PN-AAK-104

Nutrition Intervention in Developing Countries

Study I
SUPPLEMENTARY FEEDING

Prepared by the Harvard Institute for International Development

Prepared for
Office of Nutrition
Development Support Bureau
U.S. Agency for International
Development

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Developing Countries

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UPPLEMENTARY FEEDING

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Office of Nutrition
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U.S. Agency for International
Development

Oelgeschlager, Gunn & Hain,
Publishers, Inc.
Cambridge, Massachusetts

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International Standard Book Number: 0-89946-081-x

Library of Congress Catalog Card Number: 80-29235

Printed in the United States of America

Library of Congress Cataloging in Publication Data

Main entry under title:

Nutrition intervention in developing countries.

CONTENTS: v. 1 Study one, Supplementary feeding.--v. 2. Study two, Nutrition education.--v. 3 Study three, Fortification. Study four, Formulated foods.--(etc.)
1. Underdeveloped areas--Nutrition policy--Collected works. 2. Underdeveloped areas--Nutrition--Study and teaching--Collected works. 3. Underdeveloped areas--Food relief--Collected works. 4. Underdeveloped areas--Food supply--Collected works. I. Austin, James E. II. Zeitlin, Marian F.
TX359.N874 363.8'8 80-29235
ISBN 0-89946-081-x (v.1)

This document has been prepared by a staff of professionals through the Harvard Institute for International Development under a contract with the Office of Nutrition, U.S. Agency for International Development. The purpose of this volume is to provide guidance to those interested in the development and implementation of programs directed at preventing malnutrition among preschool populations.

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FOREWORD

How do nutrition projects begin? How are specific interventions selected? Who makes the decisions and what is the rationale behind them?

Since such decisions relate to health or food policies of countries and have important implications for budgets, personnel and other resource allocations, it would be prudent that they be made only after careful study and analysis. Regrettably, this is not usually the case. More often than not, the choice is a subjective one.

Some interventions are undertaken because they seem "obvious." Since many others are doing it, it seems like the right thing to do, and there is unquestioned faith that it works. An approach may be fashionable at a given time period. A particular activity may be promoted by an external agency. There may be very attractive offers, such as free food or technical assistance, or a start-up grant.

To the degree that costs are considered, there is usually concern only with what funds are needed to cover immediate and direct costs. The indirect or hidden costs, which may be much greater, are overlooked. Project staff time may be charged to other budgets. The implications for an increased demand on energy or scarce materials may not be considered. There is a tendency to forget overhead costs such as those for the use of buildings or for heating, cooling, and lighting.

Social costs are even more often ignored. Some projects accelerate a change away from traditional practices such as breast-feeding or using natural foods or cultivating home gardens. A project may encourage a welfare mentality, reduce incentives to work, or create lasting demands for convenience foods where packaging and processing may forever raise the price of a food. Obsessed with political needs, decision makers may not be concerned with long-term consequences, such as the problem of terminating a popular service when it is no longer needed.

Too often these kinds of questions are not addressed, resulting in only marginal effectiveness for many projects. An apparently "good project," (that is, one which is scientifically sound, well organized, etc.), will bring disappointing results if it is aimed at a problem it is not designed to deal with. This in turn can lead to a dilemma of whether to continue a project while lacking confidence in it or to terminate it and admit failure. More often, projects go on and on without bringing results but without any objective evaluation or analysis.

Avoiding these problems requires accurate identification of problems, insightful analysis of causation, and a good understanding of interventions in terms of how they work, what they cost, what they achieve, what other consequences they bring, and what pre-conditions should be present before a particular intervention is selected.

To help deal with the question of intervention selection the U.S. Agency For International Development commissioned Harvard University to prepare this series of Special Studies dealing with supplementary feeding, nutrition education, formulated foods, food fortification, consumer price subsidies, agricultural production, and integrated programs. Together the separate pieces comprise a manual intended to provide guidance on selecting from alternative approaches to reach the pre-school child. We hope this effort contributes to improving the process of intervention selection, and thereby, to more effective prevention of malnutrition.

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Washington, D.C. 20523

PREFACE

This study on supplementary feeding is one of seven studies examining the major types of nutrition programs operating in developing countries. Studies II and III in the series deal with nutrition education and formulated foods, which are closely related to supplementary feeding. The reader is urged to review these studies in conjunction with this one. The other studies in the series cover fortification, consumer price subsidies, agricultural productivity, and integrated programs.

The purpose of this series is to provide guidance to planners in developing countries and international development agencies on the nature and design of these major types of nutrition interventions. The lack of knowledge about intervention design, costs, and effectiveness was cited by the National Academy of Sciences in its 1976 World Food and Nutrition Study as a major impediment to efforts to reduce the malnutrition problem. Our series, which was prepared for the Office of Nutrition of the U.S. Agency for International Development, is an attempt to help close that knowledge gap.

We have tried to assess the "state of the art" of nutrition interventions through a review of published and unpublished literature, a mail survey of 200 nutrition projects in 64 developing countries, interviews with professionals from many disciplines and institutions involved in nutrition programming, and direct field analyses of selected nutrition programs. From these multiple sources and voluminous data, we have attempted to present a representative picture of each nutrition intervention. A commonly cited difficulty for planners, especially in developing countries, is ascertaining what is going on elsewhere and obtaining factual information on the many facets of designing a nutrition program. We have attempted to alleviate that problem by providing fairly complete, although not exhaustive, documentation and supporting references. Such attention to detail is needed when one is actually going through the intervention design process. However, not all readers will need to immerse themselves in this detail. To facilitate their use of the series, we have preceded each subsection with a set of Key Questions that are addressed therein. At the end of each subsection we have presented a short Summary of the major points covered. Both the Questions and Summary sections are blocked off to facilitate the reader's scanning the document and identifying those parts that are of most interest.

Despite our efforts for completeness and our intense desire to provide useful guidance, the relative paucity of reliable evaluative data on nutrition programs and the limitation of this work leave us far short of the ideal. It has not been possible to ascertain the quality of the data and research designs of most of the literature we have reviewed. Our analyses and suggestions should be viewed as tentative, subject to further verification. It is hoped that these documents will facilitate such future evaluative efforts and that this study and the others in the series will at least provide a reasonable base upon which others can build.

The case study in the supplementary feeding study is based on field research carried out by CARE under the sponsorship of AID. The authors express their deep appreciation to CARE for their generous cooperation in allowing us to develop the case study and include it as part of this work. This cooperation is a clear demonstration of their commitment to combatting the problem of global malnutrition.

The authors also wish to thank Barbara Underwood, Jim Pines, and J.P. Habicht for their very useful comments on earlier versions of this study. Our appreciation is also extended to AID's Expert Review Panel for their constructive observations. Thanks also go to HIID staff for their administrative assistance and particularly to Melanie Mahin and Marilyn Pirkle for editorial help. The support of the staff at the AID Office of Nutrition was vital throughout the project. Dr. Martin Forman's initial vision and continued guidance was essential to the realization of the study.

On behalf of my colleagues and co-authors, Mary Ann Anderson, Joe Wray and Marian Zeitlin, we express our deep appreciation to all those who cooperated in this undertaking and our hope that this work assists others in the task of alleviating malnutrition.

James E. Austin
Project Director
Cambridge, Massachusetts

CHAPTER ONE

OVERVIEW

PURPOSE AND ORGANIZATION

The purpose of this study is to describe and analyze the ture, problems, and potential of supplementary feeding programs in veloping countries. Supplementary feeding is the most common form of trition intervention. We will attempt to provide guidance about the in considerations in planning, designing, and evaluating this type of trition intervention.

The study is organized into four chapters. The remainder of is first chapter will discuss the role of supplementary feeding in alle-ating protein-energy malnutrition problems, as well as the common forms d extent of use of this nutrition intervention. The term malnutrition ll be used throughout the study to refer to protein-energy malnutri-on (PEM). Chapter Two is the heart of the study; it analyzes the in intervention design considerations. Chapter Three looks at the costs d nutritional effectiveness of supplementary feeding programs. The final apter is a case study of feeding programs assisted by CARE in five coun-ries: Pakistan, India, Colombia, Costa Rica, and the Dominican Republic.

ROLE OF SUPPLEMENTARY FEEDING

A. KEY QUESTIONS

- What is the definition of supplementary feeding programs?
- What is the rationale for using them to alleviate malnutrition?

Supplementary feeding programs are perhaps the oldest and most despread type of nutrition intervention in developing countries. Al-ough these efforts have taken many forms, in this study we focus on ograms that distribute food on a regular basis through noncommercial annels to preschool children and pregnant and lactating women in order increase their nutrient intake directly and thereby improve their nutri-onal and health status.

One of the major attractions of such supplementary programs is their directness in attacking the malnutrition problem. The intervention uses special delivery systems to channel additional nutrients directly to the most nutritionally vulnerable groups. It does not rely on the general food-marketing system as do other types of interventions, such as consumer price subsidies, agricultural production, or fortification.

The necessity for targeting nutrient delivery especially to six- to thirty-six-month-old children is due to their particular nutritional vulnerability. Rapid growth at this time increases per-kilo nutrient requirements to levels well above those of adults. Furthermore, their increased susceptibility to infections make adequate nutrition even more important as a means of combating such afflictions, which are the major childhood killers. In effect, one is trying through supplementary feeding to give a "nutritional immunization" that will get a child through this critically vulnerable period. After 36 months, or even 24 months, survival rates increase dramatically.

In communities where infants and young children are malnourished, adolescent girls and pregnant and lactating women may also be inadequately nourished. Pregnant and lactating women who are, or are not, at risk (see Chapter Two Section III.E) should be included in supplementary feeding programs. Increased birth weights and reduced infant mortality (Habicht, et al. 1973) and improved lactation performance (Wray 1978a) have resulted from maternal supplementation.

Supplementary foods are generally free or provided for only a nominal charge. The foods serve, in effect, as an income supplement and thus can help overcome the poverty that prevents adequate diets. Furthermore, by channeling special nutrient-dense food directly to the vulnerable groups, supplementary feeding programs can help correct deleterious food habits, such as the late introduction of nutritious foods to weanling infants or the use of bulky, not easily digested staples.

It should be recognized, however, that supplementary feeding per se does not change the underlying economic and cultural causes of malnutrition. Feeding programs should not be viewed as surrogates for other income-increasing and redistributive measures or for educational efforts aimed at achieving more beneficial feeding and health habits. Supplementary feeding can be used to meet immediate, short-run nutritional needs while simultaneously supporting other actions aimed at achieving more permanent solutions. For example, feeding programs can be used to provide more sustenance while new agricultural techniques are being introduced, resettlement activities are taking place, or an infrastructure is being built. Time is a very important consideration: in the time required to introduce a new crop on a scale sufficient to improve the diet of children between 6 and 36 months of age (if such a crop can indeed affect their diets), two to five annual cohorts of children will have passed through the vulnerable period, and many will have become malnourished.

Feeding programs can also be, and generally are, used as educational vehicles to stimulate improved nutritional habits, particularly regarding weanling foods, feeding during sickness, and sanitary food practices. In some cases the use of food supplements may serve to demonstrate to mothers the importance of nutrition or the value of certain foods. In other cases food supplements may serve as concrete incentives to attract and hold program participants until the utility of other activities becomes apparent.

Like most other health programs, feeding programs have often been mounted without clearly defined nutritional goals or sufficient baseline data for evaluation. For example, political motivations intended to manifest the concern of a government for the well-being of its nation's children have produced many school feeding programs. The infrastructure exists, particularly in urban areas; visibility is high and the programs may be immensely popular. However, the nutritional deficiencies of school children are usually far fewer than those of preschoolers, and the need to assign a higher priority to the younger children is widely recognized now, even if not always applied. A basic problem here derives simply from the fact that school children are more accessible, while preschoolers represent a target population that is extremely difficult to reach.

Another factor that has given rise to many supplementary feeding schemes is surplus commodities. Disposing of agricultural surpluses was a propelling force in the emergence of international food-aid programs. In recent years, however, surplus disposal motives have been superseded by an increased focus on reaching vulnerable groups. Food aid and supplementary feeding are also used in disaster relief situations, but this study does not deal with such emergency feeding schemes, which are discussed elsewhere (Protein-Calorie Advisory Group 1977). Supplementary feeding programs clearly have drawbacks. Feeding programs have been justly criticized for creating disincentives to local agriculture, increasing external dependency, and failing to achieve nutritional improvement (Maxwell 1978). Their potential for generating nutritional improvement is also clear; the challenge appears to be in designing them correctly.

B. SUMMARY:

ROLE OF SUPPLEMENTARY FEEDING

Supplementary feeding programs distribute food on a regular basis through noncommercial channels to preschool children and pregnant and lactating women. This intervention is attractive in that it directly provides nutrients to the most nutritionally vulnerable groups rather than relying on the general food-marketing system.

The programs provide free or subsidized foods, thus overcoming the constraint of purchasing power. The intervention can also be used as an educational vehicle to correct deleterious food habits.

Supplementary feeding should not be viewed as a substitute for other income-increasing or redistributive measures. It addresses short-term nutritional needs and can thereby provide support while longer-term, more permanent interventions (e.g., increased agricultural productivity) take hold.

III. FORMS AND USAGE

A. KEY QUESTIONS

- What are the main forms of supplementary feeding interventions?
- How widely used are they?
- What are the principal strengths and weaknesses of the different forms?

B. Forms

Supplementary feeding requires delivery of food to target populations. Necessary elements are an adequate supply of supplements, a dependable delivery system, trained and responsible personnel at local and central levels, and the facilities required for food storage, preparation, and distribution. Equally necessary, but by no means always available, are baseline data to define the seriousness of the problem and identify those individuals who should be in the target population. An information system that provides data for current monitoring and long-term evaluation is also needed (see Chapter Three).

There are three basic types of programs for supplementation, which can be usefully viewed from a historical perspective. In the 1950s, when the importance of malnutrition began to be widely appreciated, it was seen as a hospital problem. The numbers of children involved and the time required for rehabilitation meant that thousands of hospital beds would be needed. Nutrition rehabilitation centers (NRCs) providing simple residential treatment were developed as an alternative. But the sheer numbers of children in need remained a problem, and ways were sought to handle larger numbers On-site feeding grew out of this concern. Rather than housing the children at an NRC, food prepared for consumption at the site was provided. Part of the appeal in this approach derived from the fact that actual eating patterns could be observed and records maintained. A given

on-site program can serve a limited number of children, however, and the concept of take-home programs evolved. In these programs, supplements to be prepared and consumed at home are provided to the mother or a surrogate, thus making it possible to increase the number of beneficiaries several times over, while using the same facilities and the same numbers of personnel as in on-site programs.

Nutritional Rehabilitation Centers

Children suffering from uncomplicated second- and third-degree malnutrition (according to the Gomez classification), and usually between 3 and 5 years of age, are the targets of NRC programs. In the original concept of Bengoa (1964), nutritional recuperation was to be accomplished in a clinical, but nonhospital, setting where children would be fed at the lowest possible cost and mothers would be educated throughout the child's recuperation.

Distribution sites have been called nutritional rehabilitation centers (NRCs), nutrition recuperation centers, nutrition education and recuperation centers, nutrition education and recuperation services (SERN), and mothercraft centers - a name suggested by W. H. Sebrell to emphasize maternal education (Research Corporation 1970). Centers may or may not be attached to a health facility. Today most centers provide day care only and children receive meals supplying their daily nutrient requirements for six days per week, although residential centers, where children and mothers live in order to insure their active participation, still exist (Cutting and Cutting 1975; Christian Medical Commission, World Council of Churches 1974). At some centers children receive only a portion of their daily nutrient requirements to enhance recuperation. Recovery usually takes three to four months.

Maternal education is constantly stressed in nutrition rehabilitation centers, and all treatment of the malnourished child must be compatible with the real economic situation of the family so that the mother can practice what she has learned once she is home (Fougere and King 1975; Beghin 1970). As part of her education, a mother is required to work in the center regularly, assisting in operations through buying, preparing, and serving food and taking care of the children (Beghin 1976). During that time the mother is taught practical food-related behaviors which aim to improve and then maintain the nutritional status of the enrolled child as well as the other children in the family.

NRCs are distinctive in that they service the most malnourished children, who require intensive feeding and, frequently, medical treatment. The on-site and take-home programs are generally aimed at the less malnourished and can serve to prevent deterioration into a more severe nutritional state. Thus, NRCs can be complements of, rather than alternatives to, the other programs.

2. On-Site Feeding Programs

In these programs children are provided with one or several cooked meals per day, five to seven days per week, to be consumed at a designated location which is most often a day-care center or a community center. Primary schools, orphanages, hospitals, and centers constructed solely for feeding are also used. Educational activities and health services may or may not be provided in addition to the meals prepared for institutionalized children and children attending day-care centers during usual meal hours. In other cases, children may be assembled at feeding centers solely to eat the meal prepared from the supplementary foods. On-site feeding may or may not be targeted to malnourished children, and usually reaches ambulatory children from 2 to 5 years old. In most cases there is no specific time limit on how long a child participates other than his age.

3. Take-Home Programs

In these programs, supplementary foods for home consumption are usually provided weekly, biweekly, or monthly to mothers or their surrogates. The ration is usually sufficient to supply a portion of the daily nutrient requirements of preschool children and pregnant or lactating mothers until the next distribution date. Prepared or partially prepared foods may also be given for take-home consumption. Distribution sites are often health or maternal and child health (MCH) centers, although many types of facilities may be used, and the feeding may or may not be integrated with health and education services. Beneficiaries are usually children between birth and five years old, who may or may not be malnourished, and pregnant or lactating mothers. Occasionally a ration is also provided for all preschool children in a target family. Excluded from this category are programs reaching preschoolers through commercial channels such as food-coupon systems, fair price or ration shops, and food-for-work schemes, because these fall under the category of general family price-subsidy interventions. Food-for-work programs do increase family incomes and food supplies and have increasingly been used as a vehicle for reaching preschoolers. However, because of the limited information on this new focus and the constraints of the scope of our work, we will not examine these programs. Nonetheless, a selected bibliography on food-for-work programs in general is included at the end of this chapter.[1]

These three types of supplementary feeding schemes have one common element - they all deliver food directly to the target groups in order to fill the nutrient gaps caused by inadequate consumption. They differ in the degree of control exerted between when and where the food is delivered and when and where it is consumed by the recipient. At NRCs and in on-site programs food leakages are minimized, while take-home programs easily facilitate the consumption of the supplementary food by nontarget-group members. Substitution of the ration for the usual daily intake occurs commonly in take-home and on-site programs, and thus reduces the net incremental nutrients delivered and the nutritional impact. NRCs specifically target the severely malnourished and can cost several times more per child benefited than the other feeding programs. The cost differential

occurs because the NRC is a total feeding program, and because the same facilities and personnel can serve more children in an on-site feeding program and many more in a take-home program. In Candelaria, Colombia, for example, a take-home program served 20 times as many children as an NRC using the same personnel and facilities, and achieved comparable improvements in growth in severely malnourished children (Wray 1967).

C. Usage

International food-aid schemes, provided as relief efforts after World War I and continuously since World War II, have made vast quantities of food available for supplementary feeding programs. The United States has been the major donor through its PL-480 program. Currently much of the food is channeled to the developing countries through private voluntary agencies such as CARE, Catholic Relief Service (CRS), or Church World Service (CWS), which work with governments in planning, developing, and administering the programs. In recent years, multilateral aid has been given principally through the World Food Programme (WFP).

Berg (1973) estimated that approximately three quarters of a billion dollars a year are spent to provide 125 million children with food in over 100 countries. Of this total, however, preschool feeding schemes receive a surprisingly small percentage of the commodities provided to supplementary programs. As of the end of 1976, only 8% (or $227 million) of WFP's financial commitment since 1963 had been devoted explicitly to preschoolers and mothers (Gongora and Shaw 1977), despite the fact that this group comprised slightly over 20% of the total number of beneficiaries receiving WFP food (FAO 1973). In comparison, WFP invested twice that amount in the primary school age group. In some countries supplementation for preschoolers is widespread. For example, Chile has a supplementation program started in 1924 which by 1977 covered 82% of children under 5 years of age (Gonzalez and Infante 1978).

The U.S. Agency for International Development, PL-480 Title II program has designated preschool nutrition schemes as a top priority committing $138 million, or 44% of the total value of commodities shipped in fiscal year 1976 to preschoolers and mothers. In that year, Title II food reached 13.8 million mothers and preschool children: 8.6 million through voluntary agencies; 5 million through United Nation's World Food Program (UN WFP), and 200,000 through government-to-government programs according to the fiscal year 1976 Annual Report on Public Law 480, Food for Peace. By 1978, WFP project recipients in the "vulnerable" category had risen from 3,440,400 to 5,461,000 and 78% were preschoolers (Shaw 1978).

Of 201 preschool-focused programs surveyed by the Harvard Institute for International Development (HIID) project, 79% included a feeding component (Austin, Mahin, Pyle, Zeitlin 1978). Half used take-home systems, half on-site. Of these two types of programs, CARE (excluding India) conducted the majority of its feeding through the take-home approach; in India, 68% of the preschool schemes were on-site. CRS estimates that 80%

of its projects are of the take-home variety because of a lack of facilities and funds to conduct on-site schemes (Bratcher 1978). The WFP reports that almost two thirds of its programs are take-home (Shaw 1978). Of the projects surveyed by the American Public Health Association (APHA), only 8% were NRCs; only 5% of CARE's preschool programs in 21 countries are NRCs.

These three forms of feeding programs are not mutually exclusive alternatives. They may be used individually or in combination, depending on the situation. Chapter Two will discuss intervention design considerations aimed at maximizing their strengths and minimizing their limitations, which are summarized in Table 1.

D. SUMMARY:

FOPMS & USAGE

There are three basic types of supplementary feeding programs. Nutrition Rehabilitation Centers (NRCs) aim at the more severely malnourished children (second and third degree). The children attend the center throughout the day and in some instances remain overnight. They are given their entire daily nutrient needs and usually require 3 to 4 months to recuperate. During this period each mother is given nutrition education on practical food-related practices which will help improve and maintain the nutritional status of the treated child and its current or future siblings.

On-site feeding programs generally provide one cooked meal daily to preschoolers in a group setting. Larger numbers can be handled than in an NRC, but the treatment is less intensive. Maternal nutrition education frequently accompanies the feeding.

Take-home programs provide on a weekly, biweekly, or monthly basis rations which are to be consumed in the homes. This system permits larger numbers of target-group members to be served, but the rations are generally shared with other family members.

Feeding programs are among the most common types of nutrition intervention. By 1978 over 1 billion preschoolers and pregnant and lactating women participated in such programs. The most common form is take-home programs, although on-site programs are more prevalent in some countries. NRCs are relatively few in number, primarily reflecting the smaller percentage of severely malnourished children and the high costs of this type of intervention.

STRENGTHS AND LIMITATIONS OF VARIOUS TYPES OF SUPPLEMENTARY FEEDING FOR PRESCHOOL CHILDREN

Type of Feeding	Potential Strengths	Potential Limitations
Nutrition Rehabilitation Center	Promotes rapid rehabilitation of severely malnourished, thereby freeing hospital beds.	Limits coverage because of lack of beds.
	Assures consumption of total Recommended Daily Allowance (RDA) by avoiding problems of sharing and substitution of the ration.	Does not directly reach other children in family.
	Provides for continuing surveillance.	Increases costs because of provision of total daily diet, kitchen and eating facilities, and high staff patient ratio.
	Involves mother in recuperation of child through mandatory education and work shifts.	Fails to acquire maternal participation in educational activities.
	Creates self-sufficiency by use of locally available, affordable foods.	Fails to provide education consistent with economic limitations.
	Prevents relapse, maintains growth of graduates.	Creates possibility of cross-infection.
	Prevents malnutrition - siblings.	Removes mother from home, other children, and job (especially residential NRC), and may cause lost wages and inconvenience.
	Enhances cost effectiveness because targeted.	Requires dynamic, dedicated person in charge.

Table 1 (continued)

Type of Feeding	Potential Strengths	Potential Limitations
On-site	Assures consumption of ration in intended quantity.	Reaches few children under two years old.
	Growth and recovery are possibly more rapid than in take-home.	Ration is frequently substituted for the home diet.
	Day-care and child feeding facilities provided for working mothers.	Takes responsibility for child feeding away from mother and creates dependency.
	Provides opportunity to educate children and prepare them for primary school.	Kitchen, eating facilities, staff, and cook are expensive.
	Provides opportunity for psychological stimulation, socialization, and normal mental development, especially through mixing malnourished children with the well-nourished.	Provides low coverage, with attendance limited to batches of thirty children.
	Generally serves larger numbers of children than NRCs.	Generally has low geographic outreach.
	Assures growth surveillance, monitoring is easy.	Creates possibility of cross-infection.
	Provides maternal education through participation (as in NRCs).	Inconvenience of daily attendance is sometimes a problem.
	Costs per person served are less than for NRCs.	

Type of Feeding	Potential Strengths	Potential Limitations
Take-home	Has high geographic outreach.	Sharing and selling of rations result in high diversion to unintended groups.
	Covers children under two years old.	Achieves slow growth and recuperation.
	Convenient for mothers because of less frequent distributions and fewer lost wages.	May not be sufficient for the severely malnourished child.
	Provides high coverage, with attendance of up to 600 children per center.	Distribution site may be too far for people to travel.
	Less expensive than on-site because fewer facilities and staff needed.	Provides less opportunity for education because of infrequent food distribution.
	Minimizes cross-infection risk.	
	More realistic maternal education achieved through home treatment.	
	Home treatment can act as a nutrition education demonstration in distant communities.	
	Ration can be fed in more frequent, smaller portions than is possible in on-site, resulting in higher nutrient intake despite bulk limitations.	
	Program located in a health center may promote greater use of health facilities.	
	Treats the malnutrition problem in its milieu.	
	Emotional disturbance is reduced because the child is not moved to a new environment.	

Chapter One Footnote

[1]The following documents can be consulted regarding food-for-work issues:

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CHAPTER TWO

INTERVENTION DESIGN

I. INTRODUCTION

The purpose of this chapter is to identify and discuss the major considerations in designing supplementary feeding interventions. Every intervention should be tailored to the particular circumstances of its economic, social, political, and biological setting; nonetheless, there are basic design elements that are common to all these programs. The following design aspects will be analyzed:

- Community involvement, which considers the importance of program beneficiaries and means of their participation in design and operation;
- Participant selection, which discusses the rationale for and means of targeting feeding programs to preschoolers and pregnant and lactating mothers;
- Food type, which examines acceptability, nutritional adequacy, and source (local vs. imported) factors influencing the form of the supplement;
- Food quantity, which analyzes nutritional requirements and deficits and food leakages as determinants of the size of the supplement;
- Time dimensions, which concerns how often, and how long the supplementation should occur;
- Location, which sets forth site selection criteria involving nutritional need, accessibility, image, and availability;
- Site facilities, which covers suggestions regarding operating conditions and procedures for feeding centers;
- Logistics and control, which presents managerial aspects of food procurement, delivery, preparation, feeding, and stocking and discusses the use of growth surveillance as a monitoring system.

Intervention design is part of a larger program-planning process which can encompass three phases: 1) Program development-general diagnosis, detailed plan elaboration, program preparation, community level planning, village preparation, field testing and adapting; 2) program initiation; 3) and program operation.

Although Chapter Three will deal explictly with feeding program evaluation, it is important to note that an evaluation system should be an integral part of the intervention design. Accordingly, aspects of such a system will be touched on in the discussion of the above-mentioned topics. Those aspects of program design which most impinge on costs or impact on nutritional status are of particular relevance to evaluation. It should also be noted, however, that we consider evaluation to be primarily a management tool and part of the management control and information system. Evaluation results are, of course, also of interest to national planners and funding agencies. Since the needs of program staff and external donors may differ, data collection and analysis should reflect this.

I. COMMUNITY INVOLVEMENT

A. KEY QUESTIONS

- Why is community involvement important?
- How may it be achieved?

If supplementary feeding programs are to be successful, involvement of the community is crucial. They should be involved initially in deciding whether or not to have a program and, if so, how it should be designed. The motivation of participants to attend the program regularly and to practice the lessons they learn is equally important. They should also participate in the management of the operations. Community involvement in supplementary feeding programs leads to greater understanding, commitment, and impact. It ensures that local beliefs and practices are considered. In a nutrition rehabilitation program in Madurai, India, the highest impact centers were found in communities that had the greatest understanding and involvement (Venkataswamy and Kabir 1975).

Community involvement and commitment to supplementary feeding programs often is made concrete through the donation of land and buildings for the feeding center and for storage of commodities, and through the local provision of foods (Fougere and King 1975; Chaudhuri and Prince 1977; Gill 1972). Community participation also may involve the appointment of program personnel. In Tanzania, "ten house cell leaders" were asked to publicize the program and win community support (Bernstein and Kreysler 1972). In Madurai, India, in addition to the usual nutrition education for mothers and school children, publicity about the program was spread through posters, movies, and slides on display in mills, transport depots, and police stations (Venkataswamy and Kabir 1975). In Indonesia, community interest was generated through monthly weighing sessions for preschool children, held in the family's own neighborhood rather than in the clinic; the community used the results to identify and decide how to tackle its own nutrition problems (Hendrata 1976). A similar and even more widespread program is being carried out in the Philippines (Solon and Florentino 1976).

However, it is important to be honest with the community about ways in which the program may fail, at the same time as attempting to develop enthusiastic support for it (Research Corporation 1970). Communities should be warned that failure may occur if the program leaders' instructions with respect to age of enrollment, improved weaning practices, change in intrafamilial distribution, food preparation, and health are not followed. They must realize that a malnourished child may die if enrolled too late.

An interesting example of community involvement in a nutrition intervention can be found in the Jamkhed Comprehensive Rural Health Project in Maharashtra, India (Arole and Arole 1975). The project is based on finding resources within the community and activating people to identify and help solve their health problems. The villagers must donate land for the production of foods for the supplementary feeding scheme. A village committee carries out the project activities, such as supplementary feeding with local commodities. The project relies heavily on the village health worker, who is chosen in consultation with the village council. The mothers of the admitted infants supply the foods used in the nutritional rehabilitation centers with the exception of milk for orphans and twins.

Several researchers hae reported that a long time is often required to win the mothers' trust once the program is initiated. The Tamil Nadu (Cantor Associates 1974) and Project Poshak take-home feeding programs in India (Gopaldas et al. 1975), as well as the Diaconia nutrition rehabilitation project in Brazil (Federal University of Pernambuco 1972), found that it took six months to a year to win the mothers' trust. Until confidence was achieved, rations were not fed in ample quantities to the children by the mothers. In the Candelaria, Colombia project, on the other hand, when a take-home program was started by health personnel already trusted by the community, substantial results were obtained within three months (Wray 1978b). Generally, however, new programs should anticipate some delay and make special efforts to establish rapport and be worthy of trust in the community. Project Poshak in India achieved particular success by using the supervised recuperation of severely malnourished children as "demonstration" to convince the community of the role of food in curing the malnourished and to show the benefits of the program.

Regular attendance of mothers and children is a prerequisite if feeding programs are to have an impact on growth, and yet considerable difficulty is experienced in assuring the regular attendance of mothers and curbing the rate of dropouts. In an evaluation of the targeted material-child health program in the Philippines (Asia Research Organization 1976), irregular attendance was found to be the main reason for failure of a growth response to the feeding program. Individual attendance in two different take-home feeding programs in India was found to range from 53% to 61% of possible time unless there was special house-to-house supervision (Cantor Associates 1974; Gopaldas et al. 1975). Whether or not the children ate less at home when the ration was not collected was not known. However, a supervised supplementary feeding program in Brazil managed to bring attendance rates up by making home visits to motivate mothers to attend and by eliminating from the program mothers whose attendance was irregular; of 428

children who began the program, 68% completed the four-month period with an attendance rate of 95%, 7% were transferred to an NRC, 10% moved, 7% were dismissed, 5% had more than three absences, 3% stopped attending, and 1% died (Beghin et al. 1972). Thus, it is possible to increase attendance rates through vigilant supervision and by making regular attendance mandatory. However, it should be noted that by excluding those with poor attendance records, a program could be cutting off those most in need. Before resorting to elimination of these families, a special effort should be made to visit their homes to ascertain the reasons for their absence and to encourage attendance.

Project Poshak also conducted an on-site feeding trial, and compared the attendance rates of this six-days-per-week program with that of weekly take-home food collection. They found that children ate at the on-site center 62% of the scheduled times, compared with the collection rate of 53% of the possible weekly distributions. Thus, attendance rates were not that different. In an on-site feeding program in Colombia, a vehicle went to children's homes daily to bring them to the center in order to assure regular attendance (McKay, McKay, and Sinisterra 1972). A similar program in northern Peru also provided transport (Baertl et al. 1970). However, this type of assistance, which is feasible in a small-scale research project, would not seem practical for replication in a high-coverage program.

Nutrition rehabilitation centers have usually been designed with a key component of maternal education, to be implemented through mandatory work shifts at the center for the mother as well as required attendance at classes. However, in a review of NRCs in Latin American, Beghin (1970) found that mothers' attendance was not being enforced. Fougere and King (1975) also report that it is very hard for the person in charge of the Haitian mothercraft center to expel a severely malnourished child because its mother refuses to attend class or has deserted the child. The streamlined Haitian NRC called a "foyer," in which the educational period is reduced from three months to two weeks, is more convenient for mothers and has resulted in higher attendance (Berggren and Berggren 1977).

