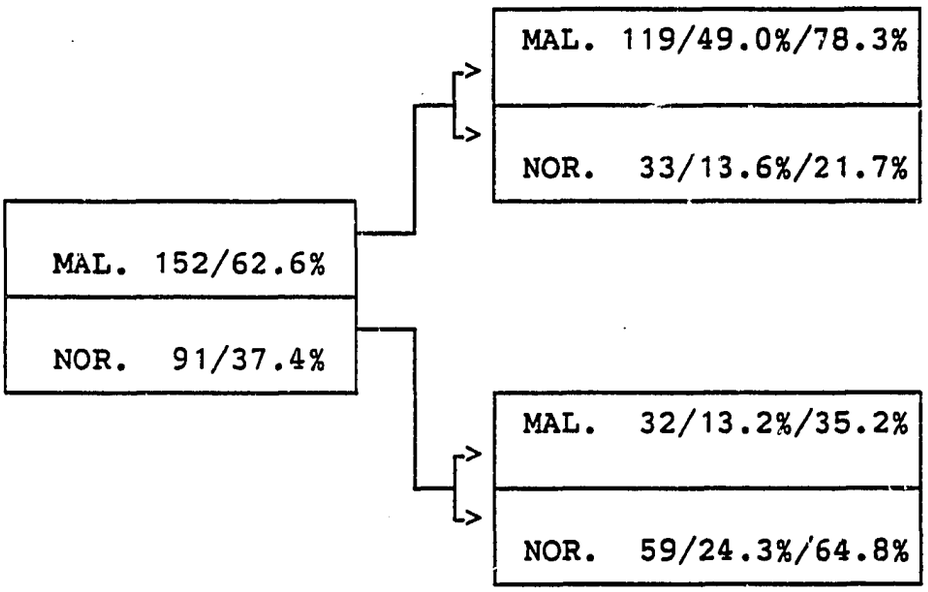


EXCLUDED POPULATION:

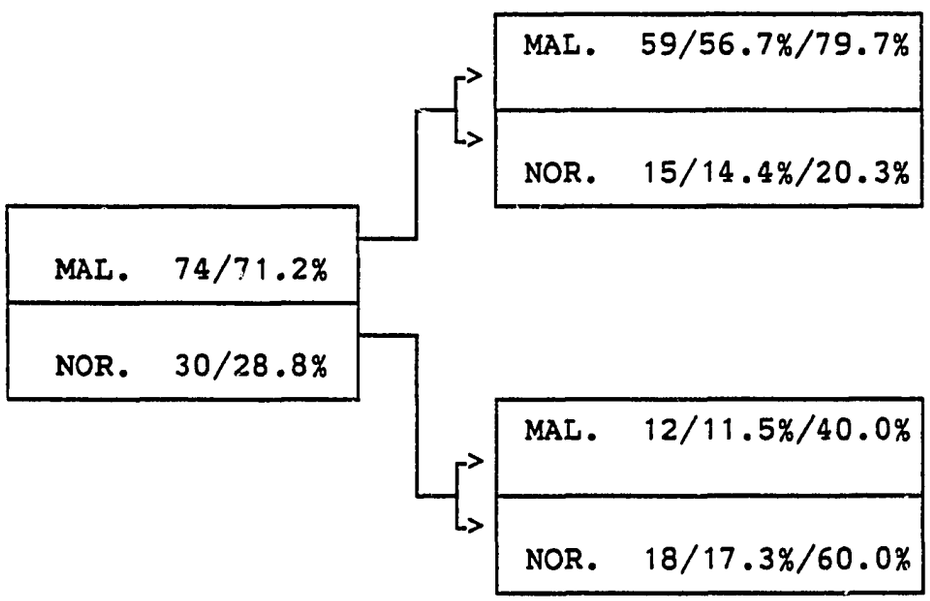


T_7. SELECTED POPULATION = (70.0%)

- Preschoolers in families determined to be at extreme risk by socioeconomic indicators



EXCLUDED POPULATION:



APPENDIX G.

TABLE 3-3
PROJECT POSHAK TAKE-HOME PROGRAM - EARLY STAGE[1]

COST CATEGORY	MONETARY VALUE[2]	PERCENTAGE OF TOTAL
1. Commodity costs at U.S. point of embarkation, ocean shipping, and commodity cost of indigenous raw materials (recurring cost)[3].	11.61	76.1%
2. In-country processing costs (if any), storage at port, and transportation from port to local distribution point (recurring cost)[4].	.69	4.5%
3. Local field level program costs:		
a) Educational materials and other supplies (recurring costs)[5].	1.38	9.1%
b) Local facility and equipment costs (non-recurring costs)[6].	.32	2.1%
c) Personnel for local implementation (recurring costs)[7].	1.25	8.2%
d) Other local costs including local transportation, administration and management (recurring costs)[8].	*	*
4. Overall administrative and management expense incurred by the implementing agencies, both governmental and non-governmental.[9]	*	*
5. Total cost per unit of time for implementation of program.[1]	15.25	100%

*Cost data not included in percentage totals.

[1]Costs for this program reflect the feeding component only for a program attached to an existing health care facility. This early stage of Project Poshak took place in Madhya Pradesh, India between 1971 and 1975. Food was distributed weekly.

[2]Monetary value expressed in 1974 U.S. dollars per child per year.

[3]For some purposes of analysis it may be more appropriate to value the commodity at local market price rather than total cost.

[4]These estimates are often understated due to the gifting of storage space and to source processing expenses. Many host countries bear the cost of shipment to the feeding site, which makes the cost difficult to estimate. More important still, these costs are dependent upon the existing type of transportation infrastructure, the distances traveled, and the volume of shipments.

[5]While these costs are primarily recurring, there is generally a small component of non-recurring cost associated with development of training materials.

[6]Costs for facilities and equipment which are already in existence at the local level are often understated, because some already exist at the local level. For the purposes of synthesizing annual costs as a percentage of the total, we have assumed a life of 3 years for non-recurring materials and 7 years for equipment such as vehicles, refrigerators, furniture and weighing scales.

[7]While personnel costs are primarily recurring, initial training is non-recurring. Estimates with a non-recurring training cost component are amortized a three-year life for the purpose of synthesizing annual costs.

[8]These local costs are often understated due to the presence of an already existing activity and volunteered time.

[9]These costs are also generally understated due to volunteered effort and inclusion in other budgets.