High rates of participation in take-home feeding in Project Poshak were found from:

- village within three kilometers of the distribution site
- farmers with marginal landholdings (one to five acres)
- nonworking mothers
- families with male preschoolers
- smaller villages (50 to 300 inhabitants)
- mothers enrolled as units with their children, who thereby received larger rations

- larger families - the more children, the more participation
- poor families
- mothers who perceived their children as ill or unhealthy.

Various take-home feeding programs in Africa and Brazil have reported dropout rates ranging from 20% to 32% of those initially enrolled (CRS 1975; Jacob 1975; Habte 1973; Beghin et al. 1972). These rates could be used by the planner as a rough estimate of how many beneficiaries are not likely to remain in the program for a full term. A large number of children who left the CRS (1975) Ghana program before completing one year of participation reduced potential impact because their stay in the program was too short for achieving positive nutritional impact. Dropout rates are similar for nutritional rehabilitation centers, ranging from 23% to 32% in India (Venkataswamy and Kabir 1975), Haiti (Weil 1972), and Brazil (Federal University of Pernambuco 1972). Of course, a certain amount of program desertion is unavoidable owing to migration and mortality, but systematic efforts should be made through follow-up interviews to find out the reasons for dropouts and possible means for encouraging their continued participation in the program.

Greater involvement of mothers and fathers in feeding programs, so that they are participants and not merely recipients, may be important for their motivation and for achieving the educational goals. In this regard, requiring mothers to work periodically in nutrition rehabilitation centers is excellent. Another means of involving families is through requiring them to provide some of the things necessary for the program, e.g., in a nutrition rehabilitation program in Zaire, mothers are required to donate local foods, condiments, water, and firewood (Brown 1974).

Very few feeding programs solicit the participation of fathers in any way. This is a serious omission, particularly in cultures where the male head of the household makes many key decisions regarding family food purchases and child-rearing. In "under-five clinics" in Tanzania, most mothers attended on advice of their husbands and the majority of women not enrolled in the program cited their husband's disapproval as the reason (Bernstein and Kreysler 1972). The inclusion of fathers in the educational component of feeding programs has been highly recommended for these reasons, although fathers would not literally receive a ration for themselves (Beghin and Viteri 1973; Christian Medical Commission, World Council of Churches 1974).

An interesting means of assuring family involvement has been proposed by CRS in Africa (Capone 1977). An agreement that describes the parents' responsibilities for the child's nutritional status is drawn up in formal terms at the time when a child is first enrolled in the feeding program. Growth surveillance charts are used to prove whether or not parents are fulfilling the terms of the contract, which are as follows: to give the ration or home equivalents daily in addition to the child's usual diet,

assuring that the total daily diet is adequate; to prevent or treat promptly infectious diseases or parasites afflicting the child; and to accept the growth surveillance chart, which the program administrators will use as evidence that the first two parts of the agreement are being accepted and carried out. In conjunction with the formal agreement with the parents in the CRS program, the center administrator agrees to: provide the established ration regularly; inform parents of the terms of the agreement; instruct parents on the home equivalents and use of imported Title II foods; instruct parents on recognition, prevention, and treatment of major illnesses - infectious and parasitic; and interpret the growth surveillance chart at every session and share this with parents as evidence of their roles. As part of this program, sponsors promise to provide an effective ration for the agreed period and a suitable growth-surveillance system which is intelligible to illiterate, rural parents and to nonprofessional health workers.

This arrangement places final responsibility for the child's health with the parents. Feeding programs are intermediate, temporary measures, with the ultimate goal of rendering families capable of raising healthy children.

B. SUMMARY:

COMMUNITY INVOLVEMENT

Community involvement in the planning and operation of supplementary feeding programs enhances understanding, motivation, commitment, program attendance, and impact. Involvement can come through donation of land, buildings, food supplies, and personnel. Erratic attendance and dropout rates have often been serious problems in all three types of supplementary feeding programs. Reasons can be varied and should be carefully ascertained by interviews with participants. Various forms of parental involvement in the design and operation of the programs (for example, "participation contracts," weight charts, or time contributions) have improved attendance.

III. PARTICIPANT SELECTION

A. KEY QUESTIONS

- Who should participate in feeding programs?
- What selection criteria should be employed?
- What selection techniques can be used?

B. The Concept of Targeting

Because resources available for nutrition programs are generally quite limited, priorities must be set as to who shall receive them. This leads to the necessity of targeting interventions toward those groups which can benefit most from the programs. Only in this manner can cost-effectiveness, i.e., the maximum impact for the least cost, be achieved. The inefficiency of nontargeted interventions which channel resources to nutritionally non-needy groups has been analyzed by Reutlinger and Selowsky (1976).

For targeting feeding programs, the key criterion is nutritional vulnerability. The state of risk is related basically to age, nutritional status, and pregnancy or lactation status. Each of these factors will be discussed in detail in the subsequent sections, but they lead us to specify as the primary target groups children under three years of age, and pregnant and lactating women in low-income families. However, a planner must still employ a series of more specific screening criteria and selection techniques, based primarily on anthropometric measurements.

C. Age of the Preschool Child

A key factor in the degree to which supplementary feeding programs play a preventive role is the age at which children are enrolled. It is well known that preschool children suffer a nutritional crisis at the time of weaning (usually between the ages of 6 to 36 months), and therefore they should be given first priority in feeding programs. At present most feeding programs do not attempt to limit enrollment to preschoolers younger than three years old, though many have recommended that more attention be given to this group. Rather, most feeding programs for young children allow enrollment of all preschoolers through five years of age. In take-home, on-site, and nutritional rehabilitation programs, the average age of children enrolled is three years (Checchi and Company 1976; Fougere and King 1975; Beghin and Viteri 1973). On-site and nutrition rehabilitation centers in particular do not reach children under one year old, and most participants are three to five years old and able to walk to the feeding center.

Special feeding programs of an experimental nature, in which enrollment was restricted to children less than three years old, have been implemented in India. In two of these programs which used a take-home delivery system, Project Poshak (Gopaldas et al. 1975) and the Tamil Nadu Nutrition Study (Cantor Associates 1974), it was found that, once home, the ratio was eaten by all preschoolers up to the age of six. The age limitation of enrollment existed only on paper. Both of these teams of researchers recommended that it would be more realistic and lead to higher impact if rations were given to all the preschoolers in the family. Setting an arbitrary age cut-off at 30 to 36 months, which was not observed by the mothers in any case, resulted in smaller rations being consumed by too many children. Furthermore, it was found in Project Poshak that children under one year old consumed almost none of the ration, primarily because of the mothers' strong beliefs that solid foods are harmful to the infant before one year of age.

On-site programs for children under three years old might be one ay to give special nutritional attention to this age group while avoiding he problems of intrafamilial sharing of the ration. However, it has proven ifficult in most cases to get these younger preschoolers to attend meals egularly. The Narangwal project (Taylor et al. 1978) succeeded in distributng foods to children younger than three years old through an on-site system, nd therefore it did not encounter the problems of intrafamilial distribution. owever, the project also had no effect on the weight of the children less han one year old, probably because of the difficulties of getting this age roup to consume solid foods, particularly in an on-site program. In a argeted take-home program in the Philippines (Asia Research Organization 976), children under six months of age are not eligible because they are enerally breast-fed and in good nutritional status. Thus, depending on he country, it would seem that children less than six months old may not eed supplementary feeding if mothers provide breast milk of adequate quality nd quantity. This is not always the case, however.

Beyond the age of six months, when the introduction of solid foods n addition to breast milk is essential for continued normal growth, feeding rograms can play a key role. However, no descriptions of programs designed o convince mothers to introduce solid foods at an earlier age were found in he literature. Frequently the problem is not that mothers do not breasteed long enough, but that solid foods are introduced too late (MacKay, pone, and Jacob 1974; Asia Research Organization 1976; Chandra 1975; hare, Shah, and Junnarkar 1976; Checchi and Company 1976). In the evaluaions of preschool feeding programs conducted separately by Checchi and ARE in seven countries in Asia, Africa, and Latin America, during 1974-76, o support was found for the argument that supplementary feeding programs educe the duration of breast-feeding. On the contrary, breast feeding coninued for at least a year in most countries, but solid foods were introuced far later than six months of age. If the planner wants to reach hildren from six months to one year old in order to prevent serious nutriional consequences of the late introduction of solid foods, considerable hought will have to be given to innovative ways of changing mothers' weanng practices.

Nutrition education can play a major role in this regard (see in his series - Study II, Nutrition Education). The weaning crisis is a ality which should be addressed by supplementary feeding programs. In e CRS (1975) feeding program in Ghana, the weight of the beneficiaries proved in all ages except children from six to 23 months old who were eing weaned and the same thing occurred in the Candelaria, Colombia, proam (Wray 1967). During this time, children are particularly vulnerable o diarrhea and infection, and more than food may be required. In the amil Nadu Nutrition Study (Cantor 1974), the diet of one- to two-year lds was the most nutritionally deficient of anyone in the family, even hen the total family food expenditure and intake was sufficient to provide ll members with their daily nutrient requirements. Child feeding pracices often result in the weaning infant getting a smaller share of the amily food than he requires. Growth failure between six and 18 months f age suggests that failure to feed the younger preschooler adequately

is almost a universal phenomenon, although researchers in Colombia did not find this prejudice with respect to intrafamilial food distribution (Community Systems Foundation 1976; Overholt 1977); this may depend on income level and culture.

Targeting programs to more "at risk" preschoolers from 6 to 36 months old may be the only feasible way to feed the malnourished in countries with severe budget constraints. Lack of funds may make it uneconomical to include older preschoolers in feeding programs, and emphasis may have to be placed on the most nutritionally vulnerable child. In such cases, a strong and vigilant nutrition education component and other supervisory measures would be absolutely essential to assure that the ration is consumed only by the targeted beneficiary.

There are also findings to support the practice of enrolling older preschoolers and allowing them to continue receiving supplements through their fifth year. In the Philippines' targeted maternal-child health program (Asia Research Organization 1976), malnutrition at entry was found to be as severe and prevalent among two- to five-year olds as among one- to two-year olds, as measured by weight for age. Furthermore, older children had a higher percent of standard weight gain than younger children. Children 12 to 23 months old gained weight at a rate of 342% of the standard whereas 24- to 60-month-old children gained at a rate of 415% of the standard. There may be some confusion here due to the use of weight for age as the measure of malnutrition, because this masks the fact that older children may have more stunted height than younger children and thus appear more malnourished by weight for age, but the reported more rapid weight gain of older children is of interest. In the CRS program in Lesotho, South Africa, it has been found that the longer children remain in the program, the greater is the improvement in their weight for age. Thus, some urge keeping children in the feeding program through their fifth year, if resources permit (Jacob 1973).

In another CRS (1975) take-home feeding program in Ghana, three- to four-year-old children who had been enrolled in the program since they were a year old were doing no better nutritionally than children of the same age who had been in the program for only one year. There seems to be a sound basis for enrolling children throughout the preschool age range in feeding programs. However, first priority should be given to children under three years old because the consequences of malnutrition are more severe in this group.

D. Preschooler Nutritional Status

Some feeding programs also strive to prevent malnutrition among children who are currently in good nutritional status or suffering only from mild malnutrition. Beghin (1976) has stressed enrolling the siblings and mother of a malnourished child in a feeding program even if they are not malnourished, because they are "at risk" of becoming so because of sharing the same environmental factors. This was, in fact, done in the Candelaria program (Wray 1967). These siblings, whom he calls "contacts,"

well as the child's mother, should be given food as a protective measure. sed on this concept, the presence of one malnourished child in a family taken as a universal risk factor.

Beneficiaries in preschool feeding programs surveyed by HIID in 976-1977 were selected on the basis of nutritional status in 64% of the rograms. "At risk" factors were used to select beneficiaries in 49% of the rograms and socioeconomic class was used as a selection criterion in 25% of he programs. Of programs using nutritional status as a selection prerequi-lte, approximately 50% used third-degree malnutrition as the qualifying riterion; approximately 40% used second-degree.

The planner is faced with resource limits and needs facts on what vel of impact can be achieved depending on the initial nutritional condi-ion of the child. Some recent feeding-program evaluations may shed light the issue. It has generally been found that the lower the nutritional vel at entry to the program, the better is the response to supplementation. the take-home feeding program in the Philippines (Asia Research Organiza-ion 1976), 75% of the children with severe (third-degree) malnutrition proved, whereas the majority of children with moderate (second-degree) lnutrition remained at the same level despite the program. The response feeding of Philippine children who joined the program with mild (first-gree) malnutrition was negative - 38% regressed to a lower nutritional vel, while the majority stayed at the same level and only 9% improved. those who were of normal nutritional status when joining the program, % got worse and 14% maintained their normal status.

Possible explanations for why children with milder cases of mal-trition failed to improve or actually worsened may be that they used the tion as a replacement for their normal home diet, which led to a decrease their net caloric intake. Also, the nutritional classification of these ildren was based on their weight for age and failed to take into consid-ation their height. Many of the children classified as suffering from rst-degree malnutrition by weight for age measures may be short for their e but have weights that are proportional to their heights. Therefore, ey could be considered as currently adequately nourished.

In a nutritional rehabilitation program in Madurai, India, the eatest improvement was seen in children admitted with third-degree malnu-ition and little change was seen in the nutritional status of children mitted with first- or second-degree malnutrition (Venkataswamy and Kabir 75). Similar results were found in villages near Hyderabad, India (Rao d Naidu 1977). In a take-home food distribution program in Colombia, eater weight increments were observed in participants who were initially lnourished than among those who were well nourished at the time of enroll-nt (Mora et al. 1974). Furthermore, providing food to the well nourished s inefficient in Colombia because these families used only 60% of the tion as a supplement to their diet and substituted the rest for foods rmally purchased, whereas the malnourished used 90% of the ration as a pplement to their usual diet, and substitution was minimal among them.

In the Narangwal, India, integrated health and on-site feeding project, it was found that 60% of the project participants who died because of infection and nutritional deficiency had weights less than 70% of standard (second- or third-degree malnutrition). Among the general population 20% of the children had second- or third-degree malnutrition (Narangwal Rural Health Centre 1974). The risk of childhood mortality is clearly much greater in the severely malnourished. Therefore, it is evident that the greatest nutritional impact of supplementary feeding will be seen when programs enroll the most severely malnourished. These children deserve top priority, especially when limited funds make it necessary to be highly selective in choosing who is the most in need of supplementation.

Although the Haitian Nutrition Rehabilitation Center program had originally set the eradication of all malnutrition among preschoolers as its goal, when faced with the large number of malnourished children in the country and inadequate funding, planners chose as a more realistic goal the eradication of fatal malnutrition among preschoolers, the halting of third-degree malnutrition, and the minimizing of second-degree (Fougere and King 1975). Only the thirty most malnourished cases in the community are admitted.

There may be considerable embarrassment for families enrolled in programs which admit only severely malnourished children. Therefore, even highly targeted nutrition rehabilitation programs admit that it may be necessary to enroll a few influential mothers even though their children are not very malnourished (Research Corporation 1970). The stigma of malnutrition is abolished when the malnourished are mixed with well-nourished children. Furthermore, CRS has pointed out that the presence of the well nourished may be invaluable in the normal recovery of the lethargic malnourished because of the mental stimulation they can provide (Capone 1977). The stigma of having a malnourished child, however, could serve as a positive force to motivate the mother to correct the situation in order to avoid further embarrassment. In other types of facilities, such as day-care centers, which provide basic services other than nutrition to the community, it may be very hard to exclude certain families. Also, in situations of severe food shortage or poverty which affect the whole community, feeding programs cannot cover all those in need, and the center administrator may succumb to severe pressure from the community and be less stringent in enforcing selection criteria, as has been the case in India (Rao et al. 1975) and in Bangladesh (Institute of Nutrition and Food Science, Dacca University 1977).

This community pressure on the center administrator to admit to the program children who do not meet the eligibility criteria is common and points out the need for monitoring by supervisory staff to see if targeting is being enforced. In an evaluation of the targeted maternal-child health program in the Philippines (Asia Research Organization 1976), which uses both age and nutritional status as selection criteria, it was found that 21% of the children who had been enrolled were not eligible based on their nutritional status and 4% were not of the proper age. Thus, monitoring is crucial. Additional difficulty may be experienced in communities where the program was not formerly targeted, once poor nutritional status is made a prerequisite for participation.

In view of the above discussion, the best way to answer the question of which children is to give priority always to the severely malnourished. The children to enroll first are those diagnosed as suffering from severe, third-degree malnutrition, revealed by weights less than 60% of the standard for their age, or those suffering from acute malnutrition as measured by weights less than 80% of the reference weight for height. Next preference should be given to moderately malnourished children with second-degree malnutrition, with weights ranging from 60% to 75% of the standard for age or with weights from 80% to 90% of the reference weight for height. All preschool ages should be eligible if resources permit. However, special efforts should be made to enroll as many 6- to 36-month-old children as possible owing to the weaning crisis. This age group should be given top priority when a program faces a limited budget. An exception to this age specification must be made for on-site and nutrition rehabilitation programs which, because of their day-care nature, will have difficulty attending to children under one year old.

If additional financial resources are available, the program coverage should be expanded to include mildly malnourished (first-degree) children with weight for age 75% to 90% of the standard or 90% to 95% of reference weight for height, and well-nourished preschool siblings and mothers of malnourished participants. If further funding allows, women of childbearing age may be enrolled, as well as currently well-nourished preschoolers, where certain "at risk" factors prevail. High risk children are born of women who have been handicapped by nutritional deficiency and other environmental factors since early life. Many of these infants, mostly of low birth weight, die from infectious diseases because of their increased vulnerability. Those who survive continue being at greater risk than those born with satisfactory weight. Preventive efforts which provide adequate nutrition to future mothers and their offspring are needed to break this cycle and safeguard the health of these children (Puffer and Serrano 1973). A composite list of risk factors drawn from several experts (Cameron and Hofvander 1977; Gosh et al. 1976; Shah et al. 1974; Cutting and Cutting 1975) follows:

- same weight for three consecutive weighings or faltering of growth at second weighing
- birth weight less than 2500 grams
- twins
- breast milk failure or problems
- failure to gain 500 grams per month during first trimester of pregnancy and 250 grams during second trimester
- birth order sixth or over
- death of siblings under 12 months
- single parent family

- measles, whooping cough, tuberculosis, repeated diarrhea
- low economic status

It is important to understand the picture of the entire community's nutritional status, at least for the purpose of obtaining a baseline for evaluation of any nutrition program. An active community search or weight census may be needed to identify those who would not come forward on their own to seek help. All children should be measured, not just those who show up at the center or are referred from an outpatient clinic (Beghin 1970). Village health workers, volunteers, and community leaders have become accustomed to going from house to house to seek out the malnourished and encourage their participation (Weil 1972; Chaudhuri and Prince 1977).

E. Pregnancy and Lactation Status

One of the ways in which supplementary feeding programs may be able to prevent malnutrition is through distributing foods to pregnant and lactating mothers.

1. Pregnancy

Maternal caloric supplementation during the last trimester of pregnancy has been found to reduce significantly the number of children born with low birth weights (less than 2500 grams) in recent studies in Guatemala (Lechtig et al. 1975), Colombia (Mora et al. 1974; Mora et al. 1976; World Food Programme 1974) and Mexico (Chavez, Martinez, and Bourges 1972; Chavez, Martinez, and Yashine 1974). The Colombia study (Mora et al. 1979) showed statistically significant increase in birth weight only in male infants of supplemented mothers. Children with higher birth weights born to supplemented mothers show less growth retardation at 36 months of age than children of unsupplemented mothers. The Guatemala program of gestational supplementation has had positive effects on subsequent mental development of children, in contrast to supplementation initiated after birth, which showed no continued impact on mental and motor subscales scores (Klein et al. 1975).

Further justification for the inclusion of pregnant mothers in feeding programs can be found in the following consequences of maternal malnutrition and low birth weights. Low birth weight is a leading factor associated with perinatal and neonatal mortality as well as stillbirths in India (Gopalan 1961; Shah, K. 1975) and in Latin America (Puffer and Serrano 1973). The proportion of those born with low weights was higher among children dying throughout the preschool years from infections and nutritional deficiencies than among the general preschool population in Narangwal, India (Narangwal Rural Health Research Centre 1974). There is a high incidence of abortion and stillbirth among malnourished mothers, who are actually losing body fat owing to inadequate diets during pregnancy (Gopalan 1961). Severe nutritional deprivation during the last half of pregnancy reduces birth weight (Mora, Navarro, Suescun and Herrera 1976). The stigma of intrauterine constraint is still evident in the growth of low birth weight babies at four years of age, as evidenced by stunted

weight and retarded bone age (Fitzhardinge and Stevens 1972). Thus, preschooler malnutrition may begin prenatally, and programs could play a preventive role by supplementing the diet of pregnant and lactating mothers.

It should also be pointed out that a considerable calorie increment is necessary in the last trimester of pregnancy if birth weight is to be increased. In the previously mentioned studies of the effects of maternal supplementation on birth weight, conducted separately in Guatemala (Lechtig et al. 1975) and in Colombia (Mora, Pardo and Grueso 1974), it was found that the fetus gained only 29 to 42 grams for each additional 10,000 calories consumed by the mother. Significantly higher birth weights were seen only in women whose diets had been increased by 150 to 190 calories per day, or approximately a 20,000 calorie increase during the last trimester of pregnancy. The Colombian project had no statistically significant effect on mean birth weight or number of low birth weight cases in female infants of supplemented mothers (Mora et al. 1979). However, male birth weights were increased 95 grams and the frequency of male low birth weight infants was reduced from 12.9% to 5.6% when supplemented mothers were compared to the unsupplemented group. These results were statistically significant, but the mechanisms responsible for the sex differences remain to be elucidated. The limited impact of both of these projects may be due to the fact that the mothers were not malnourished as indicated by their weight for height although their caloric intake appeared to be inadequate. The nutritional significance of birth weight increases of less than 100 grams has not been established.

In Colombia, mothers were provided an 856-calorie supplement for take-home consumption, but this resulted in an increase of only 155 calories in dietary intake because the ration was substituted for other foods usually eaten or was shared with other family members or sold. The dilution effect of intrafamilial sharing was minimized by providing enough food for all family members. Thus, it can be seen that a substantial quantity of food may be required to get a minimal increase in birth weight.

If one wants to minimize cost by including only "at risk" pregnant and lactating mothers rather than all such mothers, certain characteristics may be used to identify beneficiaries. The following "at risk" factors have been proposed by K. Shah (1975) for India:

- maternal height less than 145 centimeters
- maternal weight less than 38 kilograms before pregnancy or 40 kilograms at the twentieth week of pregnancy
- maternal weight gain of 1 kilogram after the twentieth week of pregnancy
- first pregnancy
- multiple pregnancies

In India, women with these characteristics would include 25% to 30% of all pregnant women. It should also be pointed out that in India no correlation was found between weight gain during pregnancy and birth weight, because the detrimental effects of maternal malnutrition begin before pregnancy; for this reason it has been recommended that special nutritional attention should be given to young females. Birth weight has also been found to be correlated with maternal height and weight immediately preceding pregnancy as well as maternal nutrition during pregnancy (Lechtig et al. 1975).

Frisancho and co-workers (1977) suggested that an increase in maternal calorie reserves will increase infant fatness more so than linear growth. However, an increase in maternal protein reserves will enhance both birth weight and fetal linear growth. When reserves of protein and calories are held constant, differences in maternal stature have minimal influence on birth weight or growth. It must be recognized that these conclusions may not be applicable to chronically malnourished populations where a calorie increase alone may be reflected in greater prenatal growth, as expected in terms of energy metabolism. In the case of the latter, supplementation should directly affect both birth weight and growth.

2. Lactation

The nutritional status and dietary adequacy of lactating mothers may affect the quality and quantity of breast milk produced as well as the duration of breast feeding. Therefore, supplementation to improve the diets of lactating mothers may also serve to prevent preschool malnutrition. Again we find that differences in quantity and quality of breast milk occurring in populations where dietary intakes are inadequate may be due to the mothers' current nutritional situation, their prior nutrition, or some combination.

A review of field experience establishes the probable nutritional value of providing food supplements to lactating mothers whose diets are inadequate. As summarized by Wray (1978a), the evidence suggests that the quality of breast milk is affected when the diet of the mother is grossly inadequate. The quantity of milk produced seems to decrease with less severe dietary inadequacy. Finally, the evidence available suggests that the effects of maternal nutrition on duration of lactation produce wide variation. The quality of breast milk seems to be fairly consistent through a wide range of maternal dietary intake, and suffers only at the lower end of the scale, where changes in composition (a decrease in fat content) produce at least a 10% fall in caloric content. The quantity of milk produced, as well as the duration of lactation, seem to be more sensitive to maternal intake and vary more widely. When maternal caloric intake is extremely low, daily volume may decrease by 40% to 50%; the Guatemalan findings suggest that duration of lactation decreases by as much as 60%. Thus, a maternal diet that is adequate for producing milk of relatively normal quality may not be sufficient to support maximum quantity. As Wray noted (1978a), the human mammary gland seems to adapt to dietary deprivation by maintaining quality at the expense of quantity and duration.

Many existing preschool feeding programs do not provide supplements for pregnant and lactating mothers. In the HIID review of preschool nutrition intervention, pregnant and/or lactating mothers were enrolled in only one third of the feeding programs surveyed. In the 1976 worldwide survey of the American Public Health Association, it was found that only 15% of the nutrition projects had mothers enrolled as beneficiaries (Karlin 1976). Still other programs have attempted to feed pregnant mothers and have had considerable difficulty in doing so. In India in particular, pregnant women do not perceive that they require an increased dietary intake and deliberately try to consume as little as possible in order to have a smaller baby and an easier delivery. For this reason, the participation of pregnant mothers was very poor in Project Poshak (Gopaldas et al. 1975). However, participation of lactating mothers was good in the same project. Attendance improved in Project Poshak if mother and child were enrolled as one unit and given a ration adequate for both. Similar results have been reported by Catholic Relief Services in Africa (Capone 1977). Mothers and children are more likely to be enrolled together in take-home feeding programs. CRS has recommended that all women of childbearing age be included whether or not they are pregnant or lactating because they are likely to be mothers sooner or later. However, this could increase costs considerably. In some countries only pregnant mothers with preschool children are enrolled. The World Food Programme (1974) recommended that this practice be stopped in their program in Colombia so that pregnant mothers who did not have children yet could be covered.

F. SUMMARY:

PARTICIPANT SELECTION

The scarcity of resources demands that nutrition interventions be targeted toward priority groups to maximize cost-effectiveness. Because of their acute nutritional vulnerability, the key target groups for supplementary feeding are children from 6 to 36 months old and pregnant and lactating women from low-income families.

The 6- to 36-month period is particularly critical because of heightened nutritional requirements and disease exposure and the frequent lack of adequate feeding of solid foods during this age. Most programs include children through age five. Where resources permit, this may be desirable because it provides added protection and recuperaation of the older malnourished children. For take-home programs, siblings over three years old will probably require an allocation within the ration because the food will probably be shared with them. Nonetheless, those under three are the critical group and special efforts should be made to insure their participation.

Priority should be assigned on the basis of need. Child enrollment should give preference to those suffering from third-degree malnutrition (weights less than 60% of standard for age, or weights less than 80% of reference weight for height) and next those evidencing second-degree malnutrition (weights 60% to 75% of standard for age, or weights less than 90% of reference weight for height). Moderately or well-nourished children should be admitted if they have "at risk" characteristics, e.g., high birth order (over five), twin, birth weight under 2500 grams. A less stringent criterion would make any preschool siblings of a malnourished child eligible.

Maternal supplementation during pregnancy and lactation is a preventive intervention Caloric supplements during the last trimester have produced higher birth weights, which increase the chances of survival and nutritional well being. Priority should be given to pregnant mothers with certain "at risk" characteristics, such as first pregnancy, height below 145 centimeters, weight under 40 kilos at twentieth week. Regarding lactation, the quality of the milk seems to be affected only when the mother's diet is grossly inadequate, but quantity can suffer with less severe dietary inadequacy. Poor maternal nutrition causes varying effects on the duration of breast feeding and in some instances greatly reduces it. Insufficient efforts have been made to include pregnant and lactating women in supplementation schemes.

V. FOOD TYPE

A. KEY QUESTIONS

- How do you determine what food to use as the supplement?
- What determines acceptability?
- What are the requirements for nutritional adequacy?
- What are the pros and cons of using local or imported foods?

The choice of food for a supplementary feeding program will be determined by acceptability to the recipients, availability, cost, shelf life and by nutritional adequacy. These aspects plus the question of whether to use imported or local foods will be discussed below.

b. Acceptability

If the food distributed is not eaten by the intended beneficiary in sufficient quantities in addition to the usual home diet, then the nutritional impact of the program will be thwarted. It is therefore essential that the foods be designed to be acceptable culturally and organoleptically to the beneficiaries.

The preschool child is dependent on what his mother feeds him, and for this reason the foods provided by the program must appeal to the tastes of the mother. Young children's taste preferences are often not that pronounced, and they will accept most foods given to them. However, the mother may feel that if the food does not taste good to her, the child also will not like it, so she may not give it to the child. This may be overcome to some extent by presenting the food as a "medicine," which mothers do not expect to taste good (Wray 1967). The opinions of grandmothers and mothers-in-law also influence what is fed to young children, and therefore their approval of the supplementary food is also very important.

Many supplementary feeding programs in the developing world continue to rely heavily on imported commodities as the principal resource, and many of these are foods initially unknown to program participants. Large-scale promotional and educational campaigns have been necessary to get the beneficiaries to accept Title II donated foods, and the majority of these efforts have eventually been quite successful. Feeding programs have been responsible for winning favor for protein sources and many soy-cereal blends, such as Wheat Soy Blend (WSB) and Corn Soy Milk (CSM), which remain unknown to consumers in their country of origin (the United States). Countries where milk consumption was not previously customary have accepted milk as one of the best foods for preschoolers through their receipt of nonfat dry milk in supplementary feeding programs. Thus, it is definitely possible in many instances to win acceptance for new foods if proper education is provided for mothers on the nutritional benefits of these foods. Mothers should be taught how to prepare the new foods, including correct proportions to give to weanling children and methods for incorporating the commodity in local dishes.

The fact that the foods are often given free of charge obviously enhances their acceptability. If families had to pay for the foods they might not buy them or find them so acceptable. However, a major danger that clouds the apparent success of cultivating tastes for new foods is that mothers may develop a dependence on these foods and feel deprived if they cease to be available. Self-reliance is not necessarily fostered.

There are instances in which new foods may not be accepted, no matter how much promotional activity takes place, because of local taste and cultural preferences. In Bangladesh, Fish Protein Concentrate (FPC) was poorly accepted in a preschool feeding program because it had a bad smell and mothers thought it contained pulverized frogs and snails (Institude of Nutrition and Food Science, Dacca University 1977). However, FPC was accepted when distributed as a flavored sauce. In Bombay, mothers thought soy-milk drink smelled like "crushed bedbugs" (Pyle 1971). However, preferences vary regionally, as the acceptance of soy-milk in other parts of South Asia illustrates.

In other situations, failure may be primarily due to insufficient education of the mothers regarding the benefits and preparation of the unknown food. In Bangladesh, beneficiaries received free wheat with their Fish Protein Concentrate, which motivated them to come to the center for their ration; once home, they would keep the wheat and throw away or sell the FPC ration to farmers for fertilizer.

Acceptability trials must be carried out and repeated in the setting in which the product is to be served. In Pakistan, a blended, imported food made from whey and soy, Whey Soy Drink Mix (WSDM), was thought to be well accepted because a preliminary trial had shown that children drank their portions when given WSDM under observation in an on-site setting. However, the subsequent take-home acceptance of the product was very poor because mothers were not familiar with its beneficial qualities, disliked its odor, and did not known how to prepare it (Anderson 1977). Initial acceptance under supervision is very different from continued use at home without supervision.

C. Nutritional Adequacy

The foods distributed as supplements are intended to alleviate or remove certain nutritional deficits in the child's diet; therefore, they must contain the required nutrients in an adequate concentration. A more detailed discussion of the amount of nutrients to be supplied by supplementary rations will be found in the section on Food Quantity. However, certain nutritional aspects of the food are relevant to the consideration of what type of food to supply.

Preschool children, particularly ones at the weaning stage, have very real physiological limitations to their digestive capacity. Because of their stomach size, they require a diet with a concentrated source of calories and protein and minimal bulk (Jelliffe 1971). Precise data quantifying the stomach capacity of the average preschooler in reference to the bulk constraint are as yet not fully known (see in this series, Study III, Formulated Foods).

A study in South India, where cereals provide 70% of the calories and protein in the diet, showed that preschool children may not be able to meet their nutritional requirements from such a diet because of the bulky nature of cereals, which swell two to three times when cooked (Jones and

Pereira 1972). When a high-cereal diet was fed by these researchers, ad libitum to preschoolers in day-care centers and orphanages, it was found that 47% of the children were unable to eat enough to meet their protein and calorie requirements. Therefore, although a child's protein requirement can theoretically be met by a high-cereal diet if this diet is consumed in sufficient quantity to meet energy needs, such diets are frequently so bulky that insufficient quantities would be eaten (Nicol 1967).

A child can grow slowly on a bulky high-cereal diet in which 7.8% of the calories are supplied by protein (Whitehead 1973), but better growth has been found when malnourished children are recuperated with diets that are concentrated to provide 15% of the total calories as protein (Meredith, Closa, and Rio 1977). In the same study in Argentina, malnourished children with diets supplying less than 9% of total calories as protein suffered from negative nitrogen balance. This indicates that the body is breaking down its own tissues to provide the required protein not consumed in the diet. A United Nations FAO/WHO (Food and Agriculture Organization/World Health Organization) advisory group has recommended that 11% to 12% of the calories for preschoolers should come from protein when diets are based on cereals and legumes (Scrimshaw 1978). It seems desirable to strive to provide the recommended 11% of calories in the form of protein and this rate will be used throughout this study.