TABLE 3-4
PROJECT POSHAK TAKE-HOME PROGRAM - LATER STAGE[1]

COST CATEGORY	MONETARY VALUE[2]	PERCENTAGE OF TOTAL
1. Commodity costs at U.S. point of embarkation, ocean shipping, and commodity cost of indigenous raw materials (recurring cost)[3].	11.61	42.0%
2. In-country processing costs (if any), storage at port, and transportation from port to local distribution point (recurring cost)[4].	1.08	3.9%
3. Local field level program costs:		
a) Educational materials and other supplies (recurring costs)[5].	3.33	12.0%
b) Local facility and equipment costs (non-recurring costs)[6].	*	*
c) Personnel for local implementation (recurring costs)[7].	11.64	42.1%
d) Other local costs including local transportation, administration and management (recurring costs)[8].	*	*
4. Overall administrative and management expense incurred by the implementing agencies, both governmental and non-governmental.[9]	*	*
5. Total cost per unit of time for implementation of program.[1]	27.66	100%

*Cost data not included in percentage totals.

[1]Costs in this program reflect the feeding component only for a program attached to an existing health care facility. This phase of Project Poshak took place in Madhya Pradesh, India during 1975. Food was distributed weekly.

[2]Monetary value in terms of 1975 U.S. dollars per child per year. Source: Adapted from Gopaldas et al., 1975.

[3]For some purposes of analysis it may be more appropriate to value the commodity at local market price rather than total cost.

[4]These estimates are often understated due to the gifting of storage space and to source processing expenses. Many host countries bear the cost of shipment to the feeding site, which makes the cost difficult to estimate. More important still, these costs are dependent upon the existing type of transportation infrastructure, the distances traveled, and the volume of shipments.

[5]While these costs are primarily recurring, there is generally a small component of non-recurring cost associated with development of training materials.

[6]Costs for facilities and equipment which are already in existence at the local level are often understated, because some already exist at the local level. For the purposes of synthesizing annual costs as a percentage of the total, we have assumed a life of 3 years for non-recurring materials and 7 years for equipment such as vehicles, refrigerators, furniture and weighing scales.

[7]While personnel costs are primarily recurring, initial training is non-recurring. Estimates with a non-recurring training cost component are amortized a three-year life for the purpose of synthesizing annual costs.

[8]These local costs are often understated due to the presence of an already existing activity and volunteered time.

[9]These costs are also generally understated due to volunteered effort and inclusion in other budgets.

TABLE 3-5
SRI LANKA - MATERNAL AND CHILD HEALTH PROGRAM UTILIZING THRIPOSHA[1]

COST CATEGORY	MONETARY VALUE[2]	PERCENTAGE OF TOTAL
1. Commodity costs at U.S. point of embarkation, ocean shipping, and commodity cost of indigenous raw materials (recurring cost)[3].	3.9606	82.6%
2. In-country processing costs (if any), storage at port, and transportation from port to local distribution point (recurring cost)[4].	.5884	12.3%
3. Local field level program costs:		
a) Educational materials and other supplies (recurring costs)[5].	*	*
b) Local facility and equipment costs (non-recurring costs)[6].	*	*
c) Personnel for local implementation (recurring costs)[7].	*	*
d) Other local costs including local transportation, administration and management (recurring costs)[8].	*	*
4. Overall administrative and management expense incurred by the implementing agencies, both governmental and non-governmental.[9]	.2460	5.1%
5. Total cost per unit of time for implementation of program.[1]	4.7950	100%

*Cost data not included in percentage totals.

[1]This program provides a package of health care services and thriposha to the targeted population of at-risk children under six and pregnant and lactating mothers.

[2]Costs are annual budget estimates for providing services and commodities to the entire covered population in Sri Lanka converted to a cost per pound of thriposha. Monetary value is expressed in terms of 1982 Sri Lankan rupees.

[3]For some purposes of analysis it may be more appropriate to value the commodity at local market price rather than total cost.

[4]These estimates are often understated due to the gifting of storage space and to source processing expenses. Many host countries bear the cost of shipment to the feeding site, which makes the cost difficult to estimate. More important still, these costs are dependent upon the existing type of transportation infrastructure, the distances traveled, and the volume of shipments.

[5]While these costs are primarily recurring, there is generally a small component of non-recurring cost associated with development of training materials.

[6]Costs for facilities and equipment which are already in existence at the local level are often understated, because some already exist at the local level. For the purposes of synthesizing annual costs as a percentage of the total, we have assumed a life of 3 years for non-recurring materials and 7 years for equipment such as vehicles, refrigerators, furniture and weighing scales.

[7]While personnel costs are primarily recurring, initial training is non-recurring. Estimates with a non-recurring training cost component are amortized a three-year life for the purpose of synthesizing annual costs.

[8]These local costs are often understated due to the presence of an already existing activity and volunteered time.

[9]These costs are also generally understated due to volunteered effort and inclusion in other budgets.

TABLE 3-6
INDIA - MATERNAL AND CHILD HEALTH - ICDS PROGRAM AS IMPLEMENTED[1]

COST CATEGORY	MONETARY VALUE[2]	PERCENTAGE OF TOTAL
1. Commodity costs at U.S. point of embarkation, ocean shipping, and commodity cost of indigenous raw materials (recurring cost)[3].	1,337,200	75.2%
2. In-country processing costs (if any), storage at port, and transportation from port to local distribution point (recurring cost)[4].	*	*
3. Local field level program costs:		
a) Educational materials and other supplies (recurring costs)[5].	32,000	1.8%
b) Local facility and equipment costs (non-recurring costs)[6].	30,900	1.7%
c) Personnel for local implementation (recurring costs)[7].	239,800	13.5%
d) Other local costs including local transportation, administration and management (recurring costs)[8].	30,000	1.7%
4. Overall administrative and management expense incurred by the implementing agencies, both governmental and non-governmental.[9]	108,000	6.1%
5. Total cost per unit of time for implementation of program.[1]	1,778,000	100%

*Cost data not included in percentage totals.

[1]Costs are annual budget estimates for providing services and commodity to a population of one block (approximately 100,000). Targeted population is children 0-6 years and pregnant and lactating women.

[2]Monetary value in terms of 1981 Indian Rupees. Source: Draft proposal document, USAID/India April, 1981.

[3]For some purposes of analysis it may be more appropriate to value the commodity at local market price rather than total cost.