Recent research throughout the developing world has shown that children are often more deficient in calories than in protein in countries where the diet is based largely on cereals. Severe protein deficiency is far less common than calorie deficiency and occurs primarily in African countries with diets based largely on tubers, which have low protein content. Thus, foods intended for preschool children, particularly those of weaning age, should be concentrated with calories while providing sufficient protein. The protein content of most blended, processed weaning foods is high, while calorie content remains inadequate. This situation has resulted in more recent mixes of high-calorie, low-bulk foods suitable for weaning.

Compact calories are extremely important in preschool rations, and caloric content of foods may most easily be boosted through the addition of oils and fats, sugar, and oilseeds whose oil has not been removed in the process of making flour, e.g., fullfat soy flour. Programs should test the amount of the ration that the preschooler is able to eat in one sitting or per day to assure that it is not too bulky to meet the child's nutrient requirements.

Additional aspects of physiological suitability of supplementary food rations for preschoolers, particularly the weanling child, must also be given consideration (see Jelliffe 1971).

D. Supplemental Food Source

Most large feeding programs sponsored by WFP, CARE, and CWS still distribute primarily imported foods. In CARE's (1976) worldwide preschool feeding programs, the most frequently encountered ration was composed of

three commodities - usually WSB, CSM, and vegetable oil - provided through Title II of U.S. PL-480, and 61% of the programs utilized some local food in addition to the PL-480 commodities. In most programs, however, the local food consisted merely of condiments. Significant contributions were generally made in countries that were formulating locally blended foods in which a substantial portion of the formula (often one third) was composed of indigenous cereals or legumes, used to complement the PL-480 ingredients. In the worldwide survey conducted by HIID in preparation for this manual, it was found that of the 148 responding preschool nutrition programs which distributed supplementary foods, 77% used at least some local foods, 23% used only imported foods, 52% distributed both imported and local foods. Most of the imports were commodities.

Many programs dependent on imported commodities are currently in the process of gradually increasing the local percentage of the ration and decreasing the foreign contribution, in order that local governments may eventually run supplementary feeding programs without outside assistance. In anticipation of such turnover, and also to facilitate nutrition education of the mothers, it is beneficial to distribute imported commodities that are also locally available and familiar in the recipient country. For instance, in a supervised supplementary feeding program in Brazil, program planners chose to distribute imported cornmeal and nonfat dry milk, which were also available locally, instead of supplying unknown commodities such as WSB and CSM (Beghin et al. 1972). In the CRS programs in Africa, mothers receive PL-480 commodities but are taught through demonstration sessions about "home equivalents" with similar nutritional value that they can purchase and prepare themselves from local markets (Capone 1977). The Narangwal program for integrated health and nutrition in India started out with the provision of PL-480 commodities and shifted to local foods as commitment to the program grew and beneficial effects of supplementary feeding were demonstrated. Local farmers contributed some of the food (Taylor et al. 1978).

There are numerous examples in Third World countries of supplementary foods blended from partially imported and partially indigenous ingredients as part of the transition to greater local involvement in preschool nutrition programs. In India, Balahar and Sukhada are examples of such foods. In neighboring Sri Lanka, Thriposha is another food whose main ingredients come through PL-480, but will increasingly supplied from indigenous sources as the national government assumes greater financial responsibility for the program. Other foods that contain both PL-480 and indigenous ingredients are Bienestarina in Colombia and Fortesan in Chile.

An interesting variation on the model partially using local foods is Cininutrimix in India, which is composed of 70% PL-480 wheat, 5% nonfat dry milk, and 20% locally purchased dhal (Chaudhuri and Prince 1977). Mothers come to the feeding center to collect the wheat and dhal in unprocessed form, then take it home to roast it themselves and to have it ground at the local village mill. They then return to the center with the powder, which is weighed and sealed into 450-gram polyethylene packets. The mothers pay a fee of three cents per packet, which is used to purchase the dhal and polyethylene bags.

Elsewhere in India, local foods have been processed at the village level for take-home consumption, and this approach has particular advantages over the use of centrally processed imported or local foods. In Project Poshak, it was found that attendance of mothers was better for the village-level multimix than for imported Instant CSM because familiar foods were preferred and better utilized, especially in highly traditional rural areas. Preparation of multimixes at the village level resulted in decreased transport and administration costs, economic benefits to small entrepreneurs, greater community involvement in the program, fewer delivery delays, and less spoilage because of rapid turnover of the commodities (Gopaldas et al. 1975). The Hyderabad mix, produced under the direction of the National Institute of Nutrition by local Indian village women's clubs, resulted in increased acceptance of weaning foods by mothers who used to believe that these foods were harmful (Mathur and Madhavi 1976). Some or all of the ingredients were donated by local farmers, and mothers paid 2.3 cents per packet. These foods were also found to be cheaper for use in hospitals than commercially prepared weaning foods (Mathur 1975). Possible disadvantages of this approach are the need for vigilant supervision, irregular production due to agricultural seasons, short measuring and other malpractices which affect quality control, and inadequate hygiene.

The principal benefit of using locally available foods (aside from possible foreign-exchange savings) comes from being able to teach the mother remedies for malnutrition that she is capable of implementing in her own home. If this type of education is to be effective, the foods provided in supplementary feeding programs must be inexpensive so that participants can afford to buy them. The exclusive use of cheap, locally available foods for the recuperation of the malnourished child is the chief technique of internal nutrition education in nutrition rehabilitation centers. Before starting such programs, planners must identify the locally available and affordable nutritious foods. Mothers are then taught how to prepare these foods for preschoolers, using local recipes. In some programs, as in Yako, Upper Volta, mothers are required to provide the foods themselves. An extensive selection can be found in the Manual on Feeding Young Infants and Children, Cameron and Hofvander, 1977. Recipes should have a flexible composition that coincides with the seasonal availability of different ingredients, or be based on foods that are available throughout the year.

Commercially processed indigenous weaning foods may meet with failure because their price, unless heavily subsidized, places them out of reach of the low-income family with malnourished preschoolers. Often these cereal-based products are not seen by the consumer as superior to the basic unfortified grain products they resemble, which sell for much less. Commercially processed weaning foods may also create in the mother dependency on sophisticated products, and prevent her from realizing that she may be able to feed her child a healthy diet from the staples she is capable of preparing totally in her own home. This is the central theme to be stressed in nutrition rehabilitation centers, where everything the mother does should be performable at home. Foods that are not obtainable in the district or too expensive should not be accepted as donations at mother-craft centers. The reader is referred to the study on Formulated Foods for a further discussion of industrially processed nutrient-dense foods.

In take-home feeding programs where dispersion of the ration is a big problem because older children and adults share the food intended for preschoolers, it has been found helpful to use foods which have a "baby food" image (Cantor Associates 1974; Gopaldas et al. 1975). In this respect, blended weaning foods with special names connoting their use for young children may reduce the sharing of the child's rations with adults, and also prevent the resale of the ration because such foods are not known in the local market. Recipes for preparing the food should be geared toward dishes for the preschooler, and description of how the blended food can be used in recipes that appeal to adults should be avoided.

There are also particular advantages and disadvantages to using imported commodities in supplementary feeding programs which the planner can take into consideration. Among the benefits attributed to imported blended foods have been the following:

- large-scale, efficient production is achieved by well-established manufacturers with high standards of quality control.
- opportunity is present to fortify or enrich staples because of availability of equipment and technical support.
- food aid sources are available to low-income countries suffering from food shortages due to disaster, drought, insufficient production, etc.
- such foods provide a temporary means of mobilizing local commitment to child nutrition programs.
- such foods may be cheaper than locally processed foods due to large-scale, high-volume production.

Some criticisms against using imported foods have been:

- the local government should take responsibility for the nutritional well-being of its people and not rely on donated foreign surpluses.
- programs are subject to the availability of commodities, which constantly vacillates depending on weather, agricultural yields, and prices, and it may be difficult to maintain continuity and active participation of mothers in a program in which the ration keeps changing.
- the foods have poor acceptability because they are foreign.

- recipients may develop dependence on foreign assistance and fail to learn how to use locally available commodities for treatment and prevention of malnutrition and for achieving self-sufficiency.

- imported foods may create a disincentive to local agriculture.

- imported foods compete with local initiative to produce indigenous weaning foods.

- there is often an overemphasis on high-protein, soy-fortified products because most imported supplementary foods products have these characteristics.

- there is greater probability of spoilage due to shipment over long distances and extended storage.

Program planners should carefully assess these aspects in terms of e local resources they have available for a feeding program. Most of the advantages can be overcome. Planners can then decide whether to supply ported foods, some imported foods and some local foods, or a totally indi- nous ration. All foods distributed, regardless of source, should meet the ic requirements described at the beginning of this section in terms of ceptability, nutritional value, and physiological suitability. It is commended that program designers put a realistic limit on how long they ll use imported commodities before making the transition to indigenous ods.

E. SUMMARY:

FOOD TYPE

The foods to be used in feeding programs must be designed to insure cultural and senory acceptance by the users. For small children, mothers' taste preferences become critical. Through nutrition education of mothers, new weaning foods have been successfully introduced. Acceptability trials must be carried out in the setting in which the product is to be served, and they should be repeated.

In addition to acceptability, the foods must be nutritionally adequate to address the identified nutrient deficiencies. Because of the small stomach capacity of preschoolers, the supplements should generally be a highly concentrated source of calories and proteins with minimal bulk. Providing at least 11% of the calories as protein seems desirable. Compact calories need particular attention; protein context has been overemphasized.

Most supplementary feeding programs use local foods, but there is continued heavy reliance on imported foods. Local foods have the advantages of saving scarce foreign exchange, promoting domestic agriculture and food processing, and facilitating education in the use of local foodstuffs, thereby enhancing self-reliance. Imported foods often have the short-run advantage of being donated (although local handling costs can be sizeable) and are usually of high quality. Local weaning food technology may not be able to produce such quality. The development of local agricultural and industrial capacity to decrease reliance on imported foodstuffs is generally a desirable goal. However, for some nations imports may still be more cost-effective.

V. FOOD QUANTITY

A. KEY QUESTIONS

- How should one determine the size of the supplement?
- What are the nutrient requirements of the target group?
- What are their deficits?
- What supplement leakages might the program incur?

The question of how much to feed can be resolved by considering the child's daily nutrient requirements, the deficit of these nutrients in the existing diet (also referred to as the nutrient gap), and the amount of food required to compensate for leakages or diversion of the ration away from the targeted beneficiary. In on-site and nutrition rehabilitation programs in which the child is kept at the center all day, the question of how much to feed the child is simplified. In this type of program, the child should receive enough food to meet total daily nutrient requirements. However, in on-site feeding programs which provide the child with only one or two meals per day, and in take-home programs, which supply a ration meant to be a supplement to the home diet, the determination of appropriate ration quantity is more complicated. It is necessary to examine nutritional requirements and deficits as well as leakages.

B. Food Requirements

A problem in filling a child's nutrient requirements through supplementary feeding is the limited knowledge about the requirements for calories and protein. Furthermore, the health significance of meeting 80% to 90% of the requirements presently established by the FAO/WHO (1973) is

unknown. The FAO/WHO protein and energy requirements by age and/or body weight for normal preschool children are presented in Table 2. Scrimshaw (1978) has recommended that the FAO/WHO protein allowances be increased to allow for recovery from frequent diarrhea and respiratory infections, especially at the age of weaning. New allowances established by the UN FAO/WHO working group (Scrimshaw 1978) specify that 11% to 12% of calories should come from proteins in preschool diets based on grains and legumes (Table 2).

For administrative simplicity, a basic calorie requirement of 110 calories per day per kg. of body weight can be used in planning supplementary feeding rations for all preschool children. However, severely malnourished children's energy requirements may be higher than those just stated (Beghin and Viteri 1973). Children recovering from protein-energy malnutrition may need up to 200 calories per kilogram of body weight, and average consumption in one study was found to be 123 calories per kilogram (Spady, Payne, Picou, and Waterlow 1976). In another study it was found that malnourished outpatient children required 110 calories per kilogram in order to assure a positive nitrogen balance indicative of normal protein metabolism; severely malnourished, hospitalized children in the same study required 150 calories per kilogram to maintain positive nitrogen balance (Meredith, Closa, and Rio 1977). For severely malnourished children, energy requirements would be higher than those recommended by the FAO for normal children. Picou (1977) feels an accurate rate to use for predicting weight gain in the malnourished would be one gram weight gain for a net caloric increase of five calories.

Another important aspect in setting nutritionally beneficial ration levels is striking an appropriate balance between protein and calorie content of the foods delivered. In the past protein deficiency has been overstressed, and insufficient attention has been paid to formulating rations that can adequately meet a child's calorie requirement without being excessively bulky. Because of the supposed "protein crisis," most foods supplied through preschool feeding programs have been formulated to be high in protein, and no special attention has been given to their caloric content. Consequently, most rations distributed by CARE (Anderson 1977) in its worldwide preschool feeding programs, as well as in the CRS program in Africa (1975), amply covered protein requirements. There is a profusion of high-protein blended cereal products used in feeding programs. It is difficult with these cereal-based products to close the high-calorie deficit of many of the children. On the Title II commodity availability list of Fiscal Year 1977 produced by the Food for Peace Office of AID, only two of the twelve processed cereals and blended foods available for supplementary feeding programs were nonsoy-fortified cereals, i.e., bulgur wheat and wheat flour. These products were designed to meet the protein crisis believed to be the main nutritional deficiency based on scientific evidence and findings available at that time.

More recently numerous studies throughout the world have shown that caloric deficiency is frequently more severe than protein deficiency in preschool children (WHO 1976; Gopalan 1975; Gopaldas et al. 1975; Jacob 1975; Beaton and Swiss 1974; Beghin and Viteri 1973; FAO/WHO 1973; Hegsted

TABLE 2

FAO/WHO 1973 ENERGY AND PROTEIN REQUIREMENTS FOR PRESCHOOL CHILDREN (SEXES COMBINED)

Age	Average Weight (kg)	Requirement per Kg per day Energy (Kcal)	Requirement per Kg per day Protein (gms)*	Requirement per person per day Energy (Kcal)	Requirement per person per day Protein (gms)*	
Months						
6-11	9.0	108	2.6	795	23	
Years						
1	11.3	105	2.1	1190	24	(32)**
2	13.5	100	2.0	1350	27	(37)
3	15.5	100	1.9	1550	29	(43)
4	17.5	98	1.8	1715	32	(47)
5	20.4	91	1.7	1860	35	(51)
6	22.8	86	1.6	1960	36	(54)

*Adjusted for a diet with a protein quality of 60% relative to milk or eggs.

**Numbers in parentheses represent increased protein allowance to provide for recovery from frequent diarrhea and respiratory infections based on 11% of calorie intake as protein (Scrimshaw 1978).

72). We cite this extensive list of references because the primary orien-
tion toward proteins continues to persist among many planners of feeding
ograms. Obviously, protein is important. The critical goal is to strike
e right balance. With this abundance of evidence, it is clear that spe-
al attention should be given to reformulating rations so that they can
equately close the calorie gap as well as the protein gap.

In four CARE preschool feeding programs in Colombia, the Dominican
public, India (Tamil Nadu) and Pakistan, discussed in the case study sec-
on, rations were found to fill six to fourteen times the average child's
otein gap while covering only 62% to 83% of the calorie gap (Anderson
77). A child's energy requirements must be met before protein can be
ed for tissue building. Therefore, rations should not be inadequate in
lories, because protein will be broken down to supply the body's primary
ed for energy. Both protein and calories are necessary for normal energy
tabolism, but calories are the limiting factor (Spady, Payne, Picou, and
terlow 1976). Once calorie requirements are met in the diet of malnour-
hed children, there is no difference in nitrogen balance between children
o are suffering from infection and those who are not (Meredith, Closa,
d Rio 1977). There need not be an overemphasis on protein in preschool
eding, because protein requirements can generally be met in a mixed
real-pulse diet, provided the child's calorie requirement is satisfied.
wever, more attention must be paid to means of meeting the child's
lorie requirement through foods that will not be excessively bulky.
lories are also more critical than protein in supplements for pregnant
men, as found in Guatemala, where protein supplementation per se had no
scernible effect on birth weight (Lechtig et al. 1975).

The concern over adequate calories and protein in food rations
st be translated into practical guidelines. Beghin and Viteri (1973)
ve suggested in nutrition recuperation programs that 40 calories be pro-
ded for each gram of protein in the ration, which represents a protein
lorie percentage of ten. In another study of severely malnourished
ildren, however, it was found that all children consuming diets in which
s than 9% of the calories were supplied by protein went into negative
trogen balance. Best nitrogen balance and growth resulted from diets
pplying 15% of the total calories from protein (Meredith, Closa, and
o 1977).

In the absence of any more precise standards, planners should fol-
the UN FAO/WHO working group's recommendation that 11% of the calories
the food ration should be supplied by protein (Table 2). It is difficult
meet this requirement through use of the traditional cereal-based diets
nd in most developing countries. However, existing feeding programs
pply a greater percent of protein than the recommended range. This is
cause most of the blended high-protein foods used in the programs have
ater than 15% of their total calories supplied by their protein portion.
fact nearly all the Title II commodities currently distributed to pre-
hool children, except cornmeal, bulgur, oats, and other unfortified
reals, have more than 15% of their total calories in the form of protein;
y range from 16% to 40% of calories in the form of protein. Research is
ded to formulate products with higher calorie density and lower protein
lorie percentages.

To calculate the protein calorie percentage of a food you need to know the number of grams of protein and calories it contains per 100 grams. For example, nonfat dry milk (NFDM) contains 35.9 grams protein and 363 calories per 100 grams. Each gram of protein contains approximately four calories; so 35.9 X 4 gives 143.6 calories from protein in NFDM. Dividing the protein calories, 143.6, by the total calories, 363, gives a protein calorie percentage of 39.6 for NFDM.

A deficiency of vitamins and minerals in the preschol diet can be supplied either in the food form (by local foods rich in the specific nutrients) or in supplement form. A large portion of the World Food Programme/PL-480 foods contain a vitamin-mineral premix.

C. Deficits

A common method of ascertaining dietary intake is to conduct a food consumption survey through the 24-hour recall method. Since preschoolers cannot report on what they ate the previous day, one must rely on their mothers' recall. This method may not be very exact because of the faulty memory of the mother, difficulty in assessing exact quantities eaten, or a tendency of the mother to list foods that she feels will impress the interviewer. Errors can be minimized by carefully training the interviewers, weighing food to determine the exact quantity, using standard measures to aid the mothers' memory of quantities, and actually being in the house at mealtime to observe the types and quantities of food consumed. Institute of Nutrition for Central America and Panama (INCAP) has found that dietary recall was equally as accurate and representative over a 24-hour period as over a 72-hour period (Lechtig et al. 1975).

Dietary surveys should be conducted not just once a year but during all the major seasons, because food intake and nutritional deficiencies can vary considerably with seasonality of food availability and of diarrheal incidence. The greater incidence of nutritional deficiencies during certain seasons may warrant distribution of increased supplements during these times.

The use of dietary consumption data to establish ration size is complicated by the variations in nutrient deficits of each child. The ration should be based on the average deficit of all children surveyed whose diets are deficient. As stressed earlier in the discussion of selection of participants for feeding programs, the emphasis should be placed on the malnourished. Children whose diets are nutritionally adequate should be excluded from the calculation of the group nutrient deficit, because the well-fed children will be few in number and inclusion of their high calorie and protein intakes would make the nutrient gap of the rest of the children (the majority) appear less. Rations based on calculations which include well-nourished children would be inadequate for many of the malnourished children in the program. Rations based on the average nutrient gap of children with a deficiency would be fair for most participants, although these rations would shortchange those with severe deficiencies.

Some of the children admitted to a feeding program may have severe utrient deficiencies (consumption of less than half their daily nutrient equirements), but rations should not be based on the average deficit of his group only because this would result in waste of food through deliver-ng excess nutrients to the better-off. Furthermore, the average nutrient eficit of the entire deficient group, regardless of severity of the defi-iency, would to a certain degree reflect the deficiency of the most severe. ince the severely deficient often comprise only a small percent, special dditional rations could be given to them to make up for the remaining utrient deficits. Variable ration quantities depending on nutritional tatus would greatly increase administrative complexity in feeding pro-rams, but since only a relatively small number of children have severe eficiencies, it would seem that a system could be worked out.

If the average nutrient deficit of all children suffering from adequate diets, rather than the average deficit of all children surveyed hich might include some well-nourished children), was used to determine tion quantity, then rations in many existing feeding programs would have be increased. In CARE programs, for example, 1976 rations would have had be increased by 100 to 200 calories per day, or 30 to 60 grams above the rent 50 to 90 grams supplied per child per day, if the average caloric ficit of all enrolled children with calorie deficiencies had been used to lculate the ration. This is based on nutrient consumption estimates thered in Colombia, the Dominican Republic, India (Tamil Nadu), and kistan and reported in Chapter Four. It would mean that children need to ceive one to two kilograms more PL-480 Title II cereal-based foods per nth (Anderson 1977). Foods chosen to increase the ration should be those th the highest number of calories.

Leakages

In addition to providing rations in a quantity that covers the erage calorie gap, enough food must be included to compensate for leakages diversion of the ration through intrafamilial distribution and substitu-on for the normal diet. Such compensation definitely requires an in-ease in the ration size in most feeding programs. However, there is a ck of information about how the extra food is actually used. Perhaps it o is diverted elsewhere and does not result in any improvement in overall lorie increase in the diet of the recipient child. More research is eded to delineate the effects of greatly increased rations on the dietary take of the targeted child and to determine the variations with age.

Research performed in several supplementary feeding programs pro-des a basis for establishing rates of ration leakage (Table 3). These tes tend to be consistent for each type of feeding despite the country which the research was done, and therefore may have general applicability r planning how much rations need to be increased to compensate for likely versions.

TABLE 3

RATES OF DIVERSION, SUBSTITUTION, AND NET CALORIC INCREASES FOR RATIONS IN VARIOUS TYPES OF PRESCHOOL FEEDING INTERVENTIONS

Type of Feeding	Daily Caloric Value of Ration	Dispersion[1] Percent of Ration Not Eaten by Beneficiary	Substitution Percent of Ration Consumed Instead of Normal Diet	Net Caloric Increase Percent of Ration Consumed as Supplement to Normal Diet
Take-Home[2] (Preschool)	298-377	46-56	0-22	18-54
Take-Home[3] (Pregnant mothers)	856	Not available	Not available	18
On-Site[4] (Preschool)	340-377	0	39-53	47-61
On-Site[5] (Preschool)	737-900	0	37-42	58-63

[1]Dispersion usually results from sharing the ration with family members other than the targeted beneficiaries, from discarding the ration, or from selling the ration.

[2]Five studies, two conducted in India (Gopaldas et al. 1975; Cantor Associates 1974) and the others in Colombia, the Dominican Republic, and Pakistan (Anderson 1977).

[3]Colombian Study (Mora, et al. 1976 and Mora et al. 1979).

[4]Indian Studies (Gopaldas et al. 1975; Anderson 1977).

[5]One study in Costa Rica (Anderson 1977) and the other in India (Kamalanathan, Nalinakshi and Devadas 1970).

1. Intrafamilial Distribution

Diversion of the ration to nontargeted family members is the biggest problem in take-home feeding programs. Several researchers have reported that rations intended only for preschoolers were consumed by the entire family (Checchi 1976; Cantor Associates 1974; Gopaldas et al. 1975; Asia Research Organization 1976). This problem is not encountered normally in on-site feeding programs or nutrition rehabilitation centers unless unauthorized siblings are allowed to enter the center and eat from the target child's plate.

The number of people sharing each ration has been found to be associated with the nutritional progress of the beneficiaries (Checchi 1976; CRS 1975). The success of two take-home feeding programs in Colombia is attributed to their provision of a sufficient ration for the entire family, in recognition of the expected dispersion of the ration in the usual take-home program in which food is provided only for preschoolers and mothers (Mora et al. 1979; McKay, McKay, and Sinisterra 1973). The average intake for one child with several other family members is only half the intended amount of supplementary food in a take-home feeding program (Anderson 1977; Gopaldas et al. 1975). Furthermore, the mother frequently runs out of the ration ahead of schedule because of diverting the food to too many family members. Take-home rations often last only half the length of time for which they are intended so the targeted child may be fed supplementary foods only half of the scheduled number of days. In a take-home program in the Philippines, it was found that rations intended to last for one month were exhausted before two weeks for half the mothers (Asia Research Organization 1976), and 72% of the mothers had finished the ration within three weeks of receiving it.

Rations can be increased to compensate for intrafamiliarly sharing; a doubling would seem to offset the leakages. Even then, however, it is uncertain whether the increment will be fed to the targeted beneficiary. Education of mothers may discourage sharing, as may providing foods with a "child's food" image (e.g., Nutripak in the Philippines). In Colombia, leakages were discouraged by supplying containers for the ration; the mothers themselves painted their children's names on the used coffee cans (Wray 1967). Among the 201 feeding programs included in the 1976-1977 HIID review of preschool nutrition interventions, 9% were already providing rations to the entire family (Austin et al. 1978).

2. Substitution

The impact of supplementary food on increasing caloric intake of beneficiaries is also diminished through the substitution of the ration for the normal home diet. Substitution is more likely to occur in on-site than in take-home programs. As much as one third to one half of the ration may be used as a replacement for foods normally consumed and thus is in effect lost as a supplement. Substitution has been found to be a great problem among well-nourished children, because the initial adequacy of their diet prevents them from consuming large quantities of the ration as supplements (Anderson 1977). In a take-home program in Colombia which supplied all

children in the family with enough foods to meet 100% of their protein requirements and 66% of their calorie requirements, it was found that food purchases of the well-nourished families dropped so significantly that the ration was substituted for 40% of previous food expenditures. The malnourished only cut back or substituted the ration for 10% of previous expenditures (Mora et al. 1974 and 1979). In the same Colombian study, supplements were provided on a take-home basis for pregnant mothers, and substitution was found to be more associated with the initial diet than with socioeconomic status or culture.

Substitution of the ration for the home diet usually limits the increase of calories more than that of protein, because the substituted ration foods are often high in protein. Substitution has also been found to be a greater problem among older preschoolers (3 to 5 years old) than among the younger age group (1 to 3 years old) because older children consume more of the adult diet for which the ration is substituted (Anderson 1977; Gopaldas et al. 1975). Younger children tend to be fed less and fewer foods in general; the ration is truly used as a supplement to their diet, and it is thus more effective in closing the calorie gap in younger than in older preschoolers.

Possible means of counteracting the detrimental effects of substitution are: a) to increase greatly the ration for malnourished children, b) to educate mothers in the importance of using the ration as a supplement, and c) to serve meals at feeding centers at times that do not conflict with normal mealtimes, so the ration will be thought of more as a snack than as a substitute for regular home meals.

3. Selling of the Ration

A final source of leakage is participants' selling the supplementary foods. For example, giving mothers large quantities of food in compensation for other leakages may tempt them to turn the commodities into cash at the market. Unauthorized sale of a ration is often not a big problem, because many of the foods distributed are nor familiar and do not possess a ready retail value in local markets. However, when locally popular foods are given out in large quantities as rations, diversion of the ration through selling may be a problem, as was the case in the take-home maternal supplementation feeding program in Colombia in which large quantities of food were provided for the whole family (Mora, Navarro, Suescun, and Herrera 1976). This project tried to counteract the problem of ration sales by distributing the food in numbered containers which mothers had to return to get their next supply.

E. SUMMARY:

FOOD QUANTITY

To ascertain the size of the supplement, one must consider the nutritional requirements and deficits of the target group and possible leakages of the foods.

Knowledge of the requirements of malnourished children is far from precise. A calorie requirement of around 150 calories per day per kilogram of body weight may be reasonable. Since calorie deficiency is generally more severe than protein deficiency, increased attention should be given to meeting the former but balance should be maintained with the latter.

Deficits can be documented through 24-hour dietary recalls Imprecision is inevitable, but accuracy can be increased by weighing foods. Such dietary surveys should be taken during the various seasons because intake differences are likely. The supplement size should be based on the average per capita nutrient deficit of the malnourished children alone.

However, the ration size must be larger than indicated by the deficits to compensate for leakages or diversion of the supplement through intrafamilial distribution and sustitution of the ration for the normal diet. Studies reveal that in take-home programs, about one half of the individual's ration is shared with other members of the family. Therefore, to insure that the target person receives the needed incremental nutrients, it may be necessary to double the ration size. Special food types and packaging and nutritional education may help decrease this sharing, but some must be accepted. In on-site feeding programs, from one third to one half of the supplement may be used as a replacement for foods normally consumed, thus reducing the net incremental nutrient intake. The substitution effect is greater for the better nourished children. Substitution might be reduced by feeding children in between normal mealtimes so that the ration is not perceived as a substitute.

VI. TIME DIMENSIONS

A. KEY QUESTIONS

- At what age should supplementation occur?
- At what time of the year should it occur?
- With what frequency should supplements be distributed to beneficiaries?
- How long should a participant remain in the program?

When to feed is primarily a consideration of vulnerability. The two major issues are the age period of greatest risk to be covered by the program and the seasons or times of the year when supplementation should be enhanced owing to greater danger of malnutrition and infection. The desirable frequency of supplement distribution varies considerably among the three different types of feeding programs, and, to a lesser extent, so does the duration of a beneficiary's participation in the feeding program.

B. Vulnerability Periods

The first issue - when to feed children in order to protect them during vulnerable periods - has already been addressed in some detail in the section on how to select beneficiaries. It was stressed that the preschool child is at greatest nutritional risk between the ages of 6 and 36 months, primarily because of the weaning process. It has been suggested by some that if children from 6 through 36 months of age received special nutritional attention through supplementary feeding programs, they would then be protected from becoming malnourished during the later preschool years. This approach advocates that children need only be enrolled until they are 3 years old, and that the exclusion of older preschoolers enables greater program coverage. However, as was stated in the discussion of enrollment, it is difficult to feed only this age group to the exclusion of older preschoolers. In take-home programs the rations given only for 6- to 36-month old children are eaten by all the preschoolers, regardless of the age limits intended, once the food is taken home. Thus, food may be spread too thinly and will not result in extra protection for the younger child. In on-site feeding, it is very difficult to reach children under two years old because it is less easy for parents to bring them to the center daily. Furthermore, a child's susceptibility to malnutrition does not stop at three years old, and older children may continue to need supplementation even if they have been fed between 6 and 36 months of age.

Children under three years old should be given priority admission when program funds are scarce. Emphasis should be placed on the younger preschoolers because of their greater nutritional vulnerability, but program enrollment should not be cut off at three years of age if resources allow continuation. Malnourished children up to five years old should be included in feeding programs if all the younger preschoolers have already been covered. In several CRS preschool feeding programs in Africa, it was found that the number of children with adequate weight for age increases as length of attendance increases; therefore, it may be desirable for children to remain in the program through their fifth year, if resources permit this extended coverage (Jacob 1973 and 1975; CRS 1975).

Pregnancy represents another nutritionally vulnerable period and the importance of maternal supplementation to prevent low birth weight has already been elaborated. However, the findings of the Colombian study are useful in considering the timing for supplementation during pregnancy (Mora et al. 1976 and 1979). It was found that severe nutritional deprivation during the first half of pregnancy does not affect birth weight, whereas deprivation in the second half does. A high consumption of calories and protein in the second half or even in the last trimester of pregnancy

can increase fetal growth in mothers whose diets were inadequate during the first half, but supplementation must take place for at least 13 weeks. Thus, the crucial time for supplementation for pregnant mothers is during the last trimester. However, maternal fat stores laid down during the early months of pregnancy as a result of supplementation can be beneficial to fetal growth later in pregnancy.

The same study also showed that children who were supplemented from the sixth month of pregnancy until they were six months old rapidly lost weight once the supplement was withdrawn. In contrast, children who were not supplemented during gestation but only after six months of age showed signs of rapid catch-up growth; at one year their weights were greater than those of children who were supplemented prenatally through the sixth month of life. The children who did best were those who were supplemented continually from the sixth month of pregnancy through the third year of life. During the first six months of life, breast milk is normally sufficient and no supplementation is required. However, it is around six months of age that the addition of solid food to the diet is necessary to prevent the faltering of growth due to the inadequacy of breast milk.

Children may be at much greater danger of becoming malnourished during one season than during another. This is especially true in rural areas where the harvest cycle greatly affects food availability and results in "hungry seasons" in which the whole family's diet, but especially that of the preschool child, is inadequate. Weather conditions at various times of the year may also greatly increase the frequency of diarrhea and parasitic infestation. In India, parasitic infestation increases tremendously with the advent of sunny days approximately three months after monsoonal rains have ceased (Shah, Junnarkar, and Khare 1975). In Narangwal, India, seasons were found to have a very significant effect on weight in one-to-three-year-old children, with lower weights in the hot and wet months (April through August) than in the cool, dry months (September through March). This was because preschoolers were given less to eat and also suffered from more diarrhea and dehydration during these months (Narangwal Rural Health Research Centre 1974).

The effects of seasons on nutritional status are not restricted to India, but occur in most other developing countries as well. For this reason it has been recommended that supplementary food rations be increased during the seasons of increased vulnerability, or that program coverage be expanded during these months so that more children may be protected. Programs should carry on normal activities during most of the year, but augment their rations and services during "hungry seasons."

In many societies in which women play a major role in agricultural production, the seasonal work load may also affect the mother's ability to attend the feeding program. The distribution schedule should be adjusted to accommodate the mother's working hours. Early morning or evening distributions may enable mothers, who work in the fields all day, to collect the ration. On-site feeding programs which provide day care for children of working mothers may be especially useful during planting and harvest seasons. With this in mind, the Narangwal, India project set up special day-care centers to assist mothers during harvest time (Taylor et al. 1978).

C. Feeding Frequency

The frequency of ration distribution is another important issue facing the program planner. In take-home feeding programs, rations in dry form are usually distributed to mothers weekly, biweekly, or monthly. However, daily distribution may also take place, particularly when commodities are in prepared or semi-prepared form, e.g., bread, reconstituted powdered milk, or blended foods to which water has been added. The major considerations for deciding the appropriate frequency of distribution are staff time, convenience, shelf life of the ration, and opportunities for diversion of the ration. Convenience entails the amount of food the mother can physically carry in one trip, since she will usually be traveling on foot and bringing home rations for more than one person (herself and two preschoolers). The distance the mother lives from the center and the amount of time it will take her to walk, as well as the cost of other modes of transport, are also important issues in making the distribution schedule convenient for the mother.

Families should not be given too much of a commodity at one time because it is likely to spoil before it can be used. However, this has seldom proved to be a problem even in monthly food distribution, since families tend to finish rations considerably ahead of schedule because they share the food among them. In fact, the less frequent the distribution and the larger the quantity of food the mother is given at one time, the greater may be the problem of sharing the ration or selling it in the local market. In this regard, weekly distributions may be preferable to monthly distributions as they theoretically minimize the diversion problem, although evidence is needed to substantiate this hypothesis.

In nearly all on-site nutrition rehabilitation programs, children are fed at least three meals per day for six days a week. The child receives his or her total daily nutrient requirements from the center. The main concern here is to serve enough small meals per day that the child consumes a sufficient amount of the local diet to meet his requirements and overcome the bulk constraint. A few nutrition rehabilitation programs provide children with only two thirds of their requirements in two meals per day. These programs should also keep the child's bulk capacity in mind, provide quantities which can be consumed at each sitting, and adjust the number of meals to fill the desired proportion of the child's nutrient requirements.

In on-site feeding programs in which the child receives only one meal per day, it is desirable not to serve this meal at traditional mealtimes. Presumably then the mother will view the ration as more of a snack than a meal and not substitute it for foods she normally gives at home. However, field data are needed to verify the hypothesis that altering the timing of the meal does reduce the problem of substitution. In day-care centers, children could bring their own lunch and the ration could be used as a snack or side dish, as is done in Thailand (Weil 1972). As in nutrition rehabilitation centers, meals should be small and served frequently enough during the day that the child is able to consume the desired quantity.

Another factor which may affect the timing of on-site meals is the use of facilities that are normally used for other functions. In this case, the feeding program must be conducted during the facility's off hours, as is the case in the preschool feeding program conducted in Brazil's primary schools (Gandra 1977). Since schools are not used in the afternoon, the feeding for preschoolers is conducted then.

D. Participation Duration

The only rational way to determine the appropriate duration of participation is to monitor the growth of the beneficiaries. When a child reaches an acceptable nutritional status and has maintained this level for several months, he or she can be "graduated" from the program. Since the rate of growth and recovery of each child is different, this is probably the most efficient way of ascertaining when a child has participated in a program for an adequate length of time. This method would be far more accurate than setting an arbitrary time period for all children. As children reach a normal nutritional level and are removed from the program, new beneficiaries can be enrolled, resulting in a more efficient use of resources than with the indefinite enrollment of those who have reached a normal nutritional status. However, major improvements must be made in the environment in which the child remains once graduated from the program, including improved sanitation and water supply, increasing parents' income, etc. Without these overall changes in the community, it is likely that children will fail to thrive and that they will have to be readmitted to the program at a later date for nutritional recuperation.

Limiting the duration of participation in feeding programs to the minimum required to achieve nutritional goals may also be desirable for encouraging self-sufficiency among the beneficiaries and preventing dependence of the family on outside assistance in the form of food donations (Beghin 1976; Venkataswamy and Kabir 1975). Despite these arguments in favor of limiting the length of participation, most programs, with the exception of nutrition rehabilitation centers, have not defined the nutritional condition at which a child should be released from attending. Nor have criteria been set for determining when a feeding center should cease to operate in a certain community because its goals have been accomplished. On the contrary, most feeding programs enroll beneficiaries for an indefinite duration and allow them to stay as long as they are still in the preschool age group. No schedule has been established for closing feeding centers nor for transferring services to new communities not yet covered by the program.

The exception to this rule is nutrition rehabilitation programs, which usually limit the stay of children and mothers to three to four months, during which time the child receives all his daily meals, six days per week, and the mother receives nutrition education (Fougere and King 1975; Venkataswamy and Kabir 1975; Brown 1974; World Food Programme 1974; Beghin and Viteri 1973; Beghin 1970; Research Corporation 1970). Children are kept in the program a few months longer if they have not recuperated. However, the majority of the participants can reach a satisfactory nutritional level and mothers can learn the methods of preventing or treating

malnutrition on a local diet within their four months of active participation. Much less common are residential nutrition rehabilitation programs which keep mothers and children for three to four weeks. These keep children for the length of time that would be required for their recuperation if they were hospitalized. No nutritional impact data were available on residential, seven-days-per-week recuperation centers to compare the time it takes for a child to recuperate in them with the time required in the traditional day-care type of recuperation center. However, it has been reported that two weeks is the minimal amount of time necessary before measurable nutritional improvement occurs if a child is fed an optimal diet in an institutionalized setting (Capone 1977).

Criteria have been suggested for determining when it is time to close a nutrition rehabilitation center and move the program to a new community (Research Corporation 1970). These are not being recommended for general application but are examples of some of the indicators which could be used. Centers could be closed when:

- there is no more second- and third-degree malnutrition in the community's population of preschoolers.
- nutritional improvement in the community is no longer observed.
- when repeated readmission of the same mother-child pairs starts to occur.
- all mothers in a small community have been successfully trained in proper child feeding practices.

It would seem that criteria should be established for deciding when other types of feeding programs could be terminated. However, a key question in this approach is whether the children will relapse into malnutrition when the program leaves because of an unchanged environment. Program planners should be warned that recuperation may not be permanent if the environment remains unimproved, and therefore feeding programs may continue to be needed as a protective measure.

How long children should remain in take-home and on-site feeding programs depends on how long nutritional recuperation takes. Take-home programs in which the child receives a ration, which could theoretically provide about one third of his daily nutrient requirements, have been found to take at least one year before measurable nutritional impact occurs and the mother reaches a sufficient level of nutrition knowledge (CRS 1975; Gopaldas et al. 1975: Cantor Associates 1974). In Colombia, mothers and children are enrolled in a take-home feeding program for a maximum of six months, at which time a new batch of participants is enrolled. These time limits have been imposed in order to share limited program funds among a greater number of people in need. Since the program has a strong education component, it is felt that six months is a sufficient time for mothers to learn proper techniques of child feeding. In two separate evaluations of this program, it has been found that six months is not long enough to achieve nutritional

provement in most beneficiaries (Anderson 1977; World Food Programme 974). However, the earliest Colombian program (Wray 1967 and 1978b) owed a good response within six months. In the WFP evaluation, it was ound that when participants were allowed to stay in the program for twelve nths, the number of malnourished children was reduced by 57%, versus 39% en children remained in the program for six months only. A six-month mit has also been placed on the length of participation of mothers and ildren in the take-home Cininutrimix program in India, but no data are ailable on whether the program has been successful in recuperating child-n and educating mothers within this short period of time (Chaudhuri and rince 1977).

The evidence available would suggest that children should remain take-home feeding programs for at least one year and probably longer. ke-home feeding in the Philippines has been found to accomplish the same vel of nutritional improvement in eighteen months that was realized in a trition recuperation program in two months (Asia Research Organization 76). Even when children in Colombia were provided with their complete ily nutrient requirement through a take-home ration, and other family bers also received small amounts of food as a safeguard against intra-milial sharing, the initially malnourished children were still below ight and height norms after two years in the program (McKay, McKay and nisterra 1973). The growth increment of these children was greater than rmal, but it appeared that they would remain below weight and height norms spite the length of supplementation.

In this same program, the results of on-site feeding of the ild's complete daily needs were compared with the results of take-home eding. Nutritional results of both approaches were equal after the first r, but after the second year results of on-site feeding were superior. In ndelaria, on the other hand, recuperation of severely malnourished child-n (Grades II and III) occurred as quickly in the take-home program as in NRC program (Wray 1967). Thus, take-home feeding may require consider-le length of time to recuperate malnourished children, primarily because a lack of control of the rations used at home and the high probability of version from the intended beneficiary. There are no studies available at sent which pinpoint exactly how long recuperation takes at different ke-home ration levels, and this may be very hard to establish universally cause of the wide variation in food use and degree of diversion in the e. However, children should be enrolled for at least one year, and two rs would probably be a more realistic period.

In an on-site feeding program in Narangwal, India, in which child-n received two meals per day, supplying two thirds of their calorie re-irements, it took one year for malnourished children to reach a normal tritional status, i.e., at least 80% of the standard weight for their age ylor et al. 1978). It would appear that on-site feeding programs provid-only part of the child's nutrient requirements five to six days per k would take as long as take-home feeding programs to achieve nutritional act, because of the problem of substitution.

In light of the varying issues surrounding timing, we reiterate the initial recommendation of this section, namely, that progress be monitored and "graduation" from a program occur when acceptable nutritional status has been achieved. Furthermore, we stress again the importance of participation during the 6- to 36-month age period. Finally, increased participation during critical seasonal risk periods should be sought.

E. SUMMARY:

FEEDING TIME

The time dimension of supplementary feeding programs concerns periods of nutritional vulnerability, frequency of distribution, and duration of participation in the program.

It is most critical to service children during the 6- to 36-month period and pregnant women in their last trimester. All groups, especially in the rural areas, may be more vulnerable during certain "hungry seasons" when food supplies are short or when infection rates increase due to climatic changes. Larger rations and coverage are called for at these times. Seasonal work demands may also necessitate adjustments in the time of day when supplements are distributed or in day-care facilities while the women work in the fields.

To establish the frequency of distributing supplements, one should attempt to minimize the inconvenience to the beneficiary. On-site feeding programs require daily visits, but take-home programs can have weekly or biweekly visits. Convenience will depend on the recipients' distance from the distribution point, travel costs, and carrying capacity. Large infrequent distributions may encourage a temptation to resell rations, or may increase spoilage risks.

The only rational way to determine the appropriate duration of a beneficiary's stay in a program is to monitor his or her growth status. When an acceptable level of nutritional status has been reached and maintained, the participant may "graduate" from the program. NRCs appear to take about three months to achieve nutritional improvement. On-site and take-home programs appear to need at least a year.

VII. LOCATION

A. KEY QUESTION

- Where should the feeding site or distribution point be located?

Four factors must be considered in deciding where to locate a feeding program: nutritional need, geographical accessibility, image factors, and facilities availability.

B. Nutritional Need

If a feeding program is tied to the use of existing facilities because of economic constraints, special efforts should be made to reach out to the needy and to encourage their participation. Our earlier observations about community involvement and needs are particularly relevant to this point. Before a feeding program is initiated, a national nutrition status survey should be taken to pinpoint the regions of the country and the specific communities most seriously affected by malnutrition. These areas should be covered first. If no facilities exist in the most disadvantaged areas of a country, as is often the case, planners should try to find an alternative infrastructure to use for delivering services, e.g., rural health workers who travel house to house, or new facilities should be constructed.

C. Geographical Accessibility

Supplementary feeding program planners must consider the geographical radius that the feeding center is intended to cover, the proclivity of the beneficiaries to travel to the center on foot or otherwise, and the cost and availability of transport services. The "opportunity cost" of wages lost due to time spent traveling to the feeding center should also be considered. These factors will vary from country to country. In the Poshak take-home feeding program in India (Gopaldas et al. 1975), best attendance for weekly food distribution was among mothers who lived within three kilometers of the distribution site. In Tanzania, it was found that eight kilometers, which represented a four-hour walk, was the maximum distance mothers would travel monthly to attend under-five clinics (Bernstein and Kreysler 1972). It would seem that this distance would be a maximum radius for location of take-home feeding centers in general. However, site-specific information is necessary. In on-site and nutrition rehabilitation programs which require daily attendance, travel distances must be much less. These programs work best in compact villages so that it is easy to gather beneficiaries daily (Rao et al. 1975; Weil 1972).

D. Image Considerations

Participation may also be greatly affected by the image of the center. The site should be located so that it has prestige instead of stigma. In nutrition rehabilitation programs, it may be important for the

program site to seem more like a school or education facility than like a feeding station, because the educational goals of the program preclude a "welfare" image (Research Corporation 1970). However, in some cultures the image of prestige may be deleterious to program goals because it hinders the most needy from attending the center. This is particularly true in India, where the caste system dictates strict segregation of different social classes. It has been found that if the feeding center is built or located in a certain section of a village which is out of bounds to the lower castes, then the lower-caste children will not attend. Because the lower castes are often the most economically deprived group, they also offer the most malnourished (Cantor Associates 1974; Anderson 1977). Similar segregation of different social classes takes place throughout the world, and the feeding center location should be chosen carefully so as to minimize this obstacle to reaching the children who are most in need.

E. Facilities Availability

The need to use existing facilities, most frequently health centers, day-care centers, community centers, and schools, often determines the location of feeding centers. It is usually more economical to borrow space in existing facilities than to construct new buildings solely for the feeding program. The use of existing facilities also can result in greater use of health services because the incentive to receive food brings mothers to the center. Furthermore, if the health center has a positive image it may help in getting the feeding program accepted. However, serious drawbacks to using existing facilities may arise when the location serves as a deterrent to participation by the desired target group.

In Africa, rural day-care centers, along with rural health centers, have been found to be the most available facilities for use in health and nutrition programs (Capone 1977). In Brazil, an on-site feeding program for preschoolers that is based in primary schools makes effective use of available resources of the education system and the delivery channels already in use for school lunch programs (Gandra 1977). In this way, a shortage of health centers for use of the nutrition program was circumvented, and preschool children are given an opportunity to become acclimatized to the school environment, which eases their adjustment when they are actually enrolled in first grade.

Schools have also been used as the distribution sites in take-home feeding programs. In Cebu, Philippines, school teachers distributed dry rations to mothers on one afternoon every two weeks, at no extra pay (Weil 1972). In Project Poshak in India, a special study was made of the use of primary school children to deliver rations to their siblings and other preschoolers in their villages (Gopaldas et al. 1975). The school children were given health and nutrition education and were expected to communicate this to their parents; because the children were more literate than their parents, it was much easier to teach them. The school was an excellent infrastructure for clinic sessions after hours, and the community accepted the program more readily from the school than from the health center. The disadvantages of this method were that many school children did not have preschool siblings, they attended school irregularly and dropped out frequently. Food distribution was irregular because of school vacations, exams, agricultural seasons, and the monsoon. Teachers felt overburdened by extra work.

For this kind of program to succeed, it is vital that teachers be given a salary bonus and special training in the responsibilities of a feeding program. Program funds could be saved by converting on-site school lunch programs into take-home programs, along with the distribution to preschoolers throughout the schools. The best response to this kind of program was found when the village school distributed food to the inhabitants of the village and when parents as well as children were permitted to collect the take-home food ration. However, in some countries the poorest families may not be represented in schools, and therefore schools would not be the best location for reaching needy preschoolers.

F. Nutrition Rehabilitation Centers

The location of nutrition rehabilitation centers deserves a special word. The following guidelines have been suggested for choosing communities (Research Corporation 1970):

- frequency of malnutrition - weigh all children and choose community with a high prevalence of second- and third-degree malnutrition.
- availability of medical service - NRC should be located where health services exist and where it can share health facilities.
- availability of adequate financial resources for running the center.
- accessible and concentrated population.
- economic potential of the community - at least 75% of the community should be able to afford least expensive diet being recommended through education at the center and the foods being recommended should be readily available.
- existence of other health and food production programs which the NRC could complement instead of duplicate.
- cooperative local leaders.

If few health services exist, it is not necessary to restrict NRCs only to communities with such centers. There can be many more NRCs than health centers, thus resulting in greater outreach to the malnourished (Fougere and King 1975; Beghin 1970). In Haiti it has been found that NRCs are more successful in rural than in urban areas because urban slum dwellers are more mobile, with less cohesive families and a weaker mother-child bond, all of which leads to failure of the mothercraft approach (Fougere and King 1975).

Although NRCs may sometimes be annexed to hospitals (primarily as a teaching facility for medical staff), it has been found in some instances that this may not be a good practice because of the temptation, given a shortage of hospital beds, to send children who suffer from illnesses

other than malnutrition to the NRC (Christian Medical Commission, World Council of Churches 1974). Also, a mother may leave the program with the mistaken impression that the hospital and medicines rather than the nutritious local diet served in the NRC cured her child.

Finally, there are certain advantages to recuperating malnourished children within their own homes through take-home food rations and visits by rural health workers. Through domiciliary management of malnutrition one can involve the whole family, and the neighbors as well, in the treatment of the child, and the treatment will be more economical than in a hospital or a feeding center (Khare, Shah, and Junnarkar 1976; Shah, Wagh, Kulkarni, and Shah 1974; and Wray 1967). Parents lose fewer wages when the child is treated at home. Domiciliary management of malnutrition also makes sense because it treats the problem in its milieu, which results in less opportunity for cross-infection, less emotional disturbance, and greater certainty of applicable educational lessons (Beghin 1976). On the other side of this issue is the observation that the nearby hospital outpatient clinic has been beneficial by providing transition support for those leaving the NRC and thus has reduced the relapse rate (Cutting 1975).

G. SUMMARY:

LOCATION

The first criterion is to locate the facilities where the nutritional problem is most severe. Nutritional surveys are needed in order to identify these areas. The location must be acceptably accessible to the beneficiaries, and the maximum distances that they will travel should be ascertained in advance, through interviews. Distances must be shorter for on-site programs than for the less frequently attended take-home sites. The location must also be socially acceptable to the target groups.

To save capital, existing facilities should be used where feasible given the foregoing considerations. Existing health infrastructures may not have the coverage to reach the target groups. Schools have been used effectively in some places. NRCs should generally not be located in hospitals, but should be village-based. In fact, there appears to be considerable merit in using a take-home approach with domiciliary management of malnutrition. However, hospital outpatient clinics sometimes provide transition support for those leaving the NRC and thus reduce the rate of relapse.

VIII. SITE FACILITIES

A. KEY QUESTIONS

- What buildings are needed?
- What kitchen facilities are desirable?
- What should the environmental surroundings be?
- What other equipment is needed?

Feeding centers can be simple, secure structures. There is no need for elaborate buildings and equipment, but certain fundamental requirements must be met. All feeding centers should have access to potable water and lavatory facilities. This is particularly true in on-site feeding and nutrition rehabilitation centers, which need water for cleaning and cooking and sanitary facilities for the large groups of mothers and children who attend for several hours at a time. Water can be made potable by boiling it, and sanitary facilities can consist of simple pit privies or latrines. The presence of this level of hygiene at the feeding center can serve by way of example to educate the mother in the importance of pure water and a sanitary environment in her home.

Communities may donate facilities or land to the program as a demonstration of their commitment. Take-home feeding programs basically need just enough space for easy dispensing of the rations and safe storage of the commodities. On-site and nutrition rehabilitation centers need both a kitchen and a recreation area in addition to storage and eating space. No kitchen is necessary if meals are delivered from a central preparation facility. In all types of feeding programs, more substantial facilities are needed if the program includes health services and nutrition education. In these cases, a comfortable classroom space for mothers and a private room for use in medical examinations are needed.

B. Kitchens

For programs that involve the on-site preparation and consumption of food, the following specifications for setting up and running kitchens have been outlined (Higgins 1969). First of all, kitchens should be convenient. They should be arranged in a functional layout that follows the logical sequence of tasks and saves wasted steps, e.g., they should be constructed in harmony with the work flow from receiving and storage to preparation, to cooking, to serving, to collecting and washing used dishes and utensils and storing after washing, to sanitary disposal of garbage and scraps.

Even if a rudimentary kitchen based on three rocks, a pot, and a fire is used, one will still need a table or counter near the fire on which to prepare and serve the food. If a wood or coal fire is used, a hood with

a chimney or a vent to get rid of smoke will be necessary. If available, gas makes a better fuel because it burns cleaner than coal or wood, is less subject to pilferage, and facilitates easy regulation of the cooking temperature. Cooking pots should be of a heavy-gauge metal. There is a danger of toxicity if copper pots that have not been properly tinned are used. Enamel pots may chip and leave sharp particles in the food.

Although it might result in better quality control, modern equipment is not usually recommended for individual feeding centers because it is costly, has to be maintained regularly, and depreciates rapidly. Another argument against modern capital-intensive equipment is that the jobs so desperately needed in developing countries will be better provided by the labor-intensive approach. In rural areas especially, kitchens which are culturally familiar in design and which are stocked with familiar types of equipment may be more efficiently and effectively utilized by those preparing the food. However, in large-scale feeding operations with central kitchens in urban areas, modern equipment may be recommended.

Hygiene is also vitally important. Kitchens should have ample light, air, and ventilation to remove smoke and fumes and make it easy to see dirt. Tiled, painted, or white-washed walls also make it easier to see dirt. Heavy equipment should be flush with the wall so that dirt does not accumulate behind it, or free-standing so that there is plenty of room to clean around it.

A ready source of water is essential in a kitchen. It should either be piped in or come from a nearby source. A kitchen should not be built on a site where water has to be carried from a distance. Two separate sinks or washtubs should be available, one to to be used only for cleaning food and the other only for washing dishes. There should be a drain in the floor, or the floor should slope down toward the exit, so that excess water used in cleaning runs off and no puddles remain. Cleaning should always be done with soap and water, not just water alone.

Screens must cover all windows and air vents to reduce fly infestation. Personal hygiene of kitchen workers is also critical.

An alternative to individual on-site kitchens is to have food centrally prepared in one large facility and delivered to feeding centers daily. Ready-to-eat snack foods such as SEV in India can also be efficiently prepared in central kitchens and delivered to feeding sites. Central kitchens may be advantageous in certain situations because they are cheaper, due to the economies of scale from the larger volume of meals that can be prepared in one facility. One of the largest central kitchen-based feeding programs is operated by the government of India and CARE in Tamil Nadu, where 97 kitchens serve food daily to over 365,000 children in nearly 7,000 schools (Roth 1976). These kitchens also provide meals for preschoolers in on-site feeding centers. Centrally prepared meals (including delivery of raw commodities from a regional warehouse to the central kitchen, food preparation, and daily delivery to each feeding center) were $0.55 cheaper per 300 feeding days per beneficiary than on-site prepared meals. Excluding the cost of the food itself, central kitchens needed

$2.00 per beneficiary per 300 feeding days for preparing and delivering food, in contrast to on-site food preparation, which cost $2.55 per beneficiary per 300 feeding days in 1976. These figures exclude the $2.5 million capital required to establish the 97 central kitchens. Without access to sizeable fixed-asset capital financing, such an elaborate central kitchen network as found in Tamil Nadu might not be practical.

C. Environment

In on-site and NRC programs where severely malnourished children spend many hours of the day, it is vital to normal recovery that the environment at the center be psychologically stimulating (McKay, McKay and Sinisterra 1973; Instituto Colombiano de Bienestar Familiar (ICBF) 1976). The atmosphere at the center should be interesting, lively, and health-giving to provide an opportunity for physical and intellectual demand as well as social interaction. In order to achieve this type of environment, the feeding center will have to invest in stimulating games and toys as well as decorations for the children. Mental stimulation, speech exercises, physical exercise, and games help to improve the malnourished child's behavior and the impaired mother-child relationship. Failure to give due attention to improving speech and psychomotor development may be one of the biggest reasons for failure to recuperate children in NRCs (Beghin 1976; Beghin and Viteri 1973).

D. Other Equipment

Additional equipment for nutrition rehabilitation centers should include tables for eating; a small table with a scale for weighing children; beds for children in severe condition; a cupboard for food, dishes, and spoons; copies of menu cycles; a first-aid kit; growth charts; teaching aids; and mats for the floor (Research Corporation 1970: Fougere 1972). All foods should be cooked with the same kind of equipment and fuel as is available to the mother in her home, and the center should have the same type of furniture. There should be a small washbasin in the yard to encourage mothers to keep their children clean. As much as possible, NRCs should duplicate local home conditions in order to facilitate the mothers' understanding of and ability to implement the center's educational message. The exception to this would be the provision of toys and other means of psychological stimulation.

Finally, all feeding programs need accurate measuring devices for determining the weight and height of children and thereby assessing their nutritional recovery. Several accurate, inexpensive, and highly portable weighing scales have recently become available. In an Indonesian community-based weighing program, Dacin-type hanging market scales have been adapted for program use; the child is suspended from the scale by a sarong or a pair of pants specially made of sturdy fabric (Hendrata 1976). It was found in this program that the use of colorful pants or a colorful toy in the weighing seat may serve to amuse children and prevent their crying during the weighing process. The Salter hanging scale with a clock face, used in many markets around the world, works on the same principle. These scales are made by CMS Weighing Equipment Ltd. in England. The Chatillon

Company in Kew Gardens, New York, also produces an inexpensive tubular scale, model IN-30. Each center should also have a standard weight to check periodically the accuracy of its scale.

The length of infants who are unable to stand (usually those under two years old) can be measured with an infantometer, which can be constructed locally with a tape measure fixed to a sliding piece of wood. Directions for constructing infantometers can be obtained from the U.S. Center for Disease Control, from Alfred Zerfas at the University of California in Los Angeles, or from Frank Falkner of the Fels Research Institute in Yellow Springs, Ohio. Centers can use a tape measure fixed to a wall that is exactly perpendicular to the floor, and a right-angle piece of wood to ascertain the height of older children. Thigh circumference may also be used to measure malnutrition in preschool children (Zeitlin 1977a). All that is needed is an inexpensive insertion-type tape measure (Zerfas 1975), which eliminates the need for more expensive scales. In populations with a high prevalance of severe malnutrition (at least 5% of the children classified as suffering from third-degree), arm circumference can also be used as a screening and evaluation tool (Shakir and Morley 1974).

E. SUMMARY:

SITE FACILITIES

Site facilities need not be elaborate. In fact, low-cost, simple structures are desirable. Nonetheless, kitchens, even if rudimentary, should be conveniently laid out. For large-scale urban feeding programs, centralized, modern kitchens may be most desirable. In all cases, potable water and lavatory facilities are needed. Adequate light and ventilation are desired for hygiene.

The environment of NRCs should facilitate the intellectual and physical stimulation of the children, to help improve speech and psychomotor development. NRC equipment should duplicate as much as possible that which could be available in the children's homes.

All feeding programs should have accurate measuring devices for determining the weight and height of children. This enables the monitoring of growth and nutritional status.

IX. LOGISTICS AND CONTROL

A. KEY QUESTIONS

- How can the logistical aspects of food procurement, delivery, preparation, feeding, and stocking be handled?
- How can these activities be controlled?

The effectiveness and efficiency of supplementary feeding programs are largely determined by how well the flow of the food supplement is managed. Faulty logistics and inadequate controls can result in disrupted or misdirected food flows, which in turn can reduce nutritional impact and increase program costs. Thus, it is of critical importance for feeding programs to have a management control system.

The logistics of feeding programs consist of five basic activities: procurement, delivery, preparation, feeding, and stocking. Control procedures are necessary for each of these activities and will be discussed individually.

B. Procurement

Deciding what food is to be used is the first step. This decision involves nutritional suitability and consumer acceptability, as discussed in the Food Type section. Additionally, however, the food must be available in the desired quantities and its cost must be within the financial constraints of the program, including foreign exchange resources if the food has to be imported. If the selected food is not available because of either supply or economic constraints, then an alternative foodstuff must be chosen. This raises another key procurement concern: supply dependability. To the extent possible, it is desirable to have various interchangeable foodstuffs to increase procurement certainty in the face of supply problems for one item.

Problems can arise also because of the seasonality of crop production. If the food comes directly from farmers, procurement may have to take place during one or two harvest periods during the year. This requires working capital and storage capacity to be programmed to handle these peak demands. If supplies are obtained from wholesalers and processors, purchase contracts guaranteeing delivery of needed quantities at the appropriate times are advisable. When the food comes from international donors, recipient countries should attempt to negotiate multiyear quantity commitments to insure supplies. Port unloading and storage facilities and services should be examined to guarantee adequacy and to assess the possibility of disruptive delays due to congestion. Supplies must be available not only in adequate quantities but also at the appropriate time.

Determining the amount of food to be procured is done by projecting the number of recipients and the individual ration for the period. The individual ration size, as previously discussed, is based primarily on the type and severity of the nutritional deficiencies of the target population. The total number of rations will depend on the number of beneficiaries and their participation frequency in the program. Participation projections should be sensitive to possible seasonal variations.

If for some reason available quantities fall below expected amounts, program managers can adjust their feeding operations in two ways: either by reducing the individual ration to make supplies stretch over the total number of participants, or by keeping the ration size intact and reducing the number of program participants. Varying the ration size has the advantage of keeping participants in the program; excluding them temporarily might lead to their becoming permanent dropouts. It should be noted, however, that varying the ration size can confuse personnel at the site as to what is the appropriate ration. Furthermore, if the supply shortage is very severe in quantity and duration, then the ration might be reduced to nutritional insignificance. Faced with such a consequence, it would be better to reduce participant numbers.

In addition to obtaining food supplies in adequate quantities, the procurement system must also seek to insure appropriate quality. This means that the food must meet nutritional specifications as well as being sanitary and palatable. This dimension can be controlled by specifying quality standards in procurement contracts and by inspecting on a sample basis the incoming shipments from suppliers.

To maintain adequate control over the procurement and subsequent food utilization activities, the manager requires a series of documents. Purchase orders represent the basic initiating form. Delivery receipt forms are compared to the purchase orders to verify the shipment or to catch discrepancies. These delivery receipts are also the basic data source for entry into the central inventory record, which will be discussed in the section on stocking. Figure 1 shows a flow chart of the feeding program logistics and the corresponding documents that could be used as part of the control system.

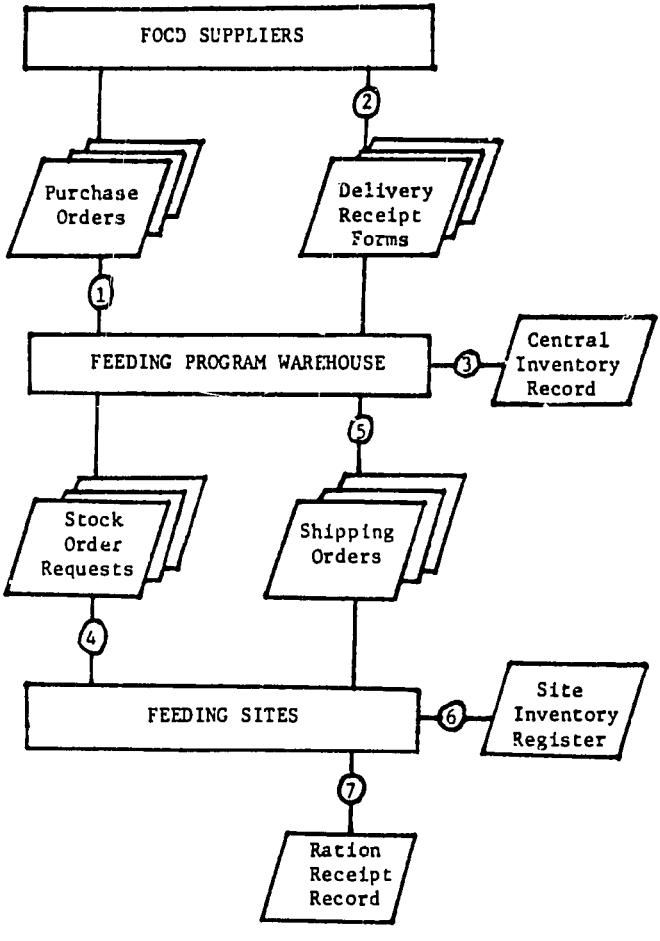
Systematic procurement informational and operational procedures are not necessary, of course, if the feeding program is located at an individualized nutrition rehabilitation center where the family is largely responsible for providing the foodstuffs, which are then prepared at a center. However, even if the feeding is a community activity and involves foodstuffs produced locally, basic procurement should be considered.

C. Delivery

The procured food has to be stored and then delivered to the feeding sites (including dispersement points for take-home programs). There are three main delivery issues: how to transport the food, with what frequency, and how to control the flow.

Figure 1

FEEDING PROGRAM LOGISTICS AND DOCUMENT CONTROL SYSTEM



Flow Explanation:

1) Warehouse orders food from suppliers.
2) Food is delivered to central warehouse.
3) Receipt is recorded in central inventory record.
4) Feeding sites request food.
5) Food shipped from central warehouse.
6) Receipt is recorded in site inventory register.
7) Ration is given to beneficiary and noted in ration receipt record.