[4]These estimates are often understated due to the gifting of storage space and to source processing expenses. Many host countries bear the cost of shipment to the feeding site, which makes the cost difficult to estimate. More important still, these costs are dependent upon the existing type of transportation infrastructure, the distances traveled, and the volume of shipments.

[5]While these costs are primarily recurring, there is generally a small component of non-recurring cost associated with development of training materials.

[6]Costs for facilities and equipment which are already in existence at the local level are often understated, because some already exist at the local level. For the purposes of synthesizing annual costs as a percentage of the total, we have assumed a life of 3 years for non-recurring materials and 7 years for equipment such as vehicles, refrigerators, furniture and weighing scales.

[7]While personnel costs are primarily recurring, initial training is non-recurring. Estimates with a non-recurring training cost component are amortized a three-year life for the purpose of synthesizing annual costs.

[8]These local costs are often understated due to the presence of an already existing activity and volunteered time.

[9]These costs are also generally understated due to volunteered effort and inclusion in other budgets.

TABLE 3-7
INDIA - MATERNAL AND CHILD HEALTH - JOINT ICDS-USAID AS PROPOSED[1]

COST CATEGORY	MONETARY VALUE[2]	PERCENTAGE OF TOTAL
1. Commodity costs at U.S. point of embarkation, ocean shipping, and commodity cost of indigenous raw materials (recurring cost)[3].	1,376,000	76.8%
2. In-country processing costs (if any), storage at port, and transportation from port to local distribution point (recurring cost)[4].	*	*
3. Local field level program costs:		
a) Educational materials and other supplies (recurring costs)[5].	46,800	2.6%
b) Local facility and equipment costs (non-recurring costs)[6].	37,900	2.1%
c) Personnel for local implementation (recurring costs)[7].	220,000	12.3%
d) Other local costs including local transportation, administration and management (recurring costs)[8].	30,000	1.7%
4. Overall administrative and management expense incurred by the implementing agencies, both governmental and non-governmental.[9]	80,000	4.5%
5. Total cost per unit of time for implementation of program.[1]	1,790,700	100%

*Cost data not included in percentage totals.

[1]Costs are budget estimates for one year providing services and commodity to a population of one block (approx. 100,000). Targeted population is children 0-6 years and pregnant and lactating women.

[2]Monetary value is in terms of 1981 Indian rupees. Source: Draft proposal document, USAID/India April, 1981.

[3]For some purposes of analysis it may be more appropriate to value the commodity at local market price rather than total cost.

[4]These estimates are often understated due to the gifting of storage space and to source processing expenses. Many host countries bear the cost of shipment to the feeding site, which makes the cost difficult to estimate. More important still, these costs are dependent upon the existing type of transportation infrastructure, the distances traveled, and the volume of shipments.

[5]While these costs are primarily recurring, there is generally a small component of non-recurring cost associated with development of training materials.

[6]Costs for facilities and equipment which are already in existence at the local level are often understated, because some already exist at the local level. For the purposes of synthesizing annual costs as a percentage of the total, we have assumed a life of 3 years for non-recurring materials and 7 years for equipment such as vehicles, refrigerators, furniture and weighing scales.

[7]While personnel costs are primarily recurring, initial training is non-recurring. Estimates with a non-recurring training cost component are amortized a three-year life for the purpose of synthesizing annual costs.

[8]These local costs are often understated due to the presence of an already existing activity and volunteered time.

[9]These costs are also generally understated due to volunteered effort and inclusion in other budgets.

TABLE 3-8
PROJECT POSHAK ON-SITE PROGRAM - LATER STAGE[1]

COST CATEGORY	MONETARY VALUE[2]	PERCENTAGE OF TOTAL
1. Commodity costs at U.S. point of embarkation, ocean shipping, and commodity cost of indigenous raw materials (recurring cost)[3].	15.45	35.5%
2. In-country processing costs (if any), storage at port, and transportation from port to local distribution point (recurring cost)[4].	3.77	8.7%
3. Local field level program costs:		
a) Educational materials and other supplies (recurring costs)[5].	4.98	11.4%
b) Local facility and equipment costs (non-recurring costs)[6].	*	*
c) Personnel for local implementation (recurring costs)[7].	19.36	44.4%
d) Other local costs including local transportation, administration and management (recurring costs)[8].	*	*
4. Overall administrative and management expense incurred by the implementing agencies, both governmental and non-governmental.[9]	*	*
5. Total cost per unit of time for implementation of program.[1]	43.56	100%

*Cost data not included in percentage totals.

[1]Costs in this program reflect the feeding component only for a program attached to an existing health care facility. This phase of Project Poshak took place during 1975. Single feedings were offered four times daily.

[2]Monetary value in terms of 1975 U.S. dollars per child per year. Source: Adapted from Gopaldas et al. 1975.

[3]For some purposes of analysis it may be more appropriate to value the commodity at local market price rather than total cost.

[4]These estimates are often understated due to the gifting of storage space and to source processing expenses. Many host countries bear the cost of shipment to the feeding site, which makes the cost difficult to estimate. More important still, these costs are dependent upon the existing type of transportation infrastructure, the distances traveled, and the volume of shipments.

[5]While these costs are primarily recurring, there is generally a small component of non-recurring cost associated with development of training materials.

[6]Costs for facilities and equipment which are already in existence at the local level are often understated, because some already exist at the local level. For the purposes of synthesizing annual costs as a percentage of the total, we have assumed a life of 3 years for non-recurring materials and 7 years for equipment such as vehicles, refrigerators, furniture and weighing scales.

[7]While personnel costs are primarily recurring, initial training is non-recurring. Estimates with a non-recurring training cost component are amortized a three-year life for the purpose of synthesizing annual costs.

[8]These local costs are often understated due to the presence of an already existing activity and volunteered time.

[9]These costs are also generally understated due to volunteered effort and inclusion in other budgets.

BIBLIOGRAPHY

Austin, James E. and Marian F. Zeitlin, eds. Nutrition Intervention in Developing Countries: An Overview. Harvard Institute for International Development. Oelgeschlager, Gunn and Hain, Publishers, Inc. Cambridge, Mass., 1981. 225 pp. Appendix A: Selected Bibliographies on Types of Nutrition Intervention; Appendix B: Intervention Design Checklists. Index.