The choice of transportation should depend on availability, dependability, and cost. Railroads, automobiles or trucks, airplanes, boats, wagons, carts or people, separately or in combination might be suitable. First the planner should ascertain the availability and capacity of transport relative to projected volumes of food. Capacity can vary during the year and might be particularly acute at certain periods, e.g., harvest time. Dependability is critical. The experience of other users should be checked to assess the frequency of delays or merchandise damage. Again, seasonality may affect dependability; e.g., roads may be impassable during the rainy season, but train deliveries might still be possible. Contracts with the transport agency are advisable. The terms and obligations, including the cost, should be very explicit. Disagreements over such details have led to highly disruptive delays in feeding programs.

If the existing transport services are unavailable, undependable, or costly, the program might have to acquire its own transport. This requires considerably higher capital outlays and greater administrative burdens, but it can also increase flexibility and dependability, and even decrease costs if adequate volume is available.

The supply chain generally consists of central and regional warehouses and local feeding sites. The frequency of delivery will vary depending on the usage rates at the sites and the capacity of the central and site storage facilities, but the size of the local inventories is the final limiting constraint; if only a week's supply can be stored, then deliveries must be <u>at least</u> weekly. Regardless of the frequency, delivery should be made on a regular basis so that the receiving procedures can be standardized and planned for. Some flexibility should be allowed so that early reorders from sites can take place if, for example, an unexpected increase in participants occurs. If appropriate storage facilities are available at the sites, then small on-site buffer inventories would permit such short-term expansion without requiring added deliveries.

The shipments to the sites are controlled through the central inventory record. The periodic stock order requests emanating from the sites trigger the inventory withdrawals. These requests should be matched by a central authority against original programmed levels to insure compliance with supply constraints. Once approved, shipping orders are issued, and these should be signed by the recipient of the food and returned to the warehouse to verify delivery.

D. Preparation

The procured and delivered foodstuffs may have to undergo varying degrees of preparation prior to consumption, depending on the type of supplementary feeding program. On-site programs will generally require some cooking. Take-home operations may require repackaging or precooking in addition to in-home preparation. In some instances, basic raw materials may need to be processed into formulated nutrient-dense foods for subsequent use.

There are two main aspects of the preparation process that warrant attention by the control system: quality and quantity. Quality control refers to nutritional content and food hygiene. The principal killer of the weanling child is diarrhea, and therefore the reduction of bacterial content in foods served to preschoolers is critical (Jelliffe 1971). One key is personnel training. The cooks at the sites or the mothers in take-home programs must be thoroughly instructed in proper mixing and cooking methods, as well as in procedures for maintaining hygienic food-preparation conditions. The other quality determinant is adequate site facilities, especially a source of preferably running sanitary water.

Sanitary and nutritional quality control is often easier if the preparation takes place centrally, in batch processing. This insures greater uniformity, and the volume justifies larger, more sanitary facilities and skilled personnel. The main drawbacks of centralized food preparation are the risk of food spoilage and contamination during transport, the complicated logistics and mechanical support system required to deliver the food, and the high initial cost required to construct and equip the kitchen and purchase delivery vehicles. Sanitation safeguards must be stringent in centralized food preparation to prevent the spoilage that can so easily occur because of multiple handling and increased duration transport under tropical conditions. Special reusable containers may need to be designed for circumventing these health hazards.

To prevent delivery delays due to broken-down vehicles, it may be necessary to set up a central vehicle-maintenance workshop. This occurred in Tamil Nadu, where there now exists a central garage which employs over sixty engineers, mechanics, and support personnel, who service the 230 delivery vans. It has cost $2.5 million to establish the central kitchen operation in Tamil Nadu - a level of expenditure which would be warranted only in large-scale feeding operations. However, at the present beneficiary level, this cost could be recovered entirely in 13 years, while centralized preparation carries the advantages of quality control, convenience, and regular delivery. Such a system may be feasible in urban areas, but not in rural areas where sites are often highly dispersed and transportation times are excessive. Furthermore, centralized preparation does not permit involvement by local community members and therefore greatly reduces the educational value of feeding programs.

The control of quantities used during preparation at the site should be part of the inventory management system. The food taken out of inventory at the feeding center is recorded as a withdrawal in the site inventory register. This withdrawal can be compared to the ration receipt figures (amount received by recipients) to verify the extent of "preparation leakages" (pilferage or wastage) during preparation.

E. Feeding

Once the food is ready for consumption, the focus turns to the user. The first logistical concern is that the appropriate ration be disbursed. A simple but often overlooked way to insure this is to provide standardized measuring devices, e.g., ladles, cups, and cans. These should

preferably be predesigned containers that when filled contain the appropriate quantities for the ration. Where the food has been centrally prepared, it may be feasible to prepackage it in uniform quantities. Program impact can be seriously limited if the central administration does not deliver the appropriate quantity of food to program beneficiaries regularly.

Containers for storing the dry ration at home and for transporting it from the center are necessary as a control device in take-home feeding programs. The importance of containers that can be tightly covered to prevent infestation and spoilage has already been stressed. In Colombia, as noted earlier, used instant-coffee tins were brought by the mothers and proved entirely satisfactory (Wray 1967). In some instances, the food has been semiprepared at the site, e.g., mixed with water, to reduce its resaleability. If containers that are sanitary and suitable for storage cannot be provided by mothers themselves, then the center should provide appropriate containers (Wray 1967; Mora et al. 1974b; Gopaldas et al. 1975).

The meals served or take-home rations dispensed should be recorded, as noted earlier, in order to compare usage with inventory withdrawals. An additional ration receipt record should be kept as a basic control device. Each participating beneficiary should have a card and code number. Every time he or she receives a meal or ration, it should be recorded. The daily totals should be recorded in the ration receipt record. This insures that only eligible beneficiaries are participating, thus reducing nontarget-group leakages. These attendance records are also critical for impact evaluation and for spotting erratic participants who might require special outreach efforts.

A final control procedure for on-site programs should be verification of plate wastage. This can be done by simple visual estimation of the amount of food left uneaten. Significant quantities would suggest either unacceptability of the food or excessively large portions. Additionally, wastage might occur because the number of meals prepared, based on expected attendance, exceeds actual attendance. If significant, this problem might warrant outreach efforts to motivate more regular attendance and closer review of attendance records to improve predictions.

F. Stocking

Throughout the above activities, references have been made to inventories and storage operations. Inventory management is, in fact, a fundamental activity that permeates the entire supplement feeding system. The three main stocking issues are where and how to store the food and how to control the entire commodity flow.

As indicated earlier, a storage system can include warehouses at the central, regional, local, and site levels. The exact numbers and levels will depend on local geography and program size. The larger the program and the country, the greater the number of warehouses and the degree of centralization. The existence of warehouse facilities and personnel will also influence the configuration. The closer the inventories are to the users, the quicker users' needs can be met. However, there are some economies of scale possible from centralized warehousing, and this also permits tighter control.

Wherever the storage occurs, considerable care must be taken to reduce the risks of environmental spoilage and infestation damage. These risks can be minimized by selecting facilities that are not excessively humid and by storing the food off the ground (on pallets or shelves) and away from walls. The selection of sturdy and well-sealed containers (e.g., metal drums) is another basic preventive measure. Procedures should be set forth for disposing of damaged products; field experience shows that otherwise they may sit unused, taking up scarce storage space.

Inventories exist in all stages in the system and the levels and flow must be documented. The purchase orders and the delivery receipt forms start the documentation into the central inventory record. The stock order requests that come from the sites to the warehouses initiate the withdrawal procedure and documentation. The corresponding shipping orders are recorded in the site inventory register. Each warehouse should have its own inventory register. Stock order requests should be accompanied by an inventory report showing beginning levels, food used in period (based on ration receipt records), and ending levels. A final suggestion is that periodic, perhaps bimonthly, physical audits of inventory levels should be conducted. Field supervisors might include this in their function, or special inspectors might be used. Inventory pilferage cannot only be costly but it can also destroy program credibility among beneficiaries.

G. SUMMARY:

LOGISTICS AND CONTROL

The logistics of a feeding intervention begin with the procurement of the food. Arrangements (e.g., contracts) must be made with the farmers, processors, or distributors to insure delivery of adequate quantities of food at the appropriate times. Contract specifications or inspections may be necessary to guarantee that the food is also of an acceptable quality.

The delivery of the goods to the sites requires an analysis of the type of transportation, the frequency of delivery, and the control of the flow. The preparation of the food will involve cooking or packaging or both. Quality control at this point must guarantee nutritional adequacy and food hygiene.

Control over the actual feeding operation primarily concerns the size of the ration. Plate wastage should be ascertained as a control on acceptability. Inventory control must be exercised throughout the operation to insure a dependable flow and to avoid spoilage. A management-control information system consisting of standard documents which record the flow and levels of each stage of the operation should be established.

CHAPTER THREE

INTERVENTION EVALUATION

I. INTRODUCTION

A basic part of evaluating a supplementary feeding program is examining how effective it has been relative to its costs. The systematic collection of data on costs and effects has generally been absent from nutrition programs. Of the programs covered in the HIID mail survey, only 23% had analyzed nutritional status data, and only 15% had analyzed cost data (Austin, Mahin, Pyle, and Zeitlin 1978). A similar scarcity of carefully evaluated data occurs in published reports on supplementary feeding interventions. Without the information provided by such analyses, program planning is seriously hampered. Developing and implementing evaluation systems as integral parts of nutrition interventions should be a top priority of program designers.

Within the limitations provided by existing data, this chapter will attempt to present a comprehensive discussion of the costs and effects of supplementary feeding programs.

II. COSTS

A. KEY QUESTIONS

- How should costs be computed?
- How should costs be related to program recipients?
- How should costs be related to improvements in nutritional status?
- What costs have been reported for take-home, on-site, and NRC programs?

The institution of accurate project costing systems is a critical nutrition program need, without which the efficient management of scarce resources is almost impossible. For this reason, we will first discuss costing procedures and then present empirical data on reported feeding program costs.

B. Costing Procedures

The first step in computing the cost of a feeding program is to list all the items. A major item will be food followed by related transport and logistical services. Personnel requirements are the other basic items. All of these should be valued first at the costs actually paid by the project; details of these costs are needed for formal accounting records.

However, the accounting costs are not necessarily equal to the real costs of the program for evaluation. The real costs to society include not merely the expenses, but a variety of hidden, or social costs - for example, the costs of goods or services donated to the program. In the case of donated foods, the calculation is relatively straightforward, but the value of labor contributed is more complex. If the time could have been utilized in other work (e.g., in harvesting crops), that value should be considered as a program cost, although it will vary with the season and with the person contributing the labor. The inclusion of such costs represents a theoretical ideal that is seldom achieved in practice.

The same may be said of "shadow prices," sometimes calculated to determine the real value to society of resources employed. For instance, wages paid may be greater than the opportunity cost of labor when unemployment is high. In such cases, the shadow wage rate may be less than the market price paid. Similarly, imported inputs that require foreign exchange may have to be shadow priced because of the difference between real and nominal exchange rates.

Finally, the costs of resources shared by more than one program need to be kept in mind. A health clinic or a school may be used as a food distribution site; personnel handling food distribution may also provide other services. The costs of such shared resources must be allocated correctly - e.g., on the basis of time spent or space used - or program cost evaluation will be misleading. The principle of marginality may be applied when appropriate, however, i.e., a cost need not be attributed to the program if it would have been incurred in another program in any case.

Accounting and costing systems for feeding programs must not be overly elaborate. They require relatively simple operations with few inputs and repetitive functions. A qualified accountant can help set up and service the necessary ledgers, and fairly unskilled clerical personnel can maintain the records. The social costing necessitates keeping separate records for nonpurchased items and applying shadow prices (if they exist) when evaluating the project. Guidance on these procedures can be obtained from the local economists.

Reporting costs for evaluation is the final important procedural issue. Costs have no meaning when reported by themselves; they must be related to something. For example, as discussed in the previous chapter, comparisons of actual with budget expenditures are useful for control purposes. For evaluation purposes, costs need to be related to program performance. Frequently, nutrition project costs are presented as the cost per recipient. This can cloak the fact that some of the recipients are

not malnourished. If the program aims to alleviate malnutrition and give priority to currently malnourished children, then the relevant figure is the cost per target-group member reached. The difference between the cost per recipient and cost per target-group member represents the economic leakage due to coverage of nontarget recipients. If feeding programs fail to have nutritional status admission criteria or are not operating in areas of high malnutrition prevalence, then the excess coverage can be significant. The feeding programs in five countries described in the case study (Chapter Four) showed that excess coverage ranged from 39% (India) to 89% (Colombia). Nontarget-group leakage can also occur in take-home programs because the food is shared by other family members. In the take-home programs in Colombia and the Dominican Republic described in the case study, mothers fed the target-group children only about one half of the ration, while the rest was given to other children. Sharing is clearly a significant economic leakage.

Even calculating the cost per target-group recipient, however, fails to relate costs to nutritional impact completely. Supplementary feeding is intended to decrease the nutrient deficits. Thus, one should attempt to calculate the cost of closing or reducing the nutrient gap. The cost of the nutrients consumed from the ration by the target child is not sufficient because substitution is likely to occur. The supplementary ration will displace a portion of the food previously consumed so that the net dietary gain will be the ration minus the decrease in the ordinary diet. In other words, cost would be related to the net diet gain (nutrient intake post-supplement minus nutrient intake presupplement), which allows for the quantity of nutrients lost through substitution. Among the case studies, there was no reported substitution leakage for Colombian or Pakistani projects, but leakages attributed to such causes amounted to 37% of the calories provided in Costa Rica, from 45% to 76% in the Dominican Republic, and to 53% in India.

Reducing a nutrient intake gap does not provide clear proof of nutritional status improvement. Consequently, costs should also be related to actual changes in nutritional status as reflected by anthropometric measures. The section on effects describes such measurements and discusses the type of information-gathering system that is needed to assess impact and to permit cost-effectiveness calculations.

C. Available Data

As indicated above, there are few reliable reports of costs. Those available, however, do at least provide indications of the relative differences in costs of the various approaches. We will therefore first present costs on take-home and on-site programs, and then on nutrition rehabilitation centers based on information gathered from both published and unpublished data. The limited validity of cost comparisons across countries should be remembered; factor costs can vary greatly, and official versus effective exchange rates can cloud the picture even further. The reported costs are almost always accounting rather than social costs. The social costing approach described above has not been utilized in field evaluations and thus represents a desirable but as yet unrealized step.

1. On-Site and Take-Home Programs

A review of sources by Weil (1972) covered cost data on 14 actual or planned nutrition projects, of which five were take-home or on-site feeding programs. His findings are summarized in Table 4. Annual costs per recipient range from $8 to $30. The variations are explained in part by differences in the size of the rations and in the prices of the protein and calorie sources used.

Analysis of the costs of various feeding programs in India have also been published. One of the most thorough of these is the study of Project Poshak, which evaluated different versions of take-home programs accompanied by different degrees of health and educational services that were carried out over a four-year period (Gopaldas et al. 1975). The take-home approach was of special interest because of the great increase in coverage that it achieved relative to existing on-site feeding programs. Table 5 presents the costs of simply providing the take-home component at existing health facilities.

About half of the enrolled families collected their rations at least half of the time. Children of those families with over a 50% pickup rate showed statistically significant improvement in anthropometric measures when compared with the nonparticipant control group. Participants whose pickup rates were less than 50% were not significantly different from controls.

In a subsequent phase of Project Poshak, also in the state of Madhya Pradesh, the take-home approach was compared with a closely supervised on-site approach. In matched villages, the take-home program distributed food rations once a week from the health center, while under the on-site program, single feedings were offered four times daily under the direction of two supervisors stationed in the villages. The costs of the two programs are shown in Table 6.

The on-site program costs were 57% greater than those of the take-home program primarily because of higher food, facilities, and personnel salaries and transportation costs. If the extra costs of education materials and medicine are deducted and one assumes use of the same type of food, then the on-site program is only 40% more expensive. In that case, the cost of the on-site facilities and the greater personnel and transportation costs are the key differentiating factors. Participants attended the on-site program 62% of the time, while the take-home participants picked up their ration 51% of the time.

Although costs were higher, children in the on-site program showed percentage weight for age on the growth standards that was statistically significantly higher than that of children in the take-home program. Nonetheless, when analyzed according to a percentile classification, there were no significant differences. Considerable substitution occurred in the on-site program. In children under 24 months of age, the ration served exclusively as a supplement, because infants were breast-fed and one to two year olds were fed mostly semisolids, so no food in their usual diet was

TABLE 4

FEEDING PROGRAM COST ESTIMATES

Program Type	Annual Costs Per Recipient	Nutrients Supplement		Cost per Nutrients		Food[a] as % of Total Costs	Funding/Sources		
		Protein (gm)	Calories	Per kg Protein	Per 100 Calories		Government	Community/ Individual	External Donor
1. Take-Home									
a. Mixed Food Distribution (Philippines)	$12.00	22	456	$1.08	$0.07	94%	4.7%	1.3%	94.1%
b. Milk Distribution (Dominican Republic)	$10.0[illegible]	12	121	$2.12	$0.23	85%	13.0%	NA[b]	87.0%
2. On-Site									
a. Special Feeding Centers (Colombia)	$30.00	22	786	$3.54	$0.13	76%	41.5%	3.1%	55.3%
b. Existing Facilities (India)	$8.00	12	300	$2.03	$0.10	76%	100.0	NA	NA
c. Feeding and Nutrition Ed. (India)	$16.00	11	123	$4.61	$0.4[illegible]	63%	37.1%	1.9%	1.0%

[a]Including freight costs.

[b]Not available.

Source: Adapted from Weil 1972.

TABLE 5

PROJECT POSHAK ANNUAL COST PER CHILD - EXTENSIVE PHASE

	US $	% of Total
Food - ICSM	11.61	76.1
Transportation: Port to Feeding Center	.69	4.5
Storage and Transport Equipment Costs	.32	2.1
Nutrition Education Materials	.75	4.9
Other Materials	.63	4.1
Personnel	1.25	8.2
TOTAL	15.25	99.9

Source: Adapted from Gopaldas et al. 1975.

TABLE 6

PROJECT POSHAK ON-SITE VS. TAKE-HOME PROGRAM COSTS

	Annual Cost Per Child			
	On Site		Take Home	
	$	%	$	%
Food Costs	15.45[a]	35.5	11.61[b]	42.0
Transportation - Port to Feeding Point	.69	1.6	.69	2.5
Storage and Transport Equipment Costs	3.08	7.1	.39	1.4
Nutrition Education Materials	1.55	3.6	.75	2.7
Drugs and Medicines	3.17	7.3	1.95	7.0
Other Materials	.26	1.0	.63	2.3
Transportation - Personnel	4.43	10.2	.55	2.0
Salaries - Personnel	14.93	34.3	11.09	40.1
TOTAL	43.56	100.0	27.66	100.0

[a] ICSM, ghee, sugar

[b] ICSM only

Source: Adapted from Gopaldas et al. 1975.

displaced to other family members. However, with children from 24 to 36 months old, a 40% substitution occurred. This is similar to the 42% displacement factor reported in other Indian feeding programs (Godavari et al. 1970). The net caloric intake gain in the Poshak program was 122 calories in the 24- to 36-month age group; this is small relative to the estimated calorie gap of around 600 calories, and is unlikely to produce much of a biological impact. Data on the extent of sharing was not provided by the study. Thus, the impact data are not sufficient to allow a firm conclusion as to whether or not the higher costs of the on-site program as compared with the take-home approach was justified by higher effectiveness. The potential effects on other aspects of an integrated program (e.g., increased health-facility utilization) can also influence the overall desirability of an approach; these aspects of Project Poshak are discussed in Study VII, Integrated Nutrition and Primary Health Care.

In take-home and on-site programs in the state of Tamil Nadu, India, the annual per-child costs were very similar: $14.46 for on-site programs, and $14.38 for take-home programs. These are, of course, less than the costs of the integrated Project Poshak program. These nominal costs rise, however, to $16.43 when one uses an indicator of Cost per Calorie-deficient Child. Some supplement recipients were not nutritionally deficient; thus an excess coverage cost was incurred. When standard anthropometric growth measures are employed, the cost per child improved rises to $23.94. When the substitution effect is considered, the cost of providing a net intake of, say, 300 calories per day per child increases to $32.40. These costs are detailed in Chapter Four, but do reveal the importance of related costs to outcome measures.

Various other feeding programs in Tamil Nadu were studied in an early evaluation project. Their costs are presented in Table 7.

An on-site government program in the tribal areas of Andra Pradesh used a daily 300-calorie, 8-gram protein supplement to feed 144,000 children (Rao et al. 1975). The cost was reported at $8.59 per child per year,[1] 75% of which was for food and 25% of which was for transportation and administration. After two years the supplemented group had no kwashiorkor, while 1% to 3% of the control group had signs of the disease. Milder malnutrition was found in a smaller percentage of the recipient group than in the control group. Children in the supplemented group also were significantly ($p < .01$) taller and heavier. Home diets of the recipient and control groups were not very different, suggesting that little substitution occurred and that cost-effectiveness was therefore increased. The cost of this program was significantly lower than the Poshak costs, probably reflecting savings deriving from the use of low-cost village workers (1 administrator at 20 rupees per month, and 1 helper at 10 rupees per month), inexpensive food (emphasizing calories rather than protein), and economies of scale from the larger volume.

The other programs examined in the case-study chaper reveal a crude range of costs and cost-effectiveness across the four additional countries examined - Colombia, Costa Rica, Dominican Republic, and Pakistan. Table 8 presents the relevant data, but for details the reader is referred to the next chapter in the study.

TABLE 7

TAMIL NADU NUTRITION FEEDING PROGRAM COSTS - 1972[a]

Program Title	Beneficiaries	Cost per 100 Calories	Annual Cost Per Beneficiary
School Mid-Day Meal	1,600,000	$0.007	$13.62
Regular Balwady Program	120,000	0.009	13.51
Industrial Canteen Program	100,000	0.004	7.28
Special Nutrition Program	172,000	0.014	10.98
Maternal and Child Nutrition Program	118,000	0.010	13.39
Integrated Child Welfare Demonstration Program	2,100	0.018	15.45
Composite Demonstration Program	6.720	0.009	11.34
Christian Agency for Social Action Program	26,000	0.006	13.25

[a] At exchange rate of 7.50 rupees to 1 U.S. dollar.

Source: Adapted from Cantor Associates 1973.

TABLE 8

ANNUAL FEEDING PROGRAM COSTS IN FOUR COUNTRIES

	Annual Cost per Child	Per Child with Calorie Deficit	Per Child with Anthropometric Deficiency[a]	Per 300 Calories Net Daily Diet Gain[b]
Colombia (Take-Home)	$24.95	$ 29.11	$260.53	$ 89.79
Dominican Republic (Dry, Take-Home)	13.55	14.89	66.10	240.90
(Wet, Take-Home)	15.24	16.75	74.34	94.17
Pakistan (Take-Home)	23.51	28.67	45.39	298.94
Costa Rica (On-Site)	94.54	112.21	290.00	98.55

[a] I.e. costs divided by number of children who were below normal compared to standard growth indicators.

[b] I.e. costs divided by number of children who after supplementation actually increased their calorie intake by at least 300 calories.

The wide variation reflects differences in ration size and quality, nutritional status of recipients, and leakages. The increasingly high costs as one reads from left to right across the chart reinforces the economic importance of targeting interventions precisely and designing programs so as to minimize leakages (see Chapter Four).

2. Nutrition Rehabilitation Centers

As was indicated in Chapter One, the purposes of the nutrition rehabilitation centers are to recuperate severely malnourished children and, during that process, to educate the mothers on food usage and hygiene. Such education is based on the assumptions that behavior is a key contributing cause to malnutrition and that even within existing family resource constraints, better habits can lead to improved nutrient intake. The educational dimensions of NRCs are dealt with in Study II, Nutrition Education, in this series. Despite education's importance in prevention, the food component of the intervention is still its main cost element. The extent to which food costs can vary is illustrated in Table 9.

It should be noted that one item that is frequently left out of NRC costing is the value of the time that the parent has to spend at the center while the child is being treated. The opportunity cost of this time will vary, but is seldom zero. One may have to calculate the value of lost wages. Actually time cost, as well as transport costs to and from centers would also be applicable to on-site and take-home programs, but is usually greater with NRCs and hospital treatment because the parent remains with the child.

The NRC costs, as in the on-site and take-home feeding programs, differ considerably by country (see Table 10). Personnel structures, salary levels, ration size, and food costs can all vary significantly, giving rise to these differences.

Cummulative tretment costs during the child's recovery period can be sizeable. The mean duration of this period in projects in seven countries Haiti, Guatemala, Costa Rica, Brazil, Peru, Philippines and Argentina was 91 days (Beghin and Viteri 1973). At an average daily cost of $0.97, this totals $88.00 per recuperation period.[2]. Furthermore, not all children admitted are recuperated; the average recuperation rate in the seven countries was 70%, thus making the cost per recuperated child $126.

These costs appear high relative to the other types of feeding programs, but those types are generally not equipped to deal with the severely malnourished child, who requires medical attention and intensive feeding, thus the valid comparison must be made between the NRC and the appropriate alternative which is hospitalization. Comparisons of hospitals with nutrition rehabilitation centers have shown that the centers cost on the average only one tenth as much as the hospitals (Beghin and Viteri 1973). Furthermore, mortality rates are lower (Cook 1971).

TABLE 9

COST OF DAILY NRC DIET	
India[a/]	$0.13
Brazil[b/]	0.18
Peru[b/]	0.20
Philippines[b/]	0.10
Haiti[c/]	0.10
Guatemala[c/]	0.32

Sources:

[a/] Venkataswamy and Kabir 1975.

[b/] Research Corporation 1970.

[c/] Beaudry-Darisme and Latham 1973.

TABLE 10

NRC COSTS

	Cost/Day/Child	Av. Duration of Stay
Uganda[a]	$1.86	42 days
India[b]	1.20	28 days
Haiti[c]	0.39	192 days
Latin America[d] (6-country average)	0.89	120 days

Sources:

[a]Schneiderman, Bennett, and Rutishauser 1971.

[b]Cutting 1975.

[c]Pyle 1977.

[d]Beghin 1970.

One reported exception was a hospital-based nutrition rehabilitation unit (NRU) in Jammalamadugu, India (Cutting 1975). The unit is located in the C.S.I. Campbell Hospital and between 1970 and 1975 serviced an average of about 117 children per year. Of these, 39% were suffering third-degree malnutrition, 34% second-degree, and 27% first-degree. Approximately 73% of the admissions showed weight gains expected for their age during the average 25-day stay. Once the NRU was instituted, child mortality rates in the hospital dropped from 29.5% to 16.6% of admissions. The cost per day per mother and child was $0.80 (without considering opportunity costs for mothers' time). The recuperated children maintained acceptable growth rates after leaving the NRU. One factor that probably minimized relapses was the existence of a large under-fives outpatient clinic at the hospital. This unit provided transitional support for those leaving the NRU.

Cost-effectiveness evaluations of NRCs have been attempted. Beaudry-Darisme and Latham (1973) tried to relate costs to changes in nutritional status. The changes attributable to the NRC were measured by comparing the treated group with a nontreated group. The cost per child showing positive weight-for-age gain was $103 whereas the cost increased fivefold to $605 when only the children who improved more than the control group were considered. This analysis reveals how the cost-effectiveness ration can worsen as more stringent nutritional improvement criteria are used (see Table 11).

Fougere and King (1975) took a different approach to NRC cost-effectiveness evaluation by incorporating the educational effect of the program into the benefits. Their assertion is that the mother's improved feeding practices will not only maintain the nutritional status of the recuperated child, but will also prevent the younger siblings from becoming malnourished. Accordingly, this prevention benefit is accounted for by including the "protected" siblings as beneficiaries, thereby spreading program costs over more children. They estimate that of the 120 children serviced by a mothercraft center per year, 16% do not recuperate and 9% relapse after discharge, leaving 90 children permanently recovered. Their studies showed that participating mothers bore an average of three subsequent children, of whom 80% showed no signs of malnutrition. It was assumed, therefore, that the program had prevented malnutrition in 288 additional children, for a total of 378 benefited children.

The average annual cost of a mothercraft center is $2,580. This gives a cost of $28.67 per child if based on the 90 children recuperated at the NRC. The cost decreases dramatically to $6.83 per child when the benefited siblings are included in the calculation. What is questionable in this approach is whether the siblings' improved nutritional status was due to the mothers' participation in the educational program of the center, or to other external factors. Using matched control groups for comparison would help reduce some of the uncertainty.

TABLE 11

NRC COST-EFFECTIVENESS MEASURES

Nutritional Improvement Criteria	Cost Per Child Haiti	Cost Per Child Guatemala
Receive Services	$ 72	$ 214
Show Positive Weight for Age Change	103	301
Show Weight for Age Change > Control	605	2672
Decrease 3rd-Dgreee PCM > Control	3627	5344

The critical factor in such evaluations is the effectiveness of he educational component in changing behavior in nutritionally beneficial ays. Evaluations of the education component of NRCs give mixed results. ome knowledge increase has been documented, but shifts in food habits have ot been clearly and consistently demonstrated. The nutrition education olume of this series specifies the multiple factors that can affect ehavior modifications, but one serious impediment to behavior change is ncome limitations. The cost of the diet fed to the child in the NRC may xceed the ability of the family to pay, and consequently recommended food hanges are not undertaken. Between 50% and 86% of the families in NRC rojects in Peru, India, Haiti, Guatemala, and Brazil could not afford the RC diet (Amigo and Valente 1976).

A final note is applicable to all three types of feeding programs. he costs reported above may make these interventions seem prohibitively xpensive, especially when one begins to express them in terms of cost per alnourished child improved, per calorie gap closed, per positive weight or height changes, etc. This appearance may be especially evident if one ompares these costs, for example, with per capita health budget costs. uch comparisons, however, often fail to take into consideration the fact hat at the center of the cost-effectiveness methodology is the concept of argeting. The nutrition programs should be reaching only the most vulnerable groups, i.e., children under 36 months old and pregnant and lactating omen who are nutritionally deficient or clearly at risk (as indicated for xample, by low incomes or the presence of a malnourished child in the amily).

This target group represents a relatively small percent of the opulation. For example, based on income distribution and calorie elasicity data, about 48% of the populations in Africa, Asia, the Middle East, nd Latin America suffer from daily calorie deficiencies greater than 250 alories (Reutlinger and Selowsky 1976). Children under three years of age onstitute approximately 12% of the population in most developing countries, regnant women constitute another 3% (three fourths of annual births), and actating women make up 2% (one half of annual births). Thus, 17% of the opulation is biologically vulnerable, but only 48% of this group, or 8% is conomically vulnerable to malnutrition. Thus, although per capita costs re high, the relatively small total number of target group individuals eans that total costs of feeding interventions for target groups would ot necessarily be excessively burdensome for developing country budgets. inimizing costs outlays is critical because of budgetary constraints, ut maximizing effectiveness within those financial limits is even more portant.

D. SUMMARY:

COSTS

Cost data for supplementary feeding programs have seldom been collected. At a minimum, simple cost collection procedures and records should be utilized. These may be further refined by "social costing," which assesses the value to society of all program resources. These values will probably differ from the costs actually incurred by the project.

Costs should be reported so that they can be related to budget figures. Differences between actual and budgeted expenditures serve as warning signals, warranting investigation to determine causes and possible corrective actions. Costs should also be related to performance. Costs per recipient should be compared with costs per target-group recipient; the difference can be sizeable and may represent the economic leakage due to excess coverage. Another useful figure is the cost of the incremental nutrient intake achieved; this measure indicates the cost of the substitution effect. Finally, and most important, costs should be related to degree of improvement in the recipient's nutritional status.

On-site programs appear to cost about 30% more than the take-home programs because of the greater costs of facilities and personnel and the smaller number of beneficiaries served. Take-home programs can, with the same facilities and staff, cover two to four times more people but considerable sharing of the ration occurs and may double ration costs. The effectiveness of on-site programs may be seriously diminished by a substitution effect. Annual costs per recipient vary widely among countries; annual costs of $10 to $30 per malnourished child seem most common. Sharing and substitution effects can increase the cost per improved child significantly.

Reported costs for NRCs are considerably higher (around $90 per child for the average recuperation period) because of the intensive feeding and medical care required by the severely malnourished child. However, NRC costs are generally much less expensive than hospital-based recuperation units. NRC costs per recipient can be reduced dramatically if preventive benefits of nutrition education to the siblings of the recuperated child are computed. Costs per child in this instance, and also of the more recent mothercraft centers that combine take-home rations and domiciliary management, reportedly drop to about $8.

The target group of supplementary feeding programs constitutes only about 8% of most developing country populations. Intervention costs to meet the needs of this group would not be excessively burdensome for most such countries.

I. SUPPLEMENTATION EFFECTS

A basic question that intervention evaluation attempts to answer what effect the supplementation is having on the nutritional status of target groups. Effects must be related to program goals and to costs this evaluation process. We will first look at the methodology for suring effects. In the final section we present a review of the reted effects on nutritional status of various supplementary feeding grams.

Evaluation Methodology

1. KEY QUESTIONS

- Who are the users of intervention evaluations?
- How can nutritional status be measured?
- What are the main considerations in using anthropometric measurements?
- When should one evaluate?
- How and why does one assess coverage?

The results of evaluation are of utility to various groups so we l first specify the users. Nutritional status can be measured in various s, so we will discuss these options. Anthropometric methods appear most irable, and, consequently, several considerations concerning their applition are presented. We also will briefly touch upon the issues of when evaluate and how to assess program coverage.

Users

Reliable information concerning program effectiveness, both for individual participant and for the community or target population, can immensely useful at every level in the system. Thus, evaluation data relevant to policy makers, program administrators, community workers, parents (Austin 1978).