Austin and Zeitlin's overview introduces a 5-vol. collection of 7 studies, the first of which is devoted to supplementary feeding; the others concern nutrition education, fortification, formulated foods, consumer food price subsidies, agricultural production, and integrated nutrition and health-care programs. The studies are based on surveys of 201 nutrition projects, complemented by field case studies and a literature review. Study I identifies key target groups (children 6-36 mos. and pregnant and lactating women from low-income families) and presents a composite list of anthropometric, clinical, and socioeconomic at-risk factors. It concludes that priority for participation in a feeding program should alwa be given to severely malnourished preschoolers. Next rence should be given to the moderately malnourished, mildly malnourished, and then to preschool siblings a s of participants. Ideally, all preschoolers shoul eligible, and if resources are available, all women of childbearing age may be enrolled.

Babson, S. Gorham. "Growth of Low-Birth-Weight Infants." The Journal of Pediatrics, Vol. 77, No. 1, July 1970, pp.11-18. 13 references.

Baer, Edward C. and Beverly Winikoff, eds. "Breastfeeding: Program, Policy, and Research Issues." Studies in Family Planning, Vol. 12, No. 4, 1981. A Special Issue, pp. 123-206.

Baertl, Juan M., Blanca Adrianzen T., and George G. Graham. "Growth of Previously Well-Nourished Infants in Poor Homes." American Journal of Diseases of Children, Vol. 130, January 1976, pp. 33-36. 10 references.

Baertl, Juan M., et al. "Diet Supplementation for Entire Communities: Growth and Mortality of Infants and Children." American Journal of Clinical Nutrition, Vol. 23, No. 6, June 1970, pp. 707-715. 11 references.

Barnum, Howard, et al. A Resource Allocation Model for Child Survival. Oelgeschlager, Gunn and Hain, Publishers, Inc. Cambridge, Mass., 1980. 190 pp. Appendix: The Child Mortality Model FORTRAN Simulation Program.

Beardslee, William R. "The Effects of Infantile Malnutrition on Behavioral Development: A Follow-up Study." American Journal of Clinical Nutrition, Vol. 35, No. 6, June 1982, pp. 1437-1441. 12 references.

Beaton, George H. and Hossein Ghassemi. "Supplementary Feeding Programs for Young Children in Developing Countries." American Journal of Clinical Nutrition, Vol. 35, No. 4, April 1982, Supplement, pp. 864-915. 93 references.

Over 200 reports on food distribution programs were reviewed in an effort to assess such matters as the effect of the programs on health, growth, and overall development of participants; the definition of target groups and extent of coverage; the specificity of coverage; the impact of these programs for young children on breast-feeding and weaning practices; the differential impact of using local or imported foods on production of local foods; the effect different types of supplementary food programs have on participation rates; and their direct and indirect costs. The reviewers find no clear answers on some of these matters, but there is evidence of considerable consolidation of knowledge. In general, food distribution programs directed towards young children were found to be rather expensive for the measured benefit.

Beaton, George H. and Lynn D. Swiss. "Evaluation of the Nutritional Quality of Food Supplies: Prediction of "Desirable" or "Safe" Protein: Calorie Ratios." American Journal of Clinical Nutrition, Vol. 27, No. 5, May 1974, pp. 485-504.

Berg, Alan. The Nutrition Factor: Its Role in National Development, The Brookings Institution. Washington, D. C., 1973. 290 pp. References. Index.

Bergner, Lawrence and Mervyn W. Susser. "Low Birth Weight and Prenatal Nutrition: An Interpretative Review." Pediatrics, Vol. 46, No. 6, December 1970. 81 references.

Bhargava, Santosh K., et al. "Birth Weight, Gestational Age and Growth Pattern in Babies with a Birth Weight of 2000 Grams or Less." Indian Pediatrics, Vol. 8, No. 11, November 1971, pp. 736-751. 15 references.

Bhargava, V., et al. "Growth Pattern in Babies of Extreme Low Birth Weight." Indian Journal of Medical Research, Vol. 60, No. 10, October 1972, pp.1492-1497. 3 references.

Bhargava, V., et al. "Survival, Growth and Development in Babies Weighing 2000 Grams or Less." Indian Pediatrics, Vol. 7, No. 3, March 1970, pp. 139-145. 6 references.

Bhatia, Satinder J. S., et al. "A Method of Screening for Growth Hormone Deficiency Using Anthropometrics." American Journal of Clinical Nutrition, Vol. 34, No. 2, February 1981, pp. 281-288. 25 references.

Biswas, Margaret R. Nutrition and Agricultural Development in Africa. Research Memorandum 78-61. International Institute for Applied Systems Analysis. Laxenburg, Austria, 1978. 26 pp. 29 references.

Bross, Irwin. "Misclassification In 2 X 2 Tables." Biometrics, Vol. 10, December 1954, pp. 478-486. (Note by D. J. Newell, Biometrics, March 1963, pp. 187-188).

Buell, Philip and John E. Dunn, Jr. "The Dilution Effect of Misclassification." American Journal of Public Health, Vol 54, No. 4, 1964, pp. 598-602. 9 references. Appendix.

Burkhalter, Barton R. and the Papago Executive Health Staff. The Papagos 3-Level Model of Political Process and Health Improvement: A Culture-Specific Intervention which Reduced Infant Gastroenteritis. Modeling and Simulation, Vol. 5, Part 1. Proceedings of the Fifth Annual Pittsburgh Conference, 1974, School of Engineering, University of Pittsburgh. Published by Instrument Society of America. Pittsburgh, Pennsylvania, U.S.A., 1974, pp. 535-541. 7 references.

Checci and Company. Food for Peace, An Evaluation of PL-480 Title II: Vol. I, A Global Assessment of Title II, Washington, D. C., 1972. 201 pp. 146 references. Appendices A-C.

Checci and Company. Food for Peace, An Evaluation of PL-480 Title II: Vol. II, Evaluation of Eight Country Programs, Washington, D. C., 1972.

Chen, Lincoln C., K.M.A. Alauddin, and Sandi Huffman. Classification of Energy-Protein Malnutrition by Anthropometry and Subsequent Risk of Mortality. International Centre for Diarrheal Disease Research. Dacca, Bangladesh, 1978. 24 pp.

Chernichovsky, Dov. The Economic Theory of the Household and Impact Measurement of Nutrition and Related Health Programs, World Bank Staff Working Paper No. 302. World Bank. Washington, D. C., 1978. 44 pp. 31 references.

The paper applies experimental and econometric approaches to evaluation of the Narangwal, India intervention and concludes that a combination of both methods is the most efficient way to measure program impact. The experimental approach incorporates theoretical considerations about household economic behavior, e.g., expected earnings, to identify outcome measures. Chernichovsky notes that household behavior may be inconsistent with program objectives.

Cochrane, A. L. and W. W. Holland. "Validation of Screening Procedures." British Medical Bulletin, Vol. 27, No. 1, 1971, pp. 3-8. 37 references.

Cooke, Thomas M., et al. Planning National Nutrition Programs: A Suggested Approach. American Technical Assistance Corporation. McLean, Virginia, U.S.A., 1973. 2 Vols. 91 references. In English and French. Funded by U.S. Agency for International Development.

Copeland, Karen T., et al. "Bias Due to Misclassification in The Estimation of Relative Risk." American Journal of Epidemiology, Vol. 105, No. 5, 1977, pp. 488-495. 20 references.

Dawid, A P. and A. M. Skene. "Maximum Likelihood Estimation of Observer Error-rates Using the EM Algorithm." Applied Statistics, Vol. 28, No. 1, 1979, pp. 20-28. 7 references.

Delgado, Hernan L., Reynaldo Martorell, and Robert E. Klein. "Nutrition, Lactation, and Birth Interval Components in Rural Guatemala." American Journal of Clinical Nutrition, Vol. 35, No. 6, pp. 1468-1476. 26 references.

Diamond, Earl L. and Abraham M. Lilienfeld. "Misclassification Errors in 2 x 2 Tables with One Margin Fixed: Some Further Comments." American Journal of Public Health, Vol. 52, No. 12, 1962, pp. 2106-2110. 3 references.

Diamond, Earl L. and Abraham M. Lilienfeld. "Effects of Errors in Classification and Diagnosis in Various Types of Epidemiological Studies." American Journal of Public Health, Vol. 52, No. 7, 1962, pp. 1137-1144. 8 references.

Drake, William D., Luis J. Fajardo, and Roy I. Miller. Volume IV: The Promotora Program in Candelaria, Part I: A Colombian Attempt to Control Malnutrition and Disease, 1968-1974, Part II: A Revisitation Two Years

After Program End. Ann Arbor: Community Systems Foundation, 1980. 149 pages. 12 references.

Drake, William D., et. al. Nutrition Programs in Sri Lanka Using U.S. Food Aid (An Evaluation of P.L. 480 Title II Programs), Community Systems Foundation, October 1982. 106 pp. 15 references.

Drillien, C. M. "Aetiology and Outcome in Low-birthweight Infants." Developmental Medicine and Child Neurology, Vol. 14, 1972, pp.563-574. 8 references.

Drillien, C. M. "Prognosis of Infants of Very Low Birth-Weight." The Lancet, Vol. 1, April 3, 1971, p.697.

Drillien, C. M. "The Small-for-Date Infant: Etiology and Prognosis." Pediatric Clinics of North America, Vol. 17, No. 1, February 1970, pp. 9-24. 42 references.

Dunlop, David N., et al. Korea Health Demonstration Project. Project Impact Evaluation No. 36, U. S. Agency for International Development, July 1982. 38 pp. 33 references. Appendices A-J.

Erdreich, Linda S. and Elisa T. Lee. "Use Of Relative Operating Characteristic Analysis In Epidemiology." American Journal of Epidemiology, Vol. 114, No. 5, 1981, pp.649-662. 24 references.

Falkner, Frank. "Maternal Nutrition and Fetal Growth." American Journal of Clinical Nutrition, Vol. 34, No. 4, 1981, pp. 769-774. 6 references.

Field, John O., Roy I. Miller, and William D. Drake. Volume III: Kottar: Malnutrition, Intervention and Development in a South Indian District. Ann Arbor: Community Systems Foundation, 1981. 72 pages, 15 Appendices.

Fleiss, Joseph L. Statistical Methods for Rates and Proportions. John Wiley and Sons. New York, 1973.

Fletcher, C. M. and P. D. Oldham. "Diagnosis in Group Research." Medical Surveys and Clinical Trials: Some Methods and Applications of Group Research in Medicine, L. J. Witts ed. Oxford University Press. London 1959. pp. 23-38. 31 references.

Gart, John J. "Point and Interval Estimation of the Common Odds Ratio in the Combination of 2 x 2 Tables with Fixed Marginals." Biometrika, Vol. 57, No. 3, 1970, pp. 471-475. 18 references.

Gavan, James A. "The Consistency of Anthropometric Measurements." American Journal of Physical Anthropology, Vol. 8, 1950, pp. 417-426. 5 references.

Gershoff, N., et al. "Amino Acid Fortification of Rice Studies in Thailand. I. Background and Baseline Data." American Journal of Clinical Nutrition, Vol. 28, February 1975, pp. 170-182. 9 references.

Gershoff, N., et al. "Nutrition Studies in Thailand. II. Effects of Fortification of Rice with Lysine, Threonine, Thiamin, Riboflavin, Vitamin A, and Iron on Preschool Children." American Journal of Clinical Nutrition, Vol. 30, July 1977, pp. 1185-1195. 5 references.

Gilmore, Judith W., et al. Morocco: Food Aid and Nutrition Education. Project Impact Evaluation No. 8, U. S. Agency for International Development, August 1980. 18 pp. 29 references. Appendices A-F.

Gladen, Beth and Walter J. Rogan. "Misclassification and the Design of Environmental Studies." American Journal of Epidemiology, Vol. 109, No. 5, 1979, pp. 607-616. 18 references.

Goldberg, Judith D. "The Effects of Misclassification on the Bias in the Difference Between Two Proportions and the Relative Odds in the Fourfold Table." Journal of the American Statistical Association, Vol. 70, No. 351, September 1975, pp. 561-567. 33 references.

Gopalan, C., et al. "Effect of Calorie Supplementation on Growth of Undernourished Children." American Journal of Clinical Nutrition, Vol. 26, No. 5, May 1973, pp. 563-566.

Graham, George G. and Blanca Adrianzen T. "Late 'Catch-Up' Growth After Severe Infantile Malnutrition." John Hopkins Medical Journal, Vol. 131, No. 3, September 1972, pp. 204-211. 8 references.

Green, Manfred S. "Use of Predictive Value to Adjust Relative Risk Estimates Biased By Misclassification Of Outcome Status." American Journal of Epidemiology, Vol. 117, No. 1, 1983, pp. 98-105. 10 references.