Centrally, planners and policy makers must know whether or not programs are working if they are to function responsibly. If sound decisions are to be made, for example, data which allow valid comparison of different programmatic approaches are essential. Similarly, economic constraints which are always present require careful examination of cost-effectiveness and this is not possible without both cost data and program effectiveness data.

Nutrition supplementation programs that are being carried out on the scale required to be effective in most countries will require program administrators and supervisors at central, intermediate, and peripheral levels in the system. If these people are to know whether or not the programs for which they are responsible are, in fact, producing the desired results, they must know, in objective terms, what is happening.

At the local level, the community workers who are actually carrying out the programs at the village level also need to know the results, and whether or not they are achieving the intended goals.

They need to know whether the program is working and, if not, how to work with their supervisors to improve it. They need to know if certain children are not responding in order to work with their mothers to try to improve the diets of those children. Finally, if the program is producing the desired improvements in nutritional status of the children, evidence that this is happening will provide morale-building positive feedback to these workers.

Parents of participants in the programs need to know how their children are doing. A mother's awareness of the response of her child can be a very important part of the educational effort which must accompany all efficient programs (Rohde 1977). If this is to happen, however, mothers must be taught the benefits to be expected from nutrition supplementation, how to recognize these benefits, and then it must be demonstrated to her that the supplementation is actually producing positive effects. Again, this can provide important positive feedback and can play a key role in motivating the mothers and in helping to sustain their interest in the programs.

3. Nutritional Status Measurements

In order to determine whether or not the supplementation program is having the desired results in program participants, we need to know what results to expect and how to measure them. There are, of course, a number of effects of malnutrition: there may be biochemical changes, there may be clinical or deficiency signs, the growth of a child may be impaired, and there may be an increase in morbidity and mortality rates in malnourished populations. When nutrition improves, these effects of malnutrition may be expected to decrease and eventually disappear. The question then is whether or not these changes can be measured and which of them are easiest to measure accurately. A consideration of the various possibilities suggests that there are differences both in usefulness and in ease of obtaining the measurements which make anthropometric data the measurements of choice for our purposes.

a. Biochemical changes associated with malnutrition have been studied in meticulous detail. They have usually been found to occur late in the process - i.e., when malnutrition has become quite severe - and are difficult to detect, or are absent, in mild or moderate malnutrition. In fact, it is well known that even infants and small children with advanced marasmus can have relatively normal levels of serum protein, hemoglobin, etc. Hence, aside from the technical difficulties involved in using biochemical measurements to assess nutritional status or improvement (the difficulties in obtaining samples, lack of laboratory facilities, and the costs), there is a need for nutritional status indicators which appear earlier in the process and are easier to measure reliably.

b. Clinical or deficiency signs tend to be associated with specific nutritional deficiencies and also to appear late in the process. They are usually difficult to quantify accurately and careful field tests have shown marked inter- and intraobserver variability in recognizing most signs and in quantifying them. The one commonly accepted exception to these general principles is the edema observed in children with kwashiorkor. This sign is easily recognizable, it is quantifiable in a crude way (e.g., 1+ to 4+), and it does disappear rather promptly when there is significant improvement in the nutritional status of a child.

c. Growth, as reflected in various body measurements, e.g., weight gain and increased height and length, is another indicator of the nutritional status of a child and improvement in the growth performance of a malnourished child provides easily obtainable objective evidence that the child is improving. We know, in fact, that the human organism adapts to an inadequate diet by maintaining the integrity of its various metabolic and biochemical systems at the expense of growth. By not using the limited nutrients available for growth, that is, the child is able to maintain normal biochemical levels. Thus, in a very real sense, growth failure which occurs as a part of the early adaptation to an inadequate diet, is a prompt and very sensitive indicator of malnutrition. For these and many other reasons, there is today a widespread consensus that anthropometric measurements which reflect the growth of children are the best indicators of their nutritional status and that changes in growth status provide the most reliable indication of program response.

4. Application of Anthropometry

If anthropometric measurements are to be used effectively and accurately in determining the nutritional status of infants and children in supplementary programs, it is obvious that the measurement chosen must be simple, and possible to carry out accurately in the field. That in turn requires that the equipment needed for the measurement be simple, durable, and relatively inexpensive. It also requires that it be possible to train the village-level workers to carry out the measurements accurately. Finally, if the measurements are to be used to evaluate changes in nutritional status in order to provide the kind of feedback mentioned earlier, it is clear that the measurements must be both responsive to changes in the nutritional status and also comprehensible to the people who need that information.

A variety of measurements have been recommended for purposes of evaluating nutritional status. These include: body weight, body length in children under two years height in those who are older, a variety of circumference measurements including the head, the chest, the mid-upper arm, the mid-thigh and the mid-calf, and, finally, measurements of skinfold thickness which reflect the thickness of fat tissue under the skin. Although almost all of these measurements have been shown to be useful under certain circumstances, it has been found that they are generally interrelated. Thus, it is now widely and well accepted that weight and height measurements alone are sufficient for the purposes described here.

The use of anthropometric measurements, even those as simple as weight and height, is based on comparison of the measurement observed in a given child against some standard for that measurement that is expected for a child of the given age. Implicit in this, therefore, is the need for: (1) an accurate age of the child in order to know the standard to compare the child against, (2) a set of standards for the measurements selected for children in the age group being studied, and (3) accurate measurements of the child.

These three requirements pose problems which, while not insuperable, certainly demand careful thought and consideration. Whether or not the ages of the target children can be determined with sufficient accuracy depends in part on local cultural practices, and especially on the attention or importance attached to birthdays in a particular culture, and in part, on the availability of birth certificates, health center records, or other written records of birth dates. It is necessary to have the age expressed in months and generally speaking it should be accurate to within one or two months. The younger the child the more important accuracy is, but fortunately mothers are more likely to know the age of the younger infants accurately. In children beyond the age of three or four years, accuracy within three months is probably sufficient. There are cultures in which an accurate age is simply impossible to obtain. Here, age independent measurements are required and the most satisfactory approach is to compare observed weight against expected weight for height, as described below. The ideal toward which those concerned with malnutrition in infancy should strive is the registration of every newborn child soon after its birth and the provision of a "growth chart" which will be used both as a record of the baby's birth date and also a record of the child's growth during the early months and years of life. When every vulnerable baby has such a record, there will no longer be any problem in determining the age with sufficient accuracy.

The choice of a set of standard measurements against which to compare those observed may also pose a problem. There is, understandably, a desire on the part of many workers to use a local or national standard. Unfortunately, in many countries in which malnutrition is a problem, satisfactory standards are simply not available. When, in those same countries, the measurements of children from rural villages or urban slums are compared against European or North American standards, the children seem to be quite small both in height and weight. Objections are often made

that such a comparison is "unfair." Studies carried out in almost every major country or culture in the world today have shown, however, that the children of the educated and prosperous families, who have been well fed and kept reasonably free of infections, grow quite well and indeed grow in height and weight at rates quite equal to those of European or North American children. For this reason, there is by now a reasonable consensus that it is perfectly appropriate to use a European or North American growth standard for comparison purposes, and that local standards are not essential. For many years, the "Harvard Standards" developed by Stuart and Smith several decades ago, have been the most widely accepted and used. Within the last year, however, the World Health Organization Expert Committee on Nutritional Surveillance has recommended that the new height and weight standards developed by the National Center for Health Statistics be used instead. What is important, here, of course, is that a standard be chosen, however arbitrarily, and then used carefully and consistently. What is needed, finally, is simply a reasonably reliable basis for estimating the child's growth performance over time in the program. International standards certainly serve this purpose as well as national standards and, no less important, they make it possible to compare the results of a program with those of similar programs elsewhere in the world.

The necessary equipment and personnel trained in the correct use of that equipment are obviously essential to the acquisition of reliable anthropometric data. The perfect equipment for weighing children under field conditions has yet to be invented. Nevertheless, there is extensive experience with a variety of scales and several are reasonably satisfactory. For satisfactory evaluation, scales need to be reasonably accurate under field conditions, and this means accurate to within half a kilo at least, and ideally to within 100 grams. Scales to be used in field surveys must be portable, and capable of withstanding a variety of physical abuses in the field. Several scales have proven to stand up reasonably well under such conditions and are described in Chapter Two of this study under Section VIII.D., "Site Facilities - Other Equipment."

Accurate measurements of length or height of children in community surveys or programs are, perhaps surprisingly, much less commonly obtained than are sufficiently accurate weights. This is so because there is a tendency to be satisfied with rather casual measurements made with a tape measure. If a child is struggling, such measurements can be off literally by several centimeters when accuracy to within a half centimeter is needed if the data are to be used reliably. Accurate measurement requires that infants and younger children be held securely and that they be measured with a sturdy, accurate "infantometer" as described in Chapter Two of this study.

Well-trained personnel are fully as important as good equipment. Here there is no substitute for on-the-job training with the personnel weighing and measuring children repeatedly under the supervision of skilled personnel. Extensive field experience has shown that any reasonably conscientious and intelligent person can easily acquire the needed skills.

Although there is now essentially unanimous agreement that height and weight measurements are the best to use in assessing the nutritional status of children, there is not an equally strong consensus about how best to use these measurements.

In the mid-1950s, Dr. Federico Gomez and his colleagues at the Hospital Infantil in Mexico City developed a system of nutritional classification based on a comparison of the observed weight of a child expressed as a percentage of the weight expected for the child's age. Three "degrees" of malnutrition were proposed: initially, children whose weight fell between 75% and 85% of the expected levels were classified as having first-degree malnutrition, children whose weights fell between 60% and 75% of the expected levels were considered to have second-degree malnutrition, and, finally, those whose weights were below 60% of the expected levels were classified as having third-degree malnutrition. Subsequently, the "cut-off point" was changed from 85% of expected level to 90% of expected level. This system of classification rather quickly became known as the "Gomez Classification System" and began to be widely used. It remains the most widely used system to this date, although it is still somewhat controversial.

One of the chief reasons for dissatisfaction with the "Gomez System" derives from the fact that as a child moves from infancy through the preschool years, malnutrition (accompanied by recurrent infections) may produce a balanced retardation in both height and weight. The result of this is that a child who is below the expected weight standards for his or her age is also likely to be below the height standards resulting in weight that may be quite normal for the height. Thus, the child who is classified as malnourished on the basis of the expected weight for age may appear to be normal because the weight is appropriate for the attained height and indeed the child may be functionally quite normal. Such children are assumed <u>not</u> to be acutely or currently malnourished and considered to be "nutritional dwarfs." Because they seem functionally normal, there is doubt both about their need for supplementation and also about their ability to recover from the retardation in height.

Because of the dissatisfaction with nutrition classification based on weight for age estimations, investigators have continued to seek other methods and to justify their use. There are those, for example, who argue that height for age is possibly the best single indicator. One of the arguments in favor of this is due to the fact that a child's height cannot regress, thus the height makes perhaps a better longitudinal indicator of growth status. Among the difficulties which must be overcome in using height as a key indicator is the fact that, as noted earlier, reasonably accurate measurements are more difficult to obtain. A health worker and the mother, for example, can usually weigh a child quite easily. Accurate measurement of the length or height of an angry, screaming child, which is often the case in the field, may require two people to hold the child, one at the head and one at the feet, and one to measure the child. Oftentimes three people simply are not available for such purposes. However, the mother can help the health worker to hold the child steady. Another reason

for concern about height measurements is the fact that the coefficient of variation in measurements of length or height is relatively much smaller than the coefficient of variation in weight. This means that precision in the measurement is much more important, or, put another way, that a relatively small error in the measurement of length or height is likely to be much more significant or lead to greater misinterpretation than would a similar degree of error in weight.

A great deal of attention has been devoted in recent years to the use of weight for height as a standard for assessing nutritional status. Here, the approach is to compare the observed weight of the child with the weight to be expected for a child of a given height. In the first place, this approach offers the advantage of being age independent; the assumption is that the "normal" weight for a particular height is constant, regardless of the age of the child. Second, for reasons implied earlier, it is claimed that weight for height provides a more accurate assessment of current nutritional status than weight for age. Seoane and Latham (1971) have worked with this approach and have described a number of important points. They suggest that a child with low weight for age might, in fact, be suffering from current, acute malnutrition of short duration, from past chronic malnutrition, or from current and longstanding malnutrition. If height for age, and weight for height, are taken into consideration, these different kinds of malnutrition can be identified. For example, the child with current, acute malnutrition of short duration will be normal in height, but low in weight for height or weight for age. The acute malnutrition has produced a weight deficit, but there is no retardation in height.

In the case of a child with past, chronic malnutrition, one could expect both low height and low weight for age, but normal weight for height because of the "nutritional dwarfism." In the case of the child with longstanding malnutrition who is also currently severely malnourished, one would expect low height and weight for age, but also low weight for height.

It has been argued that is is important to make such distinctions in classifying the nutritional status of children for supplementary feeding programs. A crucial assumption here is that if the child is retarded both in height and weight but the weight is normal for the height, then the child is currently reasonably well nourished and does not need the benefits of nutritional supplementation. That assumption is based on a prior assumption that the retardation in linear growth associated with chronic malnutrition is fixed and that providing nutritional supplements to such children will not result in catch-up growth. The validity of this argument has remained in question for many years simply for lack of adequate data. There is, however, some evidence which speaks to this issue. For example, in the Candelaria study mentioned earlier, the basic nutritional classification of the children was based on weight for age. Their response to supplementation was analyzed, however, by comparing both weight and height, expressed as a percentage of the expected standard for age, at the start of supplementation and after a year. It was found, as may be seen in Table 12, that the participant children over two years of age did exhibit catch-up growth, both in weight and height. As the table shows, the average child gained

TABLE 12

GROWTH RESPONSE OF CHILDREN WITH FIRST AND SECOND DEGREE MALNUTRITION, EXPRESSED AS CHANGE IN PERCENT OF EXPECTED WEIGHT AND HEIGHT AFTER 12 MONTHS IN SUPPLEMENTATION PROGRAM, BY AGE AND NUTRITIONAL CLASSIFICATION AT START, CANDELARIA, COLOMBIA, 1964-65

Age Group (months)	Average Change in Percent of Standard in One Year			
	Weight		Height	
	I°	II°	I°	II°
0-5	+ 9.0		-2.5	
6-11	+ 0.2	+10.3	-4.3	-4.7
12-17	+ 6.0	+ 7.4	-0.1	-1.4
18-23	+ 6.0	+11.8	+1.8	+1.2
24-29	+ 9.4	+ 9.4	+3.2	+1.9
30-35	+ 9.7	+ 8.8	+2.0	+3.1
36-41	+11.1	+ 8.9	+2.8	+2.8
42-47	+ 7.5	+ 5.0	+2.2	+1.7
48-59	+ 7.9	+12.8	+3.2	+2.4
60-72	+11.5	+11.0	+3.0	+2.7
Average Increase	+ 9.0	+ 9.7	+2.6	+2.2

over 9% in weight and approximately 2.5% in height. This discrepancy suggests that weight gains were greater than height gains, but if we recall that the coefficient of variation for weight is substantially greater than the coefficient of variation for height, then it would appear that a gain of 2.5% in height is not too different from a gain of 9% in weight. Whether or not the height gain is equivalent to the weight gain, the data do suggest, at least, that children can exhibit "catch-up" growth.

More recently Martorell and his colleagues at INCAP have presented their findings concerning the response of anthropometric measurements to improved nutrition in a study population of Guatemalan children (Martorell et al. 1978). In their careful analysis of the longitudinal observations of children who received nutritional supplementation, they found first of all that energy seemed to be more limiting than protein in this particular population, and that at three years of age there was a positive correlation between the amount of supplement received and the height and weight of the children in the program. They reported that "the supplements seemed to have improved all variables indicative of linear growth." Such was not the case for measurements such as muscle circumference or weight for height ratios in which "there was little change...." They conclude that "these results therefore suggest that in evaluating public health programs, one should rely primarily on measures of linear growth, such as height.... Weight, because it is highly related to height, is also in the same class." They agree, of course, that weight for height is an especially good measure for identifying children with acute severe malnutrition, but do not recommend it as a means of evaluating change in nutritional status in supplementary nutritional programs.

In summary, then, it would appear that under ideal conditions it would be best to measure the nutritional status and growth response of children by using both weight and height for age. In the opinion of many investigators, nutritional status should be classified on the basis of weight for height. Whether there is sufficient evidence to justify such an opinion is open to question. There is, however, evidence which suggests that in children under 24 or perhaps 30 months of age, classification based on weight for age is just as good as weight for height. What is relevant here is that regardless of the arguments in favor of using weight for height adduced by research scholars, the fact remains that weight for age systems are used in a substantial majority of programs. Furthermore, available evidence suggests that these systems are satisfactory - especially in the younger children who should be of most serious concern. The use of growth charts maintained by the mothers demonstrates the practicality of this approach (Zeitlin and Austin 1978; Rohde 1977). A growth chart based on measurement of both weight for age and height for age has been developed by the World Health Organization (1978). Growth charts using weight for height and height for age have been designed by the ICBF (1976) in Colombia and by Viteri (1976) at INCAP.

Evaluation methods based on weight for age are superior to no evaluation at all and therefore their use should not be discouraged. Such methods are effective in programs where it is not feasible to accurately measure height.

If anthropometric measurements are used as indicators of nutritional status, we still must examine how they can be used to measure changes, hopefully positive, in nutritional status. A variety of approaches have been used. In the first place, simple changes in the crude measurements can be used: weight gain in kilograms or height gain in centimeters. Second, changes in nutritional classification can be used. If a child was classified as Gomez Grade 2 at the start of a program and improves to Gomez Grade 1, this is surely a positive result. If he stays in the same classification or deteriorates to a lower one, he is obviously not doing as well. Finally, changes in height or weight can be measured as the change in the observed value as a percentage of the expected levels. All three of these approaches have been used in various studies as described below, but there are problems in the careful and consistent use of almost any method. The problem in using the actual weight gain, for example, derives from the fact that the exact rate of growth varies with the age of the child during the preschool period. A child under one year of age, for example, would normally be expected to gain much more weight during each time interval than the child between the ages of three and four. Thus, the significance of a given weight gain depends on the age of the child. A gain of one kilogram, for example, between the 6th and the 12th months would be grossly unsatisfactory, while a similar gain between the 36th and 42nd months would be quite acceptable.

If absolute gains in weight are not fully satisfactory, is the Gomez Classification approach any more satisfactory? For consistency and ease of interpretation in different age groups, the Gomez system does indeed offer advantages over absolute weight gain. It is not so satisfactory, however, because the results for a given child show up as "good" only if the child has improved in his nutritional classification. Thus, a child whose nutritional situation improves very substantially within the same classification will not appear to have positive results. For example, if weight for age were 61% at the start of the program and 74% at the time of the program evaluation, the child would surely have improved substantially, but would still be classified as having second-degree malnutrition. For this reason, evluation based on a comparison of the anthropometric measure as a percent of expected gain at the start of the program and at the time of evaluation makes a great deal of sense. When that approach is used, the growth status of children relative to the expected levels for their age will be expressed as a percentage and be examined to determine the results of the program. An example of the results obtained with such an analysis was shown in Table 12.

Other measures have been used for evaluation purposes. For example, it is possible to express the actual gain in height or weight as a percentage of the expected gain in height or weight during a given time period. This method can be useful, but it depends on very conscientious and careful measurements and arithmetic. Table 13 shows the Candelaria results expressed in this way. Since all these children were below 3rd percentile levels initially, it seemed reasonable to compare their growth with 25th percentile levels, and to express it as a percentage. The figures confirm the poor response of the youngest age groups but show clear evidence of "catch-up" growth in all age groups over 18 months.

TABLE 13

GROWTH RESPONSE OF CHILDREN WITH FIRST DEGREE MALNUTRITION, COMPARING AVERAGE GAINS IN WEIGHT AND HEIGHT BY AGE GROUP WITH EXPECTED GAINS DURING 12 MONTHS FOR CHILDREN GROWING AT 25TH PERCENTILE LEVEL, AND ACTUAL GAIN AS PERCENTAGE OF EXPECTED GAIN

	Weight			Height		
	Gain in kgs.			Gain in cms.		
Age Group (months)	Actual	Expected	Actual as % expected	Actual	Expected	Actual as % expected
0-5	4.65	4.70	98.9	16.2	17.8	91.0
6-11	2.78	3.10	89.7	9.9	13.3	74.4
12-17	2.70	2.54	106.3	9.9	11.0	90.0
18-23	2.52	2.15	117.2	10.0	8.9	112.4
24-29	2.75	1.70	161.8	10.1	7.6	132.9
30-35	2.71	1.51	179.5	9.0	7.2	125.0
36-41	2.85	1.49	191.3	9.0	6.7	134.3
42-47	2.35	1.34	175.3	8.0	6.3	127.0
48-59	2.47	1.25	197.6	9.0	6.4	140.6
60-72	3.01	1.13	266.4	7.8	6.4	121.9

5. Timing of Evaluation

The evaluation of program results must be an ongoing process, but the frequency with which results are examined depends on the level in the program and the particular needs. For example, the response of the individual child should be monitored frequently, preferably at monthly intervals, and remedial measures applied promptly whenever the response is unsatisfactory. At the local program level, the Candelaria results showed that measurable differences can occur within three months (Figure 2). Thus, where there is real concern about program effectiveness, it would be appropriate to tabulate results every three to six months to see whether the participants are growing as well as they should be. If this exercise is to be effective, it must be carried out by the local workers and their supervisors. As mentioned earlier, the use of growth charts maintained by the mothers is particularly effective.

The simplest method of tabulating growth chart results for groups of children over time is by using master charts (Capone 1977). Figure 3 presents a master chart for recording weight for age. The same person who weighs the children and records the weights on each individual weight chart simultaneously enters each weight on the master chart. At the end of the session the total number falling into each nutritional category can be counted and compared with the number falling into this category in the preceding month, or at the weighing session three months previously. Capone (1977) provides master charts for measuring length for age and weight for length in addition to weight for age.

Teaching Aids at Low Cost (TALC) at the Institute of Child Health of the University of London provide clear plastic overlays that can be placed over the standard Morley growth chart (Morley 1973). In this manner ordinary weight charts can be used for recording weights of all boys and all girls in the group separately (one for the boys' and one for the girls' group chart). The overlays show how many children fall into each nutritional category, using standard deviations rather than percentages. It is also desirable to note how many children improved in weight versus the numbers staying the same or losing. However, this calculation may strain the time, skills, and resources of the workers, whereas the master chart system requires very little extra time for training and use.

Where results are good, the evidence provides satisfaction and encouragement to staff involved, and the communities and individuals. Where program results are not satisfactory, the supervisors should work with the local workers and community leaders to determine the reasons for unsatisfactory results and to take corrective measures. Finally, at the central level, results should be reviewed on an annual basis. Clearly, for example, a reasonable interval is required for estimating cost-effectiveness and a year is sufficient. This is worth stressing because all too often pilot or demonstration programs are mounted and results are not evaluated until after the project is over. This may be acceptable for research projects, but it is not adequate for operating programs.

NUTRITIONAL STATUS OF CHILDREN ENROLLED IN SUPPLEMENTATION PROGRAM, AFTER 3,6,9, AND 12 MONTHS, BY STATUS AT START OF PROGRAM, CANDELARIA, COLOMBIA, 1964-65

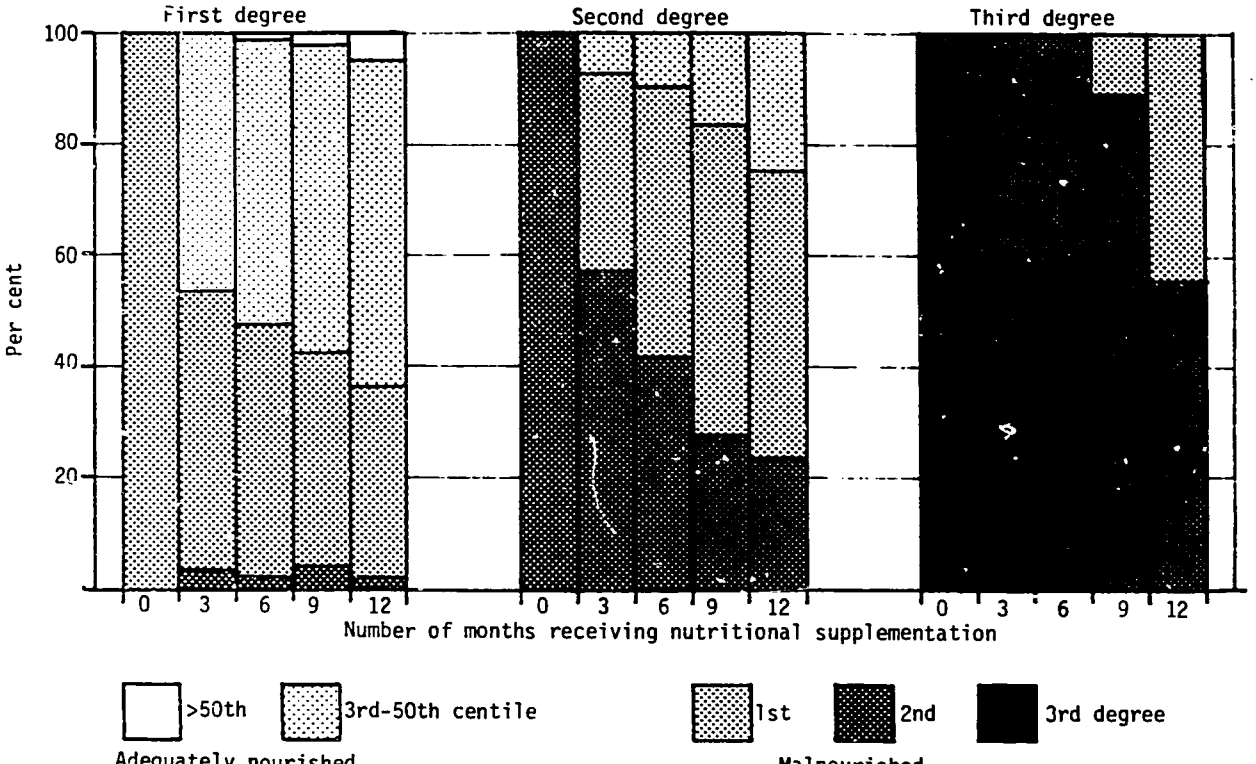
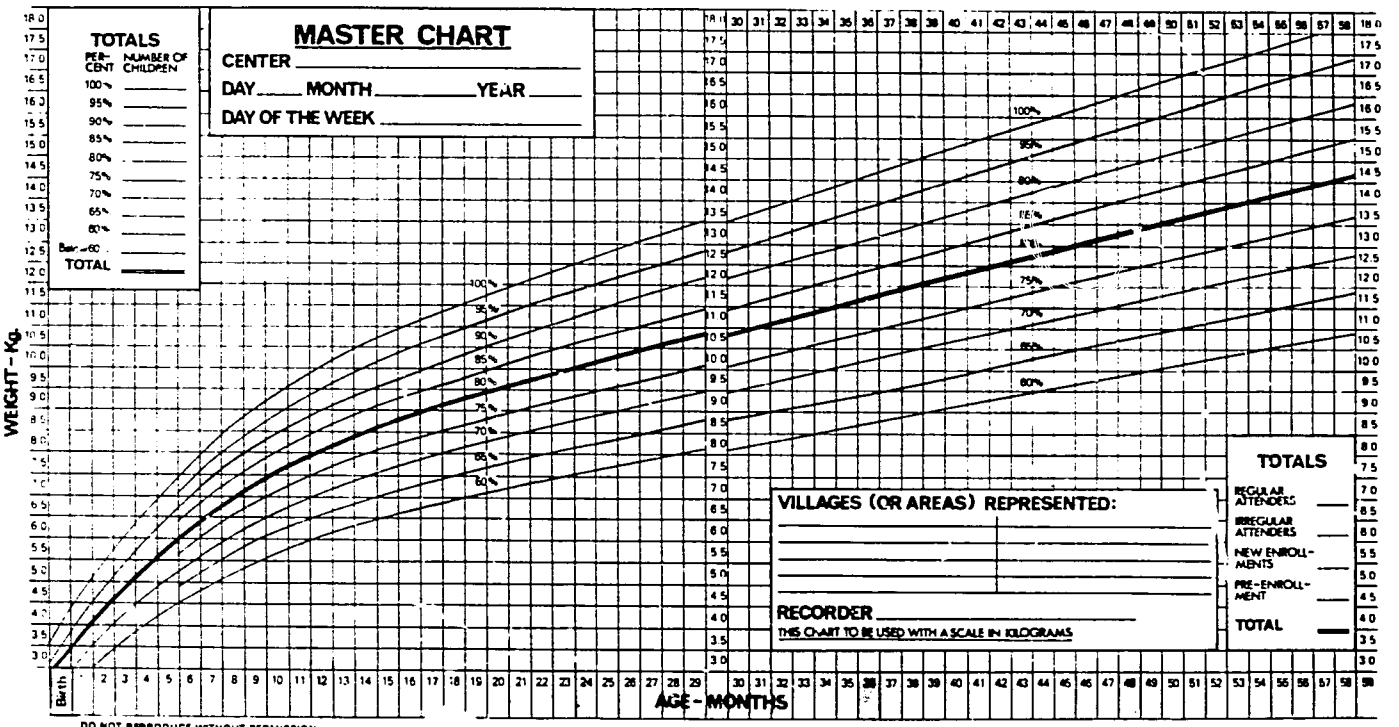


FIGURE 3


MASTER CHART
CENTER
DAY MONTH YEAR
DAY OF THE WEEK
TOTALS
PER-CENT
NUMBER OF CHILDREN
100%
95%
90%
85%
80%
75%
70%
65%
60%
Below 60
TOTAL
WEIGHT - Kg.
AGE - MONTHS
Birth
VILLAGES (OR AREAS) REPRESENTED:
RECORDER
THIS CHART TO BE USED WITH A SCALE IN KILOGRAMS
TOTALS
REGULAR ATTENDERS
IRREGULAR ATTENDERS
NEW ENROLLMENTS
PRE-ENROLLMENT
TOTAL
DO NOT REPRODUCE WITHOUT PERMISSION
PUBLISHED BY DR C. CAPONE BOX 48932 NAIROBI

6. Coverage

Satisfactory evaluation of nutrition supplementation programs requires an assessment of the effectiveness of the program in covering the target population. Unfortunately, such evaluation is rarely even attempted, much less successfully carried out. What this means, of course, is that the evaluation of supplementation programs that is usually carried out is typically very inadequate. If satisfactory evaluation of coverage is so unusual, does it really matter? An answer to such a question depends on program objectives. If 75% of the children in a particular community program are responding well, the results would seem to be satisfactory. But if, in fact, the program was reaching only 25% of the malnourished children in the community, how effective is it? Surely the responsible administrator or planner would have to consider such a result unsatisfactory.

If assessing coverage is so important, why has it been neglected? The answer is quite simple. If we are to be able to determine whether or not a given supplementation program is in fact reaching the target population, then it is essential that the total population at risk be screened and the target population be identified in a baseline study. If that is done, then at some later date it is possible to rescreen the population and determine whether or not the target population has been reached by the program and whether or not individuals in that population have improved. It is the need for the total population baseline survey that seems to be the most serious stumbling block to the adequate evaluation of coverages of such programs.

Programs now under way both in the Philippines and in Indonesia have shown clearly, however, that total population screening is not only possible but useful as a device for arousing community interest in the problem of malnutrition and educating the public. Both in the Philippines and in Indonesia the programs place responsibility for screening at the community level and provide training to teach local people how to weigh children and interpret the results. Both of these approaches are new (Solon and Florentino 1976, and Rohde 1977) and long-term results are not available, but there is no doubt that they demonstrate that adequate assessment of coverage <u>is</u> possible.

Program evaluation may reveal little improvement in the target group's nutritional status. As suggested above, this may be because they were not reached by the program. However, it may also be because of leakages. To answer the question of why no impact, one will have to utilize dietary surveys to determine to what extent the supplement is providing incremental nutrient intake. It may be that substitution or diversion is sizeable and can be reduced by program changes.

7. SUMMARY:

EVALUATION METHODOLOGY

Evaluation results are useful to many groups: policy makers, program administrators, community workers, and parents. The type of evaluation data needs will vary among these groups, and, therefore, evaluation information should be tailored to these distinct needs. Nutritional status can be assessed directly through biochemical tests, clinical diagnosis, or physical growth measurements (anthropometry).

Anthropometric methods appear most desirable from the points of view of cost, reliability, and ease of application. Height and weight measurements are generally sufficient, although arm and thigh circumferences can often be more easily used with reasonable accuracy. Anthropometric measurements are related to growth standards. The Gomez classification is the most widely used and is based on a comparison of the observed child's weight as a percentage of the weight expected for the age. The weakness of this approach is that a child might be stunted due to malnutrition but his weight might be in balance with the shorter height, although below his age standard. The stunted child may be, but is not necessarily, in current need of nutritional supplementation. Height for age is proposed by some as preferable, but height measurements are more difficult than weight, and age accuracy is often doubtful. Weight for height measurements are seen by others as more desirable; these use the "Harvard Standards" or those developed by the National Center for Health Statistics. Where feasible, height, weight, and age should be ascertained and related to their respective standards. Nonetheless, for children under 24 months weight for age seems to be an acceptable and practical approach. Where weighing is not feasible, circumference measurements can be used for screening, but may not be sufficiently sensitive to capture improvements. Given a particular method, one must still select the precise way in which changes in nutritional status will be measured (e.g., shifts in malnutrition class, changes relative to expected growth, absolute gains relative to control group, etc.).

When evaluations should be carried out will vary depending on the needs of the various groups. Thorough baseline surveys of the population are needed initially to diagnose the problem and provide the basic reference point for subsequent evaluations of program coverage. Once ongoing, however, the progress of the supplemented groups should be monitored, perhaps monthly via growth charts. More thorough program evaluations needed by central planners can take place less frequently, perhaps annually.

B. Program Effects

1. KEY QUESTIONS

- What levels of weight gain and growth rates have supplementary feeding generated?
- What changes in the percent of standard weight have been achieved?
- What shifts in the nutrition classification of participants have been produced?
- How permanent are the nutritional improvements from supplementation?
- What reduction has occurred in deficiency signs?
- What have been the effects of prenatal supplementation?
- To what extent has supplementation affected morbidity and mortality?
- What have been the effects of nutrition education that accompanies supplementation?
- What do comparative program studies reveal?
- What are the effects of integrating supplementation with other health interventions?

As mentioned at the outset of this chapter, relatively few supplementary feeding programs have been systematically evaluated. Even where evaluations have been undertaken, the reliability of the data has been questionable due to design or analysis weaknesses (Habicht and Butz 1977). Accordingly, the reader should be aware that we were not able to review the original data sources and collection procedures for the program evaluation data that we have gleaned from published and unpublished program documents. The results that we present cover the following: weight gain and growth rates; changes in percent of standard weight; changes in nutrition classification; permanency of effects; reduction of deficiency signs; effects during pregnancy; effects on morbidity and mortality; effects of educational components; comprative program performance; and feeding with other services. The varying results of different feeding programs may be caused by data deficiencies, differences in target group characteristics, and intervention design variations.

2. Weight Gain and Growth Rates

The findings in various programs in which anthropometric criteria were used for evaluation are summarized in Table 14.

At the outset, it should be stated that normal weight gain for preschool children over a year old is approximately two kilograms per year based on the Harvard Standards (Jelliffe 1966). In nutrition rehabilitation centers, the growth rate of children is usually greatly accelerated and may be three to four times the normal rate during the four months they are likely to be enrolled. Weight gains may be as much as 94 grams per week and often total from one to two kilograms during the child's four month stay. Spady, Payne, Picou, and Waterlow (1976) rated weight gains up to 30 grams per kilogram per day, which is 20 to 30 times normal growth. They also estimated that 4.4 kilo-calories are required per one gram of weight gain. This weight increase is often enough to move children up a degree in the Gomez classification of nutritional status. These large weight increases are understandable in view of the fact that the child receives his or her total daily nutrient requirements at the center six days a week. This diet may be far superior to that which the child was receiving at home prior to admission.

Few results are available for weight gains in on-site feeding. Weight gains were only 0.4 to 0.7 kilograms above those seen in control groups in programs running from one to three years and providing 25%-66% of the child's caloric requirements. These minimal results may be due to the serious problem of substitution of the on-site meal for the foods normally given to the child at home which results in little of the ration being used as a caloric supplement.

In a highly supervised take-home feeding program, weight gains have been reported which are close to those achieved in nutrition rehabilitation centers, i.e., one kilogram in four months (Beghin, Baez, Lucena et al. 1972). This program in Brazil provided a take-home ration for four months to siblings of preschoolers enrolled in NRCs. The ration contained 290 calories and 14 grams protein. Mothers received education at the NRC. Vigilant supervision of attendance and proper use of the ration was achieved through home visits of center personnel. This type of program was conducted on a small-scale, experimental basis and might not be feasible with nationwide coverage. Comparable results were obtained in Candelaria, Colombia, in a program which provided a supplement of one pound of DSM/week; after an initial, intense six-week educational program for the mothers, participants were monitored for a full year (Wray 1967, 1978b). In both the Brazil and Colombia programs, the distribution points were rural health clinics, so the recipients were also receiving some basic health care in addition to the food and education.

More typical of take-home feeding programs are weight gains which are sufficient to maintain children at the normal rate of growth, e.g., 2.6 kilograms per year as was found in the Philippines (Asia Research Organization 1976). Weights may be 0.2 to 1.5 kilograms greater than those of the control group depending on size of the ration and net caloric increment

TABLE 14

AVERAGE WEIGHT GAIN AND RATE OF GROWTH OF PRESCHOOL CHILDREN IN VARIOUS TYPES OF FEEDING PROGRAMS

Type of Feeding	Country	Authors	Age of Beneficiaries (mos.)	% of Daily Calorie Requirement in Ration*	Duration of Participation (mos.)	Mean Weight Gain (kgs.)	Mean Program Weight Gain Greater than Control (kgs.)	Mean Growth Rate Compared to Standard (%)
Nutrition Rehabilitation	Philippines	Asia Research Organization 1976	6-60		3	1.0		38% (76% of the children gained at least 150% of Standard)
	Latin America	Beghin and Viteri 1973	12-84	100	3-4	1.0-1.8		
	Brazil	Federal University of Pernambuco 1972	12-60	100	4-6	1.7 (94 gms. per week)		
	Haiti	Weil 1972	12-48	100	4	1.9**	0.9	(80% of the children gained in excess of the Standard)
On-Site	Thailand	Weil 1972		25	12	0.6	0.6	
	India	Taylor and co-workers 1978		66	24		0.4	
					36		0.7	

TABLE 14 (continued)

Type of Feeding	Country	Authors	Age of Beneficiaries (mos.)	% of Daily Calorie Requirement in Ration*	Duration of Participation (mos.)	Mean Weight Gain (kgs.)	Mean Program Weight Gain Greater than Control (kgs.)	Mean Growth Rate Compared to Standard (%)
Take-Home	Philippines	Asia Research Organization 1976	6-60 6-11 12-23 24-60	25	13-18	2.6 3.0 2.7 2.5		93 (12% of children gained at least 150% of the Standard)
	India	Khare and co-workers 1976b	0-60	25	15			106
	India	Gopaldas and co-workers 1975	12-36	25	12	1.5		
	Brazil	Beghin and co-workers 1972	< 12 12-48	20	4	1.2 0.9		
	Colombia	World Food Programme 1974	< 24 24-60	50	6	0.2 0.3		
	Colombia	Mora, Pardo, and Grueso 1974 ICBF 1976	6th month pregnancy-36	66	12	0.7		

* FAO requirement for 12-47 month old children is 1,360 calories.

** Weight gain was measured one year after graduation from the NRC.

resulting from the ration. Take-home feeding programs are often capable of maintaining children at a normal rate of growth and not capable of greatly accelerating the growth rate to achieve the rapid recovery which is possible in NRCs. However, in the Candelaria program cited above, the results in the take-home program were equal to or better than those in the NRC (Wray 1967). Thus, failure to achieve significant impact may well be due to the inadequate rations distributed and faulty design of many existing feeding programs, especially to the educational component.

It was found in the Philippines, both in take-home feeding and in nutrition recuperation, that the growth rate was greater among preschoolers over two years old than among the younger children, particularly those under one year old (Asia Research Organization 1976). This was also true in the Candelaria program (see Figure 4) and shows clearly the difficulty in having an impact on the younger infants during the weaning period when they are most vulnerable. Both in the Philippines and in Candelaria, the rate of growth and weight gain were also accelerated in children suffering from second- and third-degree malnutrition compared to those who were classified as first degree or normal. This is especially noteworthy if we recall that in the 1950s the prognosis in second- and third-degree malnutrition was so bad, that it was assumed that such children could only be treated in hospitals (Gomez et al. 1956). In the Candelaria program, weight for age of children under 24 months improved 5.5%, while for children over 24 months the increase was over 9%.

[illegible]. Changes in Percent of Standard Weight

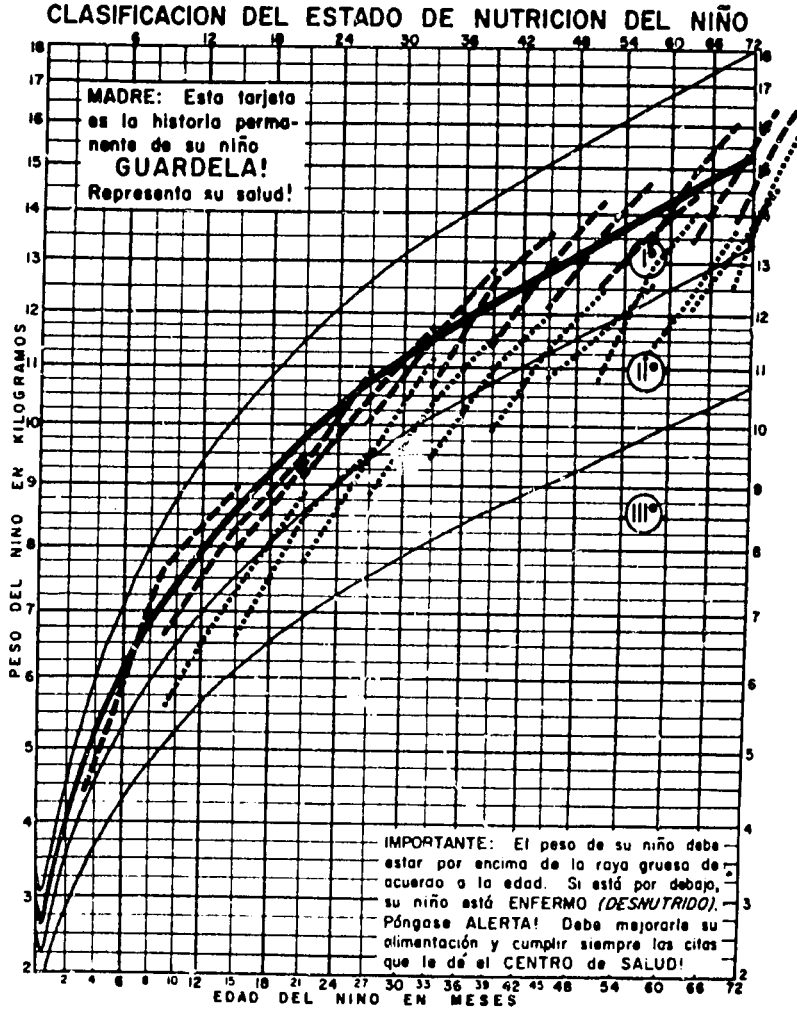
Program results can also be measured by change in percent of standard weight for age or weight for height of the individual child. Table 15 lists the results of various feeding programs that have evaluated changes in percent of standard weight for age as a result of supplementary feeding. Again, results are most dramatic in nutrition rehabilitation centers in which children's weight improves 3%-8% relative to the standard during their four months' enrollment. In take-home feeding after a year or more of participation, children's weights improve 1%-6% of the standard with rations equivalent to one-fourth to one-third of calorie requirements. In on-site feeding after one to three years of receiving rations supplying net of leakages, 25%-66% of calorie requirements, children's weights improved only by 3%-4% of the standard. An evaluation of feeding programs in the Philippines, Kenya, and Colombia was the only study which based results on weight for height. It was found that weight for height improved by 2%-5% of the standard for each year in the feeding program (Ellis et al. 1975).

[illegible]. Changes in Nutrition Classification

The change in number of children in each degree of the Gomez classification of weight for age has also been used to assess the impact of feeding programs (Table 16). These results based on the changes in frequency of malnutrition are often more favorable than results based on averages such as those reported in the previous section including average

FIGURE 4

NUTRITION CLASSIFICATION GRAPH, CANDELARIA, COLOMBIA



AVERAGE INCREASE IN PERCENTAGE POINTS OF STANDARD WEIGHT FOR AGE OF PRESCHOOL CHILDREN IN VARIOUS TYPES OF FEEDING PROGRAMS

Type of Feeding	Country	Authors	Age of Beneficiaries (mos.)	% of Daily Calorie Requirement in Ration*	Duration of Participation (mos.)	Average Increase in Percentage Points of Standard Weight for Age
Nutrition Rehabilitation	Brazil	Federal University of Pernambuco 1972	12-23 24-35 36-47 48-59	100	4-6	3-8 4-7 5-6 3-7
	Latin America	Beghin and Viteri 1973	12-84	100	3-4	3-5
	Philippines	Asia Research Organization 1976	6-11 12-23 24-60	66	3	7 8 4
Take-Home	Lesotho	McKay, Capone and Jacob 1974	0-60	33	> 12	3
	Philippines	Asia Research Organization 1976	6-11 12-23 24-60	25	13-18	4 6 1
On-Site	India	Narangwal Rural Health Research Center 1974	0-36	66	24 36	3 4.5
	India	Gopaldas et al. 1975	6-36	25	12	4.4

* FAO requirement for 12-47 month old children is 1,360 calories.

TABLE 16

CHANGE IN GOMEZ CLASSIFICATION OF WEIGHT FOR AGE OF PRESCHOOL CHILDREN IN VARIOUS TYPES OF FEEDING PROGRAMS

Type of Feeding	Country	Authors	Age of Beneficiaries (mos.)	% of Daily Calorie Requirement in Ration*	Duration of Participation (mos.)	% Increase in		% Reduction in		
						Normal	1st Degree	2nd Degree	2nd/3rd	3rd
Nutrition Rehabilitation	India	Venkataswamy and Kabir 1975	12-60	66	3	250	250	15		52
	Brazil	Federal University of Pernambuco 1976	12-59	100	4-6	300				50
	Haiti	Fougere 1972	12-48	100	4	8**				50**
	Philippines	National Nutrition Program 1975	6-60	66	3				67**	50**
On-Site	Brazil	Gandra 1977	24-84	33	12			75		
Take-Home	India	Khare and coworkers 1976b	0-60	25	15					33
	Philippines	Asia Research Organization 1976	6-60	25	13-18			11		43

Jamaica	Alderman and co-workers 1977	0-60		12		40
Colombia	World Food Programme 1974	< 24	50	6	221	
		24-60			176	
		0-60			48-189	39
		0-60		12		57

* FAO/WHO requirement for 12-47-month-old children is 1,360 calories.

** In Haiti, the changes in Gomez classification were measured after the program had been in the community for seven years. In the Philippines, changes were measured after five years. Furthermore, in the Philippines second degree malnutrition was reduced by 61% and third degree by 63% in the control group, which means the program may have had an educational effect on the control community or that the improvement in program children is not due to the NRC program.

weight gain and average growth rate. Statistical means of such measurements can mask the improvement of individual children because of inclusion of extremely high or low values in the calculations. Frequencies or number of children with improved nutritional status do not present this same source of error and are therefore recommended as a more accurate statistical measure of nutritional impact of feeding programs when sample sizes are sufficient.

Nutrition rehabilitation programs consistently reduced the rate of third-degree malnutrition among participants by half, and in two instances, resulted in a three- to fourfold increase in the number of children classified as normal or mildly malnourished (see Table 16).

Findings based on the Gomez classification are available for only one on-site feeding program which reduced second-degree malnutrition by 75% among participants during a twelve-month period with rations supplying one third of calorie requirements. In another on-site feeding study using a slightly different nutrition status classification, it was found that the number of children with weights less than 80% of standard weight for age was reduced by 30% when children received a ration supplying two thirds of their calorie needs for one year (Rao et al. 1975). Larger rations may well be the key to success in feeding programs as has already been stressed in Chapter Two of this study in the section on food quality. A study using weight for height measures found a 27% reduction in children less than 80% of standard weight for height when one third of the child's calorie needs were supplied on-site for three months (Institute of Nutrition and Food Science, Dacca 1977).

Take-home feeding programs supplying one fourth of the calorie requirement have succeeded over a 12- to 18-month period, in reducing third-degree malnutrition by 33%-43%; a reduction still less than that achieved in NRCs in four months. When rations providing up to 50% of the child's calorie requirement are provided over a 6- to 12-month period, second- and third-degree malnutrition combined can be reduced by 40%-57%, and the number of children classified as normal may be increased two- to threefold. In an evaluation based on weight for height criteria, a take-home feeding program in Bangladesh supplying one third of calorie requirements was able to reduce by one-fourth the number of children less than 80% of standard weight for height. A similar reduction was achieved in the number of children less than 90% of standard weight for height. However, it should be noted that at two sites included in this study, the percentage of children with acute malnutrition (less than 80% of standard weight for height) actually increased by 58%-123%. This occurred because of a famine situation in which the participants were consuming less than 50% of their daily calorie requirements, even with the ration (Institute of Nutrition and Food Science, Dacca 1977).

Other programs have recorded the percentage of children who have improved to a higher degree, stayed the same, deteriorated to a lower degree, based on their initial Gomez classification. In a one-month nutrition rehabilitation program in India (Venkataswamy and Kabir 1975), it was

found that of the children initially in third-degree malnutrition, 36% improved and 64% stayed the same. Among children who entered with second-degree malnutrition, 25% improved, 66% were held stationary and 6% got worse. No improvement was found among children with first-degree, of whom 84% were held stationary and 16% deteriorated. In longer NRC programs lasting four months, most children with third-degree malnutrition are improved to second-degree. In an on-site feeding program in India in which two thirds of the child's calorie requirements were provided for 30 months, it was found that 30% of the children who had initially been classified as suffering from second- and third-degree malnutrition had improved (Weil 1972).

In a take-home feeding program in the Philippines (Asia Research Organization 1976) which supplied one fourth of calorie requirements for 13-18 months, it was found that 81% of the children initially classified as third degree improved and only 19% stayed the same. Of children who entered with second degree only 38% improved and the majority (62%) stayed at the same level. Over half the children who started out with first degree were unaffected by the program, 38% deteriorated and only 9% improved. Of the children who were enrolled in normal conditions, 86% deteriorated and only 14% were maintained in good nutritional status.

This method of evaluating impact was also used in the Candelaria, Colombia, take-home program (Wray 1967 and 1978b). Nutrition status changes were tabulated at three-month (quarterly) intervals and the results obtained are shown numerically in Table 17 and graphically in Figure 2. There it may be seen that the nutritional classification of a substantial proportion of the children improved within three months, regardless of initial severity of malnutrition. Improvement continued throughout the year: after 12 months, almost two-thirds of those with first-degree malnutrition initially had moved up to the normal range in weight for age; over three fourths of the second-degree children had improved either to first degree or to "normal" levels; all of those with third degree (a small number) had improved to second- or first-degree levels.

In Project Poshak, best results from take-home feeding were found among children with second- and third-degree malnutrition (Gopaldas et al. 1975). It should be noted, however, that the validity of the nutritional impact claims of Project Poshak has been questioned (Maxwell 1978). Nonetheless, this same trend of greater impact on children with second- or third-degree malnutrition and relatively less benefit to children with first-degree or normal nutritional status is found in most studies; nonetheless, one program in Ethiopia found greater progress among children admitted with milder degrees of malnutrition (Habte 1973).

In the Philippine program, one of the defined objectives was to improve the nutritional status of children with third-degree malnutrition to first degree in 24 months - a goal which was achieved in one third of the beneficiaries in only 18 months. Another 46% of the participants who started out in third degree reached second degree in 18 months. The goal of improving second-degree children to first degree in 18 months was achieved

TABLE 17

CHANGES IN NUTRITIONAL CLASSIFICATION OF PRESCHOOL CHILDREN FOLLOWED ONE YEAR IN THE NUTRITION SUPPLEMENTATION PROGRAM BY NUTRITIONAL CLASSIFICATION AT START, AT QUARTERLY INTERVALS, CANDELARIA, COLOMBIA, 1964-65

Nutritional class	Months of participation in program									
	Start		3 months		6 months		9 months		12 months	
	Number of children	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
N+					1	1.0	2	2.0	5	4.9
N-			47	46.5	52	51.5	56	55.4	59	58.4
I°	101	100	51	50.5	46	45.5	39	38.6	35	34.7
II°			3	3.0	2	2.0	4	4.0	2	2.0
N-			6	8.5	7	9.7	12	16.7	18	25.0
I°			25	34.7	35	48.6	40	55.5	37	51.4
II°	72	100	41	57.1	30	41.7	20	27.8	17	23.6
I°							1	11.1	4	44.4
II°			5	55.6	7	77.8	8	88.9	5	55.5
III°	9	100	4	44.4	2	22.2				

n 36% of the beneficiaries, but 57% stayed the same, 5% got worse and 2% ose to normal. No such explicit goals had been stated for the Candelaria rogram, but results were, if anything, somewhat better: 44% of those with hird degree were up to first degree in 12 months; 76% of the second-degree hildren reached first degree or higher, while 63% of the first-degree hildren reached normal.

Data from a number of studies indicate the percentage of children o improve, stay the same, or decline in weight but do not indicate the tent to which they change nutritional classification (Table 18). In stanrd nutrition rehabilitation programs of four months, 62%-84% of the parcipants were found to improve and 0%-5% died (Beghin and Viteri 1973; ghin 1976). In an NRC program lasting only one month in India, only 32% the children improved, 64% stayed the same and 4% got worse (Venkataswamy d Kabir 1975). After a year of on-site feeding of one-third of the ild's requirements in Brazil, 96% of the participants improved. This proam included education for mothers (Gandra 1977). However, results were ss dramatic in an on-site feeding program in India which served a ration th twice the calories as Brazil, plus health care for 30 months (Narangwal ral Health Research Centre 1974). A little over half the children proved, 41% stayed the same, and 4% got worse. In take-home feeding proams providing one fourth to one third of a child's calorie requirements r 12-15 months, 60%-75% of the children improved. In a seven-month ogram, 27% of the children improved, 48% stayed the same and 25% got rse (Gopaldas et al. 1975). Similar results showing improvement in a nority of children, while the majority stay the same, have been found take-home feeding programs, even when participation exceeds 12 months RS 1975; MacKay, Capone, and Jacob 1974). Mildly malnourished children y already have a weight proportionate to their height and because they e short, they may be unable to catch up to normal weight for age levels.

The age of the child receiving supplementation can also influence e growth and recovery pattern. A six-month-old child may be normal upon tering the program but falter to first- or even second-degree malnutrion over the following six months due to the "weaning crisis." Growth ltering at this time can almost be considered a natural phenomenon in ny cultures, and whether or not it occurs depends both on the adequacy breastfeeding and also on the adequacy of supplements provided to the fant. Preventing this faltering may be considered the acid test of ogram effectiveness.

Permanency of Effects

Progress of preschool children after graduation from supplemenry feeding programs has been monitored as a means of determining longrm program effects and the success of nutrition education efforts (Table). Long-term results of nutrition rehabilitation programs have been sured more often than others, because these programs have the declared l of preventing future relapses into a malnourished state through materl education. Follow-up studies of nutrition rehabilitation programs show t one to five years after leaving the program 52%-75% of the beneficiarr have maintained or improved the nutrition status they had upon graduaon. A smaller proportion (3%-33%) deteriorate and have to be readmitted.

TABLE 18

GROWTH PROGRESS OF PRESCHOOL CHILDREN IN VARIOUS TYPES OF FEEDING PROGRAMS

Type of Feeding	Country	Authors	Age of Beneficiaries (mos.)	% of Daily Calorie Requirement in Ration*	Duration of Participation (mos.)	Percent Who			
						Improve	Stay Same	Deteriorate	Die
Nutrition Rehabilitation	Latin America	Beghin and Viteri 1973; Beghin 1976	12-60	100	4	62-84			0-5.8
	Haiti	Fougere and King 1975; King and co-workers 1975							
	India	Venkataswamy and Kabir 1975	12-60	100 66	1 4	32 43	64 55	.4 2	
On-Site	Brazil	Gandra 1977	24-84	33	12	96			
	India	Taylor and coworkers 1978	0-36	66	30	55			
Take-Home	India	Khare and co-workers 1976b	0-60	25	15	75			
	Ghana	CRS 1975		33	>12	21			
	Ethiopia	Habte 1973			12	60	58	21	
	India	Gopaldas and co-workers 1975	6-36	25	7	27	48	25	

* FAO requirement for 12-47 month old children is 1,360 calories.

TABLE 19

GROWTH PROGRESS OF PRESCHOOL CHILDREN AFTER GRADUATION FROM VARIOUS FEEDING PROGRAMS

Type of Feeding	Country	Authors	Duration of Participation (mos.)	Time since Graduation (years)	Percent Who Have			
					Improved or	Stayed Same	Regressed	Died
Nutrition Rehabilitation	Latin America	Beghin and Viteri 1973	1-4	1-5	52-75		3-33	
	Haiti	Fougere 1972						
	India	Venkataswamy and Kabir 1975						
	Philippines	National Nutrition Program 1975						
	India	Cutting and Cutting 1975	1	< 1	85		6	9
Take-Home	India	Khare and co-workers 1976b						
		Shah and co-workers 1974	15	1-3			6-24	6

Among children who had participated in a one-month residential nutrition rehabilitation program in India within the past year, 69% had improved, 16% stayed the same, 6% regressed, and 9% died (Cutting and Cutting 1975). On the other hand, it was found in the Philippines that weight for age was maintained at levels higher than those at the time of the child's entry into the NRC for about three years. After that weight for age fell gradually until it reached a percentage level equal to that of the child when he first entered the nutrition rehabilitation center (Asia Research Organization 1976). In a program of domiciliary treatment for malnutrition through education and take-home feeding in India, it was found that one to three years after graduation, only 6%-24% of the children had regressed and 6% had died (Khare 1976b and Shah et al. 1974). No long-term results are available for other on-site or take-home feeding programs. However, the high rates of long-term maintenance of improved nutritional levels in follow-up studies in nutrition rehabilitation programs show the value of this type of feeding with its strong emphasis on maternal education.

6. Reduction of Deficiency Signs

In programs dealing with severely malnourished children, impact can be measured by the reduction in prevalence of edema in the project community or by the length of time it takes for edema to clear in project beneficiaries. Nutrition rehabilitation centers in Haiti have succeeded in reducing the rates of edema in the project communities by 54% to 100% during the seven years of existence of the mothercraft program (Fougere 1972; Fougere and King 1975; and Beghin and Viteri 1973). When severe malnutrition is treated through take-home feeding, edema takes 5-8 weeks to subside (Khare 1976b).

Feeding programs may have the objective of reducing other serious nutritional deficiencies besides protein-energy malnutrition. One such program is the nutrition rehabilitation work carried out in Madurai, India (Venkataswamy and Kabir 1975). This program is seeking through a diet composed entirely of vegetable origin to cure vitamin A deficiency. Nightblindness has been eliminated in nearly all children under three months participation in the NRC. Conjunctival xerosis and Bitot's spots may take 90-120 days or longer. Through changing the diet alone, 34% of the xerophthalmia cases were cleared, whereas 43% of the cases required high potency vitamin A capsules in addition to diet.

7. Effects During Pregnancy

A primary goal of feeding programs which provide supplements to pregnant mothers is to reduce the number of children born with low birth weights (less than 2500 grams) and thereby prevent future malnutrition in these children. Several studies have found that the provision of rations up to 856 calories per day for at least the last thirteen weeks of pregnancy, which result in net caloric increments to the mother of 150-235 calories per day, can produce a 31%-64% reduction in the number of low birth weight babies (World Food Programme 1974; Lechtig et al. 1975; Mora et al. 1979; Chavez, Martinez, and Bourges 1972; and Chavez, Martinez, and Yaschine 1974).

8. Effects on Morbidity and Mortality

Feeding programs may also play a role in lowering morbidity and mortality rates among preschool children. The Narangwal integrated health and nutrition project in India reduced infant mortality by 67% and toddler mortality by 51% during a three-year period (Taylor et al. 1978). Other projects primarily geared towards nutrition recuperation reported significantly reduced child mortality among program beneficiaries, although the reductions have not been quantified (MacKay, Capone, and Jacob 1974; Berggren 1972). The Narangwal project also resulted in a 26% reduction in the number of days of illness in the past year. A project of feeding, health care, and health education in Ethiopia succeeded in reducing the rate of diarrhea in the previous two weeks from 32.9% to 10.3% without making any improvements in water supply or environmental sanitation (Hofvander and Eksmyr 1971). Thus, nutrition programs, especially when integrated with health care and education, may play a major role in improving the health and survival of preschool children.

9. Effects of the Educational Component

Maternal nutrition education is often stressed as a key ingredient in supplementary feeding programs if these programs are to have a lasting impact on the nutrition problem in the community (see in this series - Study II, Nutrition Education). Through education, feeding programs should give mothers the knowledge they need to feed their children properly from locally available foods and to prevent malnutrition. Yet often the educational component of feeding programs is weak or nonexistent and has little impact on the food habits of the mothers. Even in nutrition rehabilitation centers in which maternal education is intended to be as important a program activity as is the actual recuperation of the child, this is often not the case.

In an NRC in Haiti, it was found that the nutrition education was not that effective because the consumption of low-cost pulses which the center recommended was no higher in the program village than in the control village (Weil 1972). In an NRC in India, twice as many program mothers did not actually feed more greens to their children despite their knowledge (Venkataswamy and Kabir 1975). This program also did not succeed in changing one of the most nutritionally lethal practices throughout the developing world - the late introduction of solid foods (beyond six months old). The majority of mothers continued to introduce solids after the child was twelve months old. The researchers also felt that the high rate of relapse into malnutrition after graduation from the program and the high rates of severe malnutrition in the community at large were further evidence of the ineffectiveness of the nutrition education. The failure of nutrition education may often be due to recommending foods which mothers cannot afford (National Nutrition Program, Philippines, 1975 and Federal University of Pernambuco, Brazil 1972).

However, positive effects of nutrition education have also been considered to be responsible for the maintenance of good nutritional status of the majority of the children after their graduation from the center and for the prevention of malnutrition among the majority of their siblings. In a take-home feeding program in Colombia, it was found that initially 50% of the mothers gave the correct answers on a nutrition knowledge test, and the classes offered during the program raised the number of knowledgeable mothers to 85%. Furthermore, when mothers received food plus education in this program the initial malnutrition rate dropped from 54% to 32%. On the other hand, when mothers received food alone, there was little change in the initial malnutrition rate which dropped from 57% to 53% (World Food Programme 1974).

In another take-home feeding program in India, it was found that 30% of the mothers had modified their children's diets as a result of the program, but still only 11% of the mothers attributed the cause of kwashiorkor to an inadequate diet, 48% of the mothers thought food and medicine had recuperated their children, 22% thought food alone had cured their child, and an equal number (22%) thought medicine was the cure for malnutrition (Khare et al. 1976b). When this take-home feeding program's educational impact was compared to that of hospital treatment, it was found that only 7% of the mothers whose children had been treated in the hospital attributed the cure to diet versus 68% of the mothers who received take-home rations plus education; 16% of the home-treated group thought the cure was due to medicines versus 67% of the hospital group (Shah, Wagh, Kulkarni, and Shah 1974). The present diet of the previously malnourished child was adequate in 21% of the hospital group versus 64% of the home-treated group. Special efforts must be made to transform traditional nutrition education into something that is dynamic, interesting, and compelling to the mother. More than anything else, the methods being recommended for implementation must be practical and affordable to the mother. While children are being recuperated through use of food, a special effort should be made to explain to the mother the proper diet that she must feed to prevent the recurrence of malnutrition. For education purposes, the use of locally available foods in the feeding program is invaluable. It will be doubly hard to teach mothers how to treat malnutrition at home if the foods they receive in the program are imported, processed products which they cannot find in the local market once they leave the feeding program.

The effects of the nutrition education component of feeding programs can be partially ascertained through the nutritional status of siblings. It has been found in the NRC program in Haiti that 72%-96% of the younger siblings of mothers who have attended a mothercraft center are growing better than the child who attended the NRC at the same age (King et al. 1975). Thus, it has been established that of the 120 children who are enrolled in a mothercraft center during a year, 75% will improve and maintain their improved growth after dismissal from the center. To these 90 children can be added 288 siblings who wil also be protected from malnutrition because of their mothers' attendance at the NRC (based on three additional children for each of the 120 mothers enrolled, of whom 80% will be

protected from malnutrition). Thus, the average NRC can protect 378 children per year from becoming malnourished (Fougere and King 1975). Berggren (1972) has also noted that siblings of chilren who participate in Haitian mothercraft centers are nourished as well as other children in the same community as the NRC. However, in mothercraft centers in the Philippines when the progress of program and control groups as well as siblings was evaluated five years after graduation from the program, it was found that the prevalence of second- and third-degree malnutrition in younger siblings of children in the control group was 19% compared with a much higher rate of 31% among younger siblings of children who had been in the program (National Nutrition Program 1975). Clearly, the educational component of this program was weak and failed to have the intended effect on preventing malnutrition among siblings.

In a take-home feeding program for recuperating severely malnourished children in India which included maternal education and used locally available foods, it was found that the diet of other children in the family as well as the neighbors changed for the better as a result of the program (Khare et al. 1976b). The recuperation results of these children who were treated at home were compared to those of children who had been treated in a traditional hospital setting. One to three years after release it was found that only 20% of the siblings of the hospital group had a satisfactory diet versus 80% of the siblings of the children who had been treated at home (Shah, Wagh, Kulkarni, and Shah 1974). Only 19% of the neighbors of the children who had been treated in the hospital knew about their malnourished neighbor versus all the neighbors of children who had been treated at home. All the neighbors of children treated in the hospital thought that the child's cure was due to medicines, whereas 62% of the neighbors of the children treated at home cited food and medicines as the cure. Only a few (14%) of the neighbors of children treated in the hospital changed their own child's diet for the better versus 85% of the neighbors of children who had been treated at home. Thus, home treatment of malnutrition can serve as a nutrition education for the whole community and beneficially affect siblings, whereas hospital treatment affects only the immediate mother and child, and creates the impression that medicines are the cure for malnutrition. Feeding programs with a strong educational component and which use locally available foods are capable of spreading their positive nutritional impact to siblings of the enrolled child and to other families in the community as well, which greatly increases their coverage and cost effectiveness.