Greenhouse, Samuel W. and Nathan Mantel. "The Evaluation of Diagnostic Tests." Biometrics, Vol. 6, December 1950, pp. 399-412. 4 references.

"Guidelines on the At-Risk Concept and the Health of Young Children." American Journal of Clinical Nutrition, Vol. 30, No. 2, February 1977, pp. 242-254. 7

references. (International Union of Nutritional Sciences Report A.5 Commission III).

Presented are guidelines based on the papers presented at the International Conference on "At-Risk Factors and the Health and Nutrition of Young Children." Details of some biological and environmental at-risk factors in protein-calorie malnutrition of early childhood, cultural at-risk factors affecting nutrition of the fetus, and at-risk factors from various regions and selected places of the world are given.

Gullen, Warren H., Jacob E. Bearman and Eugene A. Johnson. "Effects of Misclassification in Epidemiologic Studies." Public Health Reports, Vol. 83, No. 11, 1968, pp. 914-918. 1 reference.

Habicht, Jean-Pierre, et al. The Effect of Malnutrition During Pregnancy on Survival of the Newborn. Testimony presented at the Hearings of the Select Committee on Nutrition and Human Needs, U. S. Senate, Washington, D. C., June 5, 1973. 6 pp. 6 references. Appendix.

Habicht, Jean-Pierre, et al. "Relationships of Birthweight, Maternal Nutrition and Infant Mortality." Nutrition Reports International, Vol. 7, No. 5, 1973, pp. 533-546.

Habicht, Jean-Pierre, Charles Yarbrough, and Reynaldo Martorell. Anthropometric Field Methods: Criteria for Selection. In Human Nutrition--A Comprehensive Treatise, Vol. 2, Nutrition and Growth, Roslyn Alfin-Slater and David Kritchevsky, eds. Plenum Publishing Corporation, 1979. 25 references.

Habicht, Jean-Pierre. "Some Characteristics of Indicators of Nutritional Status for Use in Screening and Surveillance." American Journal of Clinical Nutrition, Vol. 33, No. 3, March 1980, pp. 531-535. 12 references.

Habicht, Jean-Pierre. "Indicators for Identifying and Counting the Improperly Nourished." American Journal of Clinical Nutrition, Vol. 35, No. 5, May 1982, pp. 1241-1254, Supplement. 42 references.

Harkness, W. L. and L. Katz. "Comparison of the Power Functions for the Test of Independence in 2 x 2 Contingency Tables." Annals of Mathematical Statistics, Vol. 35, September 1964, pp. 1115-1127. 14 references.

Heller, Peter S. and William D. Drake. Malnutrition, Child Morbidity and the Family Decision Process. Discussion Paper No. 58, The University of Michigan, September 1976. 43 pp. 33 references.

Hobel, Calvin J., Lee Youkeles, and Alan Forsythe. "Prenatal and Intrapartum High-Risk Screening." American Journal of Obstetrics and Gynecology, Vol. 135, No. 8, December 15, 1979, pp. 1051-1056. 6 references.

Hobel, Calvin J., et al. "Prenatal and Intrapartum High-Risk Screening." American Journal of Obstetrics and Gynecology, Vol. 117, No. 1, September 1, 1973, pp. 1-9. 13 references.

James, I. R. "Estimation of the Mixing Proportion in a Mixture of Two Normal Distributions from Simple, Rapid Measurements." Biometrics, Vol. 34, June 1978, pp. 265-275. 15 references.

Jamison, Paul L. and Stephen L. Zegura. "A Univariate and Multivariate Examination of Measurement Error in Anthropometry." American Journal of Physical Anthropology, Vol. 40, 1974, pp. 197-203. 14 references.

Johnson, Faruquer and Ethna. Health, Nutrition, and Family Planning in India: A Survey of Experiments and Special Projects, World Bank Staff Working Paper No. 507. World Bank. Washington, D. C., 1982.

Johnston, Bruce F. "Food, Health and Population in Development." Journal of Economic Literature, Vol. 15, No. 3, September 1977, pp. 879-907.

Jones, Edna M., Sara J. Munger, and James W. Altman. A Field Guide for Evaluation of Nutrition Education: An Experimental Approach to Determination of Effects on Food Behavior in Lesser Developed Countries. Synectics Corporation. Allison Park, Pennsylvania, 1975. 105 pp. 6 references. Funded by U.S. Agency for International Development.

Kemper, H. C. G. and J. J. L. Pieters. "Comparative Study of Anthropometric Measurements of the Same Subjects in Two Different Institutes." American Journal of Physical Anthropology, Vol. 40, 1974, pp. 341-343. 8 references.

Kennedy, Eileen and Laura Sims. U. S. Nutrition Interventions. Draft of Chapter. Unpublished. 64 references.

Kennedy, Eileen and Odin Knudsen. A Review of Supplementary Feeding Programs and Recommendations on Their Design. October 1982. 37 pp. 34 references (Revision of April 1982 Draft).

A basic cost effectiveness analysis of supplementary feeding programs, targeted and untargeted, is presented.

Costs are limited to the costs of food, and targeting is represented by screening for moderately and severely malnourished children. The authors recommended: a two-staged targeting process; the use of infant mortality and rates of second and third degree malnutrition to identify areas and seasons with a high prevalence of malnutrition; targeting benefits to children under three with a vigorous outreach effort; nutrition education directed at the mother; treatment of food supplements as "medicine" for a definite duration; supplying a ration of at least two-thirds of the daily caloric and nutrient requirement; and coordination with primary health care services.

Keys, Ancel and Jaakko K. Kihlberg. "Effect of Misclassification on Estimated Relative Prevalence of a Characteristic: Part I. Two Populations Infallibly Distinguished. Part II. Errors in Two Variables." American Journal of Public Health, Vol. 53, No. 10, pp.1656-1660. 7 references.

Knudsen, O. Economics of Supplemental Feeding of Malnourished Children: Leakages, Costs and Benefits, World Bank Staff Working Paper No. 451. World Bank. Washington, D. C., 1981.

This paper shows that on-site, short-duration (2-3 mos.) feeding minimizes leakages and recommends feedings of a size near the full nutritional requirement of the child and an entry criterion based on weight gain to maximize effectiveness. It uses a simulation model and analysis of a project in Tamil Nadu, India to demonstrate criteria for effectiveness (including decline in mortality, increase in productivity).

Knudsen, Odin K. Evaluating the Benefits and Costs of Supplemental Feeding of Children and Pregnant and Lactating Women. May 1982. 39 pp. 17 references (Draft).

The project analyzed by social cost and benefit criteria is a feeding and nutrition education program in Tamil Nadu, India. Children 6-35 mos. screened by weight gain and weight-for-age criteria and pregnant women screened by rural health workers are to be fed a supplement (the ration varies according to children's condition and is given to pregnant women in their last trimester and during 4 mos. of lactation). The project is expected to reduce third-degree malnutrition and mortality in children under 4 years, extend life expectancy of those most at risk, and provide an extended earnings stream. The additional cost to society is measured in terms of the additional population. Among the findings, Knudsen concludes that the economic and social rate of return is "invariant to changes in any individual performance parameter"; when social benefits are added, the

rate of return is raised from below to above the opportunity cost of capital under worst-case assumptions; the results, however, are not as beneficial when social costs are attached to population increases; if "families target for a desired number of children and no social costs are taken into account . . . the project remains viable over a broad range of performance"; and a "more costly ration could easily be tolerated without the rate of return declining to the opportunity cost of capital."

Knudsen, Odin and Pasquale L. Scandizzo. Nutrition and Food Needs in Developing Countries, World Bank Staff Working Paper No. 328. World Bank. Washington, D. C., 1979. 73 pp. 5 references.

Koch, Gary G. "The Effect of Non-Sampling Errors on Measures of Association in 2 x 2 Contingency Tables." American Statistical Association Journal, September 1969, pp. 852-863. 16 references.

Koopman, James S., et al. "Food, Sanitation, and the Socioeconomic Determinants of Child Growth in Colombia." American Journal of Public Health, Vol. 71, No. 1, January 1981, pp. 31-37. 36 references.

Kulin, Howard E., et al. "The Effect of Chronic Childhood Malnutrition on Pubertal Growth and Development." American Journal of Clinical Nutrition, Vol. 36, No. 9, September 1982, pp. 527-536. 39 references.

Lechtig, Aaron, et al. "Effect of Food Supplementation During Pregnancy on Birthweight." Pediatrics, Vol. 56, No. 4, October 1975, pp. 508-520.

Lechtig, Aaron, et al. "Influence of Maternal Nutrition on Birthweight." American Journal of Clinical Nutrition, Vol. 28, No. 11, November 1975, pp. 1223-1233.

Lubchenco, L. O., D. T. Searls, and J. V. Brazie. "Neonatal Mortality Rate: Relationship to Birth Weight and Gestational Age." Journal of Pediatrics, Vol. 81, No. 4, October 1972, pp. 814-822. 17 references.

Lubchenco, L. O., et al. "Long-Term Follow-Up Studies of Prematurely Born Infants. I: Relationship of Handicaps to Nursery Routines." Journal of Pediatrics, Vol. 80, No. 3, 1972, pp. 501-508. 12 references.

Lubchenco, L. O., M. Delivoria-Papadopoulos, and D. Searls. "Long-Term Follow-Up Studies of Prematurely Born Infants. II: Influence of Birth Weight and Gestational Age on Sequelae." Journal of Pediatrics, Vol. 80, No. 3, 1972, pp. 509-512. 10 references.

Marshall, James R., et al. "On the Distortion of Risk Estimates in Multiple Exposure Level Case-Control Studies." American Journal of Epidemiology, Vol.113, No. 4, 1981, pp. 464-473. 14 references.

Martorell, Reynaldo, et al. "The Identification and Evaluation of Measurement Variability in the Anthropometry of Preschool Children." American Journal of Physical Anthropology, Vol. 43, 1975, pp.347-352. 16 references.

Mayer, Jean and Johanna T. Dwyer, eds. Food and Nutrition Policy in a Changing World, Oxford University Press, New York, 1979. 300 pp. Index.

McDowell, Ian and Jan Hoorweg. "Environmental Risk Factors in Outpatient Recovery from Malnutrition." Ecology of Food and Nutrition, Vol. 6, No. 1, January 1977, pp. 23-30. 24 references.

Mora, J. O., et al. "Nutritional Supplementation and the Outcome of Pregnancy. I. Birth Weight." American Journal of Clinical Nutrition, Vol. 32, No. 2, February 1979, pp. 455-462. 28 references.

Mora, J. O., et al. "The Effects of Nutritional Supplementation on Physical Growth of Children at Risk of Malnutrition." American Journal of Clinical Nutrition, Vol. 34, No. 9, September 1981, pp. 1885-1892. 31 references.

Murphy, James R. "The Relationship of Relative Risk And Positive Predictive Value In 2 x 2 Tables." American Journal of Epidemiology, Vol. 117, No.1, 1983, pp. 86-89. 5 references.

The Narangwal Population Study: Intergrated Health and Family Services. Rural Health Research Center. Narangwal, Punjab, India, 1975. 448 pp. 15 references.

Neumann, Charlotte G. and Melinda Alpough. "Birth weight Doubling Time: A Fresh Look." Pediatrics, Vol. 57, No. 4, April 1976, pp. 469-473. 18 references.

Newell, David J. "Error in the Interpretation of Errors in Epidemiology." American Journal of Public Health, Vol. 52, No. 11, 1962, pp. 1925-1928. 6 references.

Neyman, J. "Outline of Statistical Treatment of the Problem of Diagnosis." Public Health Report, Vol. 62, October 3, 1947, pp.1449-1456.

Nissen-Meyer, Sven. "Evaluation of Screening Tests in Medical Diagnosis." Biometrics, Vol. 20, December 1964, pp. 730-755. 7 references.

Nutrition Programmes and Health: The Development of National Nutrition Programmes with Special References to the Vulnerable Sectors of the Population. World Health Organization, South-East Asia Region, New Delhi, India, 1976. 79 pp. 57 references.

Nutting, Paul A., et al. "Reduction of Gastroenteritis in High-Risk Infants." Pediatrics, Vol. 55, No. 3, March 1975, pp. 354-358. 10 references.

Owen, Anita Yanochik. "Community Nutrition in Preventive Health Care Services." Health Planning Bibliography Series, No. 7, U. S. Department of Health, Education and Welfare, May 1978.

Pinstrup-Anderson, Per, Norha Ruiz de Londono, and Edward Hoover. "The Impact of Increasing Food Supply on Human Nutrition: Implications for Commodity Priorities in Agricultural Research and Policy." American Journal of Agricultural Economics. Vol. 58, No. 2, May 1976, pp. 131-142. 8 references.

Placek, Paul. "Maternal and Infant Health Factors Associated with Low Infant Birth Weight: Findings from the 1972 National Natality Survey." in Epidemiology of Prematurity, Dwayne M. Reed and Fiona J. Stanley eds. Urban and Schwarnzberg. Baltimore, Maryland. September 1977.

Popkin, Barry M. "Some Economic Aspects of Planning Health Interventions among Malnourished Populations." American Journal of Clinical Nutrition, Vol. 31, No. 12, December 1978, pp. 2314-2323. 32 references.

Quade, Dana, et al. "Effects Of Misclassifications On Statistical Inferences in Epidemiology." American Journal of Epidemiology, Vol. III, No. 5, 1980, pp. 503-515. 9 references (SENIC Project, CDC, Atlanta, Ga. 30333).

Rao, D. Hanumantha and A. Nadamuni Naidu. "Nutritional Supplementation--Whom Does it Benefit Most?" American Journal of Clinical Nutrition, Vol. 30, No. 10, October 1977, pp. 1612-1616.

In Hyderabad, India 211 preschoolers who received a food supplement and 82 who did not were classified into four nutritional groups: normal, current short-term malnutrition, nutritional dwarf, and current long-term malnutrition. The results indicate that all malnourished

children benefited by the food supplement, but those most severely malnourished--body weight below 60 of standard weight-for-age, weight less than 85 of standard weight-for-height, and suffering from long-term malnutrition--benefited most from the supplement. Results also indicated that nutritional dwarfs are capable of moving toward normalcy with longer periods of nutritional rehabilitation.

Report of the Comptroller General of the United States. Impact of U. S. Development and Food Aid in Selected Developing Countries, Departments of State and Agriculture and Agency for International Development, April 22, 1976.

Reutlinger, Sholmo and Marcelo Selowsky. Malnutrition and Poverty: Magnitude and Policy Options. World Bank Staff Occasional Paper No. 23 (Second Printing). World Bank. Washington, D.C., Published by Johns Hopkins University Press. Baltimore, Maryland, U.S.A., 1978. 82 pp. 7 references.

Rogan, Walter J. and Beth Gladen. "Estimating Prevalence from The Results of a Screening Test." American Journal of Epidemiology, Vol. 107, 1978, pp. 71-76.

Rubin, Theodore, Joseph Rosenbaum and Sidney Cobb. "the Use of Interview Data for the Detection of Association in Field Studies." Journal of Chronic Diseases, Vol. 4, No. 3, September 1956, pp. 253-266. 10 references. Appendix.

Schon, Donald A., William D. Drake, and Roy I. Miller. "Social Experimentation as Reflection-in-Action: Community Level Nutrition Intervention Revisited." unpublished, November 1982. 56 pages.

Selowsky, Marcelo. The Economic Dimension of Malnutrition in Young Children, World Bank Staff Working Paper No. 294. World Bank. Washington, D. C., 1978.

Selowsky, Marcelo. "Target Group-Oriented Food Programs: Cost Effectiveness Comparisons." American Journal of Agricultural Economics, Vol. 61, No. 5, December 1979, pp. 988-994. 4 references.

The paper compares three target-oriented food programs--a ration shop scheme where preselected families receive subsidized rations of food, a subsidized food stamp program for families, and a free on-site feeding program for children-- to an equivalent income transfer. First, the comparisons are made when the programs do not affect the marginal rate of substitution, and then when they do induce a change in the composition of food consumption.

Cost effectiveness is defined here as the fiscal cost of increasing by one dollar the aggregate food consumption of children. When the foods are inframarginal-- not in excess of initial consumption--all the programs have the same cost effectiveness and are equivalent to an income transfer. When the food supplements are in excess of initial consumption and the definition of children is very narrow, all three programs are more cost effective than an income transfer, except low-priced food stamp programs (these conclusions assume no resale of supplements or food stamps).

Simmons, William K., et al. "A Survey of the Anemia Status of Preschool Age Children and Pregnant and Lactating Women in Jamaica." American Journal of Clinical Nutrition, Vol. 35, No. 2, February 1982, pp. 319-326. 11 references.

Stephens, Betsy, et al. Outreach Grant Project Evaluation. International Science and Technology Institute, Inc. October 1982. 64 pp. Appendices: 50 pp. (Draft).

Study by the Staff of the United States General Accounting Office. Food and Agriculture Models for Policy Analysis. March 1977.

Tanner, J. M. and A. M. Thomson. "Standards for Birthweight at Gestation Periods from 32 to 42 Weeks, Allowing for Maternal Height and Weight." Archives of Disease in Childhood, Vol. 45, August 1970, pp. 566-569. 7 references.

Tolpin, Harriet G. "Economics of Health Care: The Necessity of a Cost/Benefit Approach." Journal of The American Dietetic Association, Vol. 76, No. 3, March 1980, pp. 217-222. 18 references.

Trowbridge, Frederick L. "Clinical and Biochemical Characteristics Associated with Anthropometric Nutritional Categories." American Journal of Clinical Nutrition, Vol. 32, No. 5, April 1979, pp. 758-766. 20 references.

Vuori, Lea N., et al. "Nutritional Supplementation and the Outcome of Pregnancy. II. Visual Habitation at 15 Days." American Journal of Clinical Nutrition, Vol. 32, No. 2, February 1979, pp. 463-469. 36 references.

Waterlow, J. C. "Classification and Definition of Protein-Calorie Malnutrition." British Medical Journal, Vol. 3, September 2, 1972, pp. 566-569. 21 references.

Weber, Richard F., et al. Senegal: The Sine Saloum Rural Health Care Project. Project Impact Evaluation No. 9, U. S. Agency for International Development, October 1980. 15 pp. 24 references. Appendices A-N.

Whaley, Fredrick S., et al. "Effects of Method Error on the Power of a Statistical Test." American Journal of Epidemiology, Vol. 111, No. 5, 1980, pp. 534-542. 9 references.

Yerushalmy, Jacob. "Statistical Problems in Assessing Methods of Medical Diagnosis, with Special Reference to X-ray Techniques." Public Health Report, Vol. 62, October 3, 1947, pp. 1432-1449.