D. Comparative Program Performance

The overall results of the various types of feeding programs have been compared earlier in this section. However, several studies were designed to compare the nutritional impact of on-site versus take-home, or take-home feeding versus nutrition recuperation within the same program. The findings of these studies provide very useful comparative data and will be presented here.

In Project Poshak a ration which provided one-fourth of a child's calorie requirements was distributed for one year to some children through a take-home system and to others through on-site daily feeding (Gopaldas et al. 1975). Attendance and consumption of the ration was slightly higher in the on-site group who came to the center 62% of the intended times and ate 62 grams of supplement per day versus the take-home group which collected the ration only 51% of the intended times and consumed an average of 53 grams of supplement per day. The net result was that the children in the on-site program had a significantly higher percent of standard weight for age than did the take-home feeding group or the control group.

In a comparison of on-site and take-home feeding carried out in Colombia in which all children were given rations sufficient to cover their minimum daily nutrient requirements, it was found that both types of feeding were as effective in producing nutritional recovery after one year of participation, but the on-site feeding program showed superior results after two years of participation (McKay, McKay, and Sinisterra 1973). The major disadvantages of on-site feeding, however, are: higher cost, lower coverage, failure to reach nutritionally vulnerable preschoolers under two years old, and substitution of the on-site meal for the normal home diet.

A nutrition rehabilitation center's effects have been compared with those of take-home feeding in the Philippines (Asia Research Organization 1976). When a child is given two-thirds of daily nutrient requirements in a nutrition rehabilitation center, a weight increase can be achieved in 3-4 months that might take a child 18 months to reach in a take-home feeding program with a ration supplying one-fourth of his or her calorie requirements. Children in mothercraft centers grow at an average rate of 387% of the standard, whereas children in take-home feeding grow at 93% of the standard rate. Most children (76%) in mothercraft centers gained weight at greater than 150% of the standard, whereas only 12% of the children in the take-home program reached this rate. Children in different age groups gained the following percentage points of standard weight for age in the two types of programs:

Age Group (months)	Change in Percent of Standard Weight After Three Months in a Mothercraft Center	Change in Percent of Standard Weight After Eighteen Months in Take-Home Feeding
6-11	7	4
12-23	8	6
24-60	4	1

Nutrition rehabilitation centers can recuperate children far more quickly than is possible through provision of take-home rations. Furthermore, the strong maternal education component of some nutrition rehabilitation centers may make the child's recuperation more permanent, plus prevent malnutrition in siblings and other people in the community. Take-home feeding programs may also achieve similar results if they use locally available foods and have a strong education component, but generally the mothers come to the

feeding center only once or twice a month which does not provide sufficient time for intensive education campaigns, versus the daily attendance of children in an NRC. The disadvantages of NRCs are high cost, low coverage, and failure to reach children under the age of one.

11. Feeding with Other Services

Research has also been conducted to ascertain the incremental effects on nutritional impact of feeding programs when various other services are offered to mothers and children at the same time as food distribution (see in this series - Study VII, Integrated Nutrition and Primary Health Care Programs. In many countries, preschool children suffer from heavy infestation with intestinal parasites, and these parasites may negatively affect the child's nutritional status. Consequently, a feeding program was designed in India in which children were given deworming medicine every three months along with their take-home ration of 280 calories and 14 grams protein (Shah, Junnarkar, and Khare 1975). It was found that children gained as much weight when they received food alone, as when they received food plus antihelminthics. When deworming medicine alone was given without any food supplement, there was no significant weight gain. These workers could not prove or disprove the adverse impact of severe infestation on nutritional status, nor the nutritional benefits of periodic deworming. In another study in Costa Rica, periodic deworming was found to have no significant impact on nutritional status (Rawson 1977).

In the Narangwal integrated health and nutrition project in India, the impact of the feeding alone or combined with infection control was compared (Taylor et al. 1978). It was found that feeding a ration which supplied two-thirds of the child's daily requirement in an on-site setting, either alone or with a health care program to control infection, achieved equally good impact on weight gain. Infection control alone, in the absence of supplementary feeding, could not significantly improve weight gain. The best reduction in mortality and morbidity rates came from food combined with infection control.

In Project Poshak in India the effects of combining take-home feeding with health care and education were compared (Gopaldas et al. 1975). The best nutrition impact results were achieved with an integration of all three components: food, education, and health care. Second best results were achieved from food combined with education and third best results from food alone. Either education or health care alone in the absence of a food supplement gave poor nutritional results.

From the above studies it is apparent that the provision of food is essential in nutrition programs if impact is to be achieved. Impact can be increased by provision of nutrition education and health services along with the ration in some instances (see in this series - Study VII, Integrated Nutrition and Primary Health Care Programs.

12. Cost Effectiveness

Examining the various effects of supplementation is a necessary but insufficient condition for evaluation. One must look at effects in relation to costs in order to ascertain the relative cost-effectiveness of various program approaches. The reader is referred back to the earlier section on costs and to Chapter Four in which various cost-effectiveness measures are used, e.g., cost per child, cost per nutritionally deficient child, cost per child improved, cost per 300 additional calories delivered. Chapter Five in Study VII, Integrated Nutrition and Primary Health Care Programs, gives cost-effectiveness figures for Lesotho's preschool program.

13. SUMMARY:

PROGRAM EFFECTS

Weight gains in NRCs can be quite accelerated (1-2 kilos) due to the low base weight and the intensive feeding. Reported weight gains in on-site and take-home programs vary considerably, ranging from gains comparable to NRCs to 0.2 and 1.5 kilos over those of the control group. In NRCs children's weights improve 3%-8% relative to the reference standard. The figures for take-home programs are 1%-10% and for on-site 2%-5%.

NRCs consistently reduce the rate of third-degree malnutrition by half over about a four-month period. Some on-site and take-home programs have reduced second- and third-degree malnutrition by about 50%. The greatest improvement appears to be in the most malnourished children. Follow-up studies show that 52%-75% of NRC beneficiaries maintain or improve their nutritional status. The permanency of improvement for the other types of feeding programs is not known.

Supplementation during the last trimester of pregnancy with daily rations of up to 850 calories (which result in net calorie increments of 150-233 calories) can reduce the number of low birth weight babies by 31%-64%. Effects of such supplementation on the child's subsequent development are not clear but the risk of infant mortality is reduced.

Clear evidence on the reduction of morbidity and mortality due to supplementation is not abundant. Nonetheless, positive impact appears likely, especially when integrated with health care services.

Maternal education is a critical component of most feeding programs where there are correctable nutritionally deleterious feeding and health habits. Unfortunately, this component has often not been given adequate attention and results have not been dramatic. Nonetheless, some improvements have been noted, including positive effects on the nutritional status of siblings.

The three forms of feeding programs are not mutually exclusive alternatives. Each has strengths and limitations that make one or the other more or less effective in a particular setting. Generally, the effectiveness of all the forms can be significantly enhanced by integrating them with health and sanitation interventions.

In carrying out an evaluation, one should relate the program effects to the costs expended. Such cost-effectiveness measures provide critical guidance in allocating resources among program alternatives so as to maximize the impact of scarce resources.

Chapter Three Footnotes

[1]Twenty paise per child per day for 365 days, 100 paise per 1 rupee, and 850 rupees per $1.

[2]Weight gain during the recuperation period ranged from 419 grams to 1790 grams, and averaged 1140 grams (Beghin and Viteri 1973).

CHAPTER FOUR

CASE STUDY

BACKGROUND

The results of an evaluation carried out by CARE in 1976 of take-me feeding programs in Colombia, the Dominican Republic, and Pakistan and f on-site feeding programs for preschoolers in Tamil Nadu, India, and sta Rica will be examined here as a means of illustrating the program sign considerations raised in the overview section. The case study is example of feeding programs conducted by governments with the collabora-on of one international agency. The findings are, of course, not uni-rsally applicable for other providers of supplementary feeding. None-eless, the data do illustrate a methodology for designing, operating, d evaluating supplementary feeding programs in general.

The survey was executed as part of CARE's three-phase project to udy its worldwide preschool nutrition programs. The purpose of this AID-nded survey was to identify factors essential to increasing the nutrition pact of feeding programs for preschool children in specific environments. idelines for designing and implementing feeding programs are being pro-ced as part of the project. Because CARE's involvement in nutrition habilitation center programs is limited, no programs of this type were aluated.

Three serious problems were encountered in evaluating the impact the CARE programs in the study populations: (a) no baseline data had en obtained on nutrition status or diet, (b) no control population was llowed, and (c) coverage of the target population could not be determined cause investigation of the total population could not be done within the nstraints of time and financial resources. The evaluation was designed overcome these problems to the greatest extent possible.

A consistent method of data collection was followed in all five untries. A sample of mothers of participating and nonparticipating ildren from each study site was interviewed, and weight, height, and arm rcumference measurements of one of each mother's children between one d five years old were taken. Participant and nonparticipant groups were nerally well matched on socioeconomic characteristics, and therefore it s assumed that the nutritional status of the two groups could be compared assess program impact (except in Costa Rica, where the nonparticipants re more affluent). Measurement of program impact was made by comparing e nutritional status of children enrolled in the programs a short time th that of long-time participants. Total dietary intake and ration con-mption were estimated by the 24-hour recall method on a subsample of ogram beneficiaries. Center administrators were also interviewed, and st data on all programs were collected consistently.

The findings of the case study will be discussed with respect to the following feeding program design considerations:

- participants and their motivation and behavior.
- ration type and quantity, measured against nutrient deficits, leakages, and net dietary effects of the rations.
- program timing.
- facilities and their location.
- personnel administration.
- logistics and control.
- integration of feeding with other services.
- cost and cost effectiveness.
- effects-impact evaluation.

II. PARTICIPANTS

A. Age, Birth Order, Family Size

The CARE feeding programs enrolled preschool children of all ages through five years old who came from low-income families. (Pregnant or lactating women were enrolled only in take-home feeding programs.) Preschool children less than three years old were nominally included in all programs, but there was little priority given to this age group. Take-home feeding programs were found to reach nearly twice as many children under three years of age as on-site feeding programs because of the difficulties in getting toddlers to eat daily at a feeding center. The average participant was from third to fifth in birth order and had an average of three siblings under 13 years of age. Birth order and family size may be strongly associated with nutritional status in these programs. This seemed to be particularly true in take-home feeding programs in this study, in which sharing of the ration with nontargeted people was prevalent in larger families, resulting in a decreased nutritional impact of the program for the preschool child.

B. Socioeconomic Characteristics

Participant characteristics in each program need to be carefully identified so that an appropriate program can be designed. For example, literacy of participant mothers varied from country to country; it was lowest in Tamil Nadu, India, where only 23% of the mothers could read. Thus, a nutrition education component for a feeding program in Tamil Nadu,

dia, would have to be very different from one designed for the highly terate female population in Costa Rica, where 80% of the mothers could ad. The existing Tamil Nadu feeding program provided no nutrition edu-tion for the mothers.

Tamil Nadu also had the highest number of participant mothers o worked outside the home (54%, as compared with the other four countries, ere working mothers ranged from 12% to 24% of all participants). A sig-ificantly higher proportion of working mothers was found among mothers of lnourished children than among those of healthy children in Colombia, sta Rica, and Tamil Nadu. Similar findings have been reported in rural dhya Pradesh, India (Gopaldas et al. 1975) and in rural Maharashtra, dia, as well (Khare, Shah, and Junnarkar 1976a and 1976b). While mothers e working, children may be left in the care of siblings who do not know oper child-rearing practices. This suggests a need for education in ild care for siblings, but no feeding programs were found to offer such ucation. The increased income gained from the mother's work may not mpensate for the decreased care of her child. On the other hand, it may ke greater food purchases possible and keep the child from becoming en more malnourished.

Breast-feeding and Weaning Practices

Data were collected on breast-feeding and weaning practices. It well known that adequate nutrition depends on the introduction of supple-ntary foods to breast-feeding from the age of six months. The need for ternal education on the importance of timely and healthy weaning prac-ces is evident from the data, which clearly support the recommendation target supplementary feeding programs to infants and children 6 to 36 nths old - those who are suffering the negative nutritional consequences the weaning process. The contribution of late introduction of solid ods to malnutrition is supported by the finding that 60% of the malnour-hed children in the Dominican Republic and 81% of those in Pakistan had rst received solids later than six months, compared with 41% and 69%, spectively, among the well nourished in those countries. In all the rveyed countries except Costa Rica, the average age of introduction of lid foods exceeded six months, with the greatest problem being in India, ere the mean age of introduction of solid foods was 14.3 months (Table). The majority of the mothers introduced solid foods too late in all untries except Costa Rica and the Dominican Republic (Table 21). Intro-ction of solid foods occurred significantly earlier in urban than in ral areas in Colombia, and significantly later in the Dominican Republic. urban/rural differences in age at introduction of solid foods were und in the other countries (Table 22).

The weaning practices that are detrimental to nutritional status ong most mothers interviewed would provide good subject matter for a trition education campaign. With the exception of Costa Rica, the prob-m lies more in introduction of solid foods too late and in too small antities than in too short a period of breast-feeding. The high rates breast-feeding found in the study should counter the fear that feeding

TABLE 20

BREAST-FEEDING PRACTICES OF MOTHERS
IN CARE PRESCHOOL FEEDING PROGRAMS AND AVERAGE
AGE WHEN SOLID FOODS INTRODUCED

Country	Sample Size	Percent Who Never Breast-fed or Stopped In Newborn Period	For Those Who Breast-fed, Average Age of Complete Weaning (Months)	Average Age When Solids Introduced (Months)
Colombia	244	6.3	14.0	9.2
Costa Rica	266	23.4	7.1	5.6
Dominican Republic	246	7.3	13.3	7.8
India (Tamil Nadu)	253	2.4	19.9	14.3
Pakistan	254	3.6	16.8	11.9

TABLE 21
BREAST-FEEDING AND WEANING PRACTICES
OF MOTHERS OF PRESCHOOLERS IN FIVE CARE FEEDING
PROGRAMS

Country	Sample Size	Breast-Feeding Duration (% ≥ 6 mos.)	Intrc. of Solid Foods (% ≤ 6 mos.)
Colombia	244	79.0	43.2
Costa Rica	266	34.8	73.6
Dominican Republic	246	77.6	55.3
Tamil Nadu	253	94.9	10.7
Pakistan	254	89.0	24.8

TABLE 22

PERCENT OF URBAN AND RURAL MOTHERS WHO BREAST-FEED THEIR CHILDREN FOR SIX MONTHS OR MORE, AND WHO INTRODUCE SOLID FOODS TO THEIR CHILDREN BY THE SIXTH MONTH OF AGE*

	Breast-feeding Duration (≥ 6 Mos.)					Introduction of Solid Foods (≤ 6 Mos.)				
	Urban (%)	N	Rural (%)	N	P**	Urban (%)	N	Rural (%)	N	P**
Colombia	77.5	218	92.0	25	N.S.	46.3	218	16.0	25	<.01
Costa Rica	25.0	72	40.6	128	<.05	73.6	72	73.6	128	N.S.
Dominican Republic	68.1	72	81.6	174	<.05	61.1	72	52.9	174	N.S.
India (Tamil Nadu)	98.1	104	92.6	149	N.S.	4.8	104	14.8	149	<.05
Pakistan	89.0	254	----	---		24.8	254	----	---	

* Urban is defined as a community with a population greater than 5,000.

**N.S. = Not significant difference between urban and rural groups.

<.05 = Significant difference between urban and rural groups.

<.01 = Very significant difference between urban and rural groups.

programs reduce breast-feeding. Mothers' literacy did not significantly affect breast-feeding or weaning practices in any of the five countries, in contrast to the finding that mothers with more education breast-fed less in Colombia reported by Heller and Drake (1976).

The proportion of mothers interviewed who had never breast-fed their children ranged from 2% to 7%, except in Costa Rica, where 23% had never done so. In fact, breast-feeding practices were nutritionally favorable in all countries except Costa Rica, where only 35% of the mothers breast-fed their children for six months or more, and the average age of complete weaning was seven months. In rural areas of Costa Rica, however, significantly more mothers breast-fed for six months or longer: 40.6% versus 25% in urban areas (Table 22). A significant urban/rural difference was also found in the Dominican Republic, where 81.6% of the rural mothers breast-fed for six months or more, in contrast to 68.1% of the urban mothers. Breast-feeding and weaning practices were similar in Colombia and the Dominican Republic, where mothers breast-fed on the average for 13 to 14 months and introduced solids around eight to nine months of age. Similarities also existed between India and Pakistan, where mothers breast-fed substantially longer, for an average of 17-20 months, and introduced solid foods significantly later, at 12-14 months of age.

Nutritional Status, Selection Criteria, and Coverage

Because they seek to prevent malnutrition as well as to cure it, the evaluated feeding programs were not targeted exclusively to malnourished children. The feeding programs enrolled many children who were not malnourished, since nutritional status criteria were not used to determine eligibility. Therefore, the malnutrition rates of the newcomers in the programs generally reflected those of the community at large. In Latin America, where malnutrition rates are generally low, the majority of participants in the feeding programs were not malnourished. In fact, as few as one in ten participants was found to be malnourished (less than 90% weight for height) in Colombia, and one in five in the Dominican Republic. The proportion was, of course, much higher when weight for age was used as a measure. In India and Pakistan, at least every other child in the programs was malnourished in weight for height. It should be pointed out, however, that although many children did not show physical signs of malnutrition, many were chronically malnourished as indicated by height deficits (see Table 23). Dietary surveys also revealed that in all the programs, at least four out of five children had home diets with inadequate energy content according to FAO standards and therefore were in need of supplementation. The nutrition status results for all five feeding programs can be seen in Table 23.

The absence of nutritional status criteria for targeting the programs is particularly important in view of the low rates of coverage of the total preschool populations in the programming areas of the evaluated countries (Table 24). The programs in general reached only 6% to 10% of the preschoolers in their programming areas, with highest coverage in the

TABLE 23

NUTRITIONAL STATUS BY LENGTH OF PARTICIPATION IN FIVE CARE PRESCHOOL FEEDING PROGRAMS (NCHS REFERENCE POPULATION)

	Nonparticipants	Participants for: ≤5 Mos.	>9 Mos.	Total Participants
Colombia				
Sample Size	536	232	502	897
Participation (Mos.)	0	3.4	20.2	13.5
Mean Age (Mos.)	35.7	34.4	37.7	35.7
Weight for Age (%)*				
1st Degree	43.0	52.6***	51.8****	52.1****
2nd Degree	10.2	10.3	12.2	11.6
3rd Degree	0.9	0.4	0.0	0.4
% <90% Reference Weight for Height	11.0	9.5	11.8	11.6
(% < 80% Ref. Weight for Height)	(0.4)	(0)	(0.6)	(0.8)
% <90% Reference Height for Age	25.7	30.6	30.8	30.7
Costa Rica				
Sample Size	266	129	249	500
Participation (Mos.)	0	2.9	20.8	14.2
Mean Age (Mos.)	38.9	36.0	44.5	50.0
Weight for Age (%)*				
1st Degree	40.2	40.3	38.5	42.4
2nd Degree	5.3	11.6***	8.2	9.0
3rd Degree	1.5	3.1	0 (****)	0.8
% <90% Reference Weight for Height	18.0	32.6****	29.3****	28.5
(% < 80% Ref. Weight for Height)	(2.6)	(7.0)	(3.2)	(3.7)
% < 90% Reference Height for Age	10.6	12.4	8.4	9.5

TABLE 23 (continued)

	Nonparticipants	Participants for: ≤5 Mos.	>9 Mos.	Total Participants
Dominican Republic				
Sample Size	822	157	811	1079
Participation (Mos.)	0	2.6	23.2	20.0
Mean Age (Mos.)	34.8	31.7	35.9	34.6
Weight for Age (%)*				
1st Degree	39.4	35.0	39.1	38.9
2nd Degree	9.1	13.4	8.0	9.3
3rd Degree	1.6	0.6	1.1	1.2
% < 90% Reference Weight for Height	22.1	20.5	16.3****	17.3***
(% < 80% Ref. Weight for Height)	(2.2)	(3.2)(**)	(0.9) (**)	(1.5)
% < 90% Reference Height for Age	19.3	21.8	17.8	18.6
India (Tamil Nadu)				
Sample Size	859	197	504	963
Participation (Mos.)	0	2.6	19.7	11.4
Mean Age (Mos.)	32.3	34.7	40.4	37.7
Weight for Age (%)*				
1st Degree	35.8	36.5	38.7	38.2
2nd Degree	47.8	40.6	41.5****	40.7****
3rd Degree	11.2	10.7	11.1	11.2
% < 90% Reference Weight for Height	67.5	60.4	68.5	64.9
(% < 80% Ref. Weight for Height)	(14.9)	(14.2)	(15.9)	(15.4)
% < 90% Reference Height for Age	51.6	44.7	44.4***	44.5****

TABLE 23 (continued)

	Nonparticipants	Participants for: ≤5 Mos.	>9 Mos.	Total Participants
Pakistan				
Sample Size	464	137	534	779
Participation (Mos.)	0	3.1	25.5	21.0
Mean Age (Mos.)	31.0	31.5	35.3	33.9
Weight for Age (%)*				
1st Degree	44.4	51.8	46.6	48.1
2nd Degree	29.7	29.9	27.7	28.6
3rd Degree	7.3	1.5***	6.6	5.4
% < 90% Reference Weight for Height	56.2	51.8	52.8	52.8
(% < 80% Ref. Weight for Height)	(10.1)	(5.1)	(7.7)	(7.6)
% < 90% Reference Height for Age	30.0	28.5	30.5	29.6

*Normal = 90+% of NCHS Reference Weight for Age Median

First Degree = 75 - 89.9% of NCHS Reference Weight for Age Median

Second Degree = 60 - 74.9% of NCHS Reference Weight for Age Median

Third Degree = Less than 60% of NCHS Reference Weight for Age Median

**Indicates significant difference between participants and nonparticipants at $p < .05$

***Indicates significant difference between participants and nonparticipants at $p < .025$

****Indicates very significant difference between participants and nonparticipants at $p < .01$

(*)Indicates significant differences by length of participation among participants only.

TABLE 24

COVERAGE OF TOTAL PRESCHOOL POPULATION
IN PROGRAMMING AREAS SERVED BY CARE FEEDING PROGRAMS

Country	Total Beneficiaries 0-6 Years	Penetration Percentage = Coverage of Total Preschool Population in Programming Area*
Colombia	236,666	7.1
Costa Rica	18,000	6.0
Dominican Republic	130,302	18.3
India (Tamil Nadu)	496,000	9.6
Pakistan	23,761	0.9

Takes into account children already covered by other agencies' feeding programs.

Dominican Republic (18%) and lowest in Pakistan (1%). Since many factors limit the enrollment capacity of feeding programs - including the amount of funds and food available, infrastructure for delivering the foods, personnel - it would seem necessary to use stricter criteria for choosing participants to increase the coverage of the malnourished.

The national programs ranged in total enrollments from 18,000 to 500,000 preschool children and mothers. The average number of children served in the take-home programs ranged from 360 to 600 per center, whereas the on-site programs reached fewer than 80 children per center. Thus, it can be seen that take-home feeding centers are capable of covering more children than the on-site centers.

Another finding was that the nutritional impact percent of standard (weight for height) within each country's program was higher at those centers that had a greater percentage of malnourished children among those recently enrolled. Thus, the CARE findings are in agreement with those of other researchers cited in Chapter Three. The existence of more malnourished children in a center will lead to greater nutritional impact if these children receive adequate quantities of food.

Failure to target programs to malnourished children also greatly reduces the cost effectiveness of feeding as an intervention for improving nutritional status of a population. It is important to calculate the excess cost incurred in reaching the malnourished given all the well-nourished children that are fed in blanket-coverage programs such as the ones evaluated. The Latin American programs were three to ten times as expensive as they would have been if targeted only to the malnourished because of low general malnutrition rates in the communities and the resulting low proportion of malnourished children in the programs. Costs per malnourished child were low in India and Pakistan because of the higher percentage of malnourished children enrolled in the programs and the generally high rates of malnutrition in those countries. To the extent that the programs kept well-nourished children from be ming malnourished, then cost effectiveness increased (see below).

Despite greater efficiency, however, it may not always be feasible or advisable to target programs only to the malnourished. Political constraints may preclude eliminating certain communitues. Within a community, if some mothers and children are excluded and only the malnourished are enrolled, potential stigma associated with the malnourished group may impede program results. Furthermore, unless the purpose of food distribution is clearly defined to be the treatment of malnutrition, it is questionable whether the administrator in the center could withstand the hostility she or he might encouner for excluding some mothers and children. Or there may not be enough malnourished children in a particular geographic area to warrant a feeding center or program.

Program centers in which fewer than 15% of the newcomers had weights less than 90% of the reference weight for their height were found to have no nutritional impact. Moreover, there was no evidence that the program at these sites was preventing malnutrition, or that the well-nourished children currently enrolled would become malnourished if withdrawn from it.

A feasible solution might be to specify 15% as a minimum malnutri-
ion rate necessary to warrant a national feeding program. Within qualifying
ommunities, it still would be desirable to target the food to the malnour-
shed and to younger preschoolers, but if such targeting encountered severe
esistance, it mght be politically or operationally necessary to feed all
reschoolers. If resources were abundant, foods might also be distributed
o all children for equity rather than for nutritional reasons.

Participant Motivation and Behavior

At the time of the CARE evaluation, the participants included in
he survey had been enrolled in the feeding programs for 11 to 14 months,
xcept in the Dominican Republic (20 months) and Pakistan (19 months).
ttendance was not calculated from center records because these were incon-
istently maintained and represented primarily an account of total meals
d or rations distributed in accordance with commodities received. Center
rsonnel often did not see the value of maintaining such attendance
cords for individual children.

A more reliable and meaningful attendance figure was estimated
rom the percentage of children whose mothers reported that they had eaten
e ration on the day prior to the 24-hour-recall dietary survey. Consump-
on of the ration varied greatly between on-site and take-home feeding
rograms. It was found that in the on-site programs, mothers reported that
% to 86% of the children had eaten the ration on the day prior to the
terview. Thus, in on-site feeding programs it appears that the majority
the children are eating the ration as intended. However, in two out of
ree of the take-home feeding programs (Colombia and the Dominican
public), only half the children were reported to have eaten the ration
the previous day. In Pakistan, the percentage reported was even lower,
%, but this was owing primarily to poor acceptability of the foods
ceived.

When mothers were asked why their children had not eaten the
tion, they replied most often that they had run out of the ration because
was shared with the entire family. In Colombia, 65% of those who had
t given the ration to their child on the previous day stated that they
d no CARE foods left, and in Pakistan, 73% of those not giving it had
n out of CARE foods ahead of schedule. As mentioned in Chapter Two,
tions may need to be increased in take-home feeding to assure that the
pplies do not become exhausted and that the intended child gets fed an
equate quantity.

In Colombia most of the mothers (74%) who had ration commodities
ilable fed them to their children. However, in Pakistan, only 46% fed
E foods to their children. Again, this low rate may be attributed to
poor acceptability of the received foods. In the Dominican Republic,
ere mothers received the ration daily in the form of Corn Soy Milk or
at Soy Blend mixed with water, only 51% had fed the ration to their
ildren on the previous day. This, too, may be due to an acceptability
blem, because the mothers complained that adding water to the ration
sed it to spoil because of the tropical heat and lack of refrigeration.

In Colombia, where consumption rates were much higher among children whose mothers still had CARE food on hand than in the Dominican Republic or Pakistan, it is interesting to note that the ration given was more varied - five commodities in Colombia, versus two in Pakistan and three in the Dominican Republic. Sheer boredom with the foods may reduce the number who feed the ration to their children daily.

These factors, which influence participant behavior and directly affect the number of children consuming the ration daily, are important to keep in mind when planning the food type and quantity for rations. Other possible determinants of ration consumption that were examined were sickness, nutritional status, and age.

According to the mothers' reports, consumption of the ration was not significantly lower or higher among children who currently had diarrhea. The number who ate the ration was also not significantly higher among children whose physical measurements indicated that they were well nourished (more than 90% of reference w ght for height) than among the malnourished group.

There were, however, differences in reported consumption according to the age of the children. A moderately higher percentage of the children over three years of age than those under three ate the ration in all countries, which was similar to the findings of Project Poshak (Gopaldas, et al. 1975). The figures for the present study are as follows:

	1-3 Years Old		3-5 Years Old	
Country	Sample Size	% Who Ate Ration	Sample Size	% Who Ate Ration
Colombia	94	48.9%	99	50.5%
Costa Rica	33	72.7	80	81.3
Dominican Republic	83	49.4	90	62.2
India	94	84.0	126	87.3
Pakistan	123	15.4	113	23.9

Although the pattern is consistent, none of the above differences was statistically significant.

It has been stressed that feeding programs should be directed toward the vulnerable infants between 6 and 36 months of age, but it is not sufficient merely to make food available to these younger children. Special efforts must be made to motivate mothers to feed the ration regularly to these infants.

Community involvement in the CARE feeding programs was minimal. Occasionally communities had provided the feeding site or donated some local foods and condiments to combine with the PL-480 foods in on-site programs. Mothers were charged a fee to help offset local operating expenses only in Colombia and the Dominican Republic. In the other countries, programs were available free of charge to the beneficiaries. It may well be that increased community participation would motivate families to utilize the rations more optimally.

III. FOOD

A. Food Type

The types of food being distributed were well received by the mothers except in Pakistan, where many mothers considered the Whey-Soy Drink Mix (WSDM) unacceptable. Cooking oil, which could greatly increase caloric intake, was one of the most popular commodities received, but of all foods, this was most likely to be used in cooking for the whole family and not for the target child. There was little evidence that CARE foods were being sold by the mothers. The nature of the commodities (primarily soy and cereal blends) safeguarded against this, as these foods are not known and readily salable in the market place.

All the evaluated programs provided rations composed almost entirely of imported PL-480 commodities, except in Costa Rica, where a ration composed of locally purchased foods with a 5% addition of PL-480 commodities was provided. Two programs distributed locally blended foods composed primarily of PL-480 commodities, but these formulations - i.e., Balahar in India and Bienestarina in Colombia - are designed to be blended increasingly from locally available ingredients. The PL-480 commodities distributed are listed in Table 25.

The total program cost presently provided by local funds and the cost of local foods of caloric value equivalent to PL-480 inputs are shown in Table 26. Only in India and Pakistan could local foods of equivalent nutritional value be provided at a lower cost than the PL-480 ration. However, the actual availability of such foods and of the funds necessary to purchase them seems particularly unlikely in India and Pakistan. Nevertheless, the educational impact and greater self-sufficiency fostered by the provision of local foods are important considerations. Wherever possible, an attempt should be made to increase the proportion of local foods in supplemental feeding programs, and imported foods should also be locally available and acceptable.

Food Quantity

Description of Rations Distributed (Table 27)

The average ration distributed was intended to provide each beneficiary with 2.6 kilograms of PL-480 foods per month and to supply 320 calories and 17.4 grams protein per day (about 20% of calories from protein). The rations filled 22% to 25% of the daily average calorie requirements of 1360 calories and 43% to 49% of the protein requirement of 37 grams per day. (See Section Two for calculation of requirements). The rations, if eaten entirely as supplements to the normal diet, could close from 62% to 83% of the calorie gaps found in the survey and from 46% to 113% of protein gaps. (These gaps were calculated by subtracting calorie and protein intakes derived from the 24-hour-recall survey from the estimated requirements.) The ration in Costa Rica was exceptionally generous, providing eight kilograms of food per person per month, or 737 calories

TABLE 25

DESCRIPTION OF TYPE, AMOUNT, AND FREQUENCY OF FOODS PROVIDED IN FIVE CARE PRESCHOOL FEEDING PROGRAMS

Country	PL-480 Foods Used	Kilograms Per Person Monthly	Distribution Frequency Per Month	% Local foods in Total Ration
Colombia Take-Home	Bulgur 12% Soy Fortified Wheat Flour, Bienestarina, Oil, Nonfat Dry Milk	2.5	Every two weeks	5
Costa Rica On-Site	Wheat Soy Blend Corn Soy Milk Milk Powder	8	Daily except Sunday	95
Dominican Republic Take-Home	Corn Soy Milk Wheat Soy Blend Soy Fortified Rolled Oats	2.7	Daily except Sunday (CEA & IAD) (Monthly) (SESPAS)	0
India (Tamil Nadu) On-Site	Soy Fortified Bulgur Wheat Balahar Soy Fortified Sorghum Oil	2.6	Daily except Sunday	7
Pakistan Take-Home	Whey Soy Drink Mix Oil	1.6	Every two weeks or once a month at some centers	0

TABLE 26

PERCENT OF TOTAL COST OF FIVE CARE PRESCHOOL PROGRAMS PROVIDED BY LOCAL INPUTS AND COST OF LOCAL FOODS OF EQUIVALENT NUTRITIVE VALUE TO THE PL-480 COMMODITIES DISTRIBUTED

	Percent of Total Cost Locally Funded *	Local Foods Cost/100 Calories($)**	PL-480 Foods Cost/100 Calories CCC Value ($) **
Colombia	49	0.0226	0.0120
Costa Rica	94	-	-
Dominican Republic	29	0.0189	0.0084
India	39	0.0087	0.0109
Pakistan	6	0.0095	0.0153

* Local costs normally include transport of commodities in country, operating expenses at the centers, and administration, whereas food is the major foreign input. However, in Costa Rica nearly all foods are purchased locally, as is a small percentage of the food in India and Colombia. In Pakistan, no administration costs are locally funded.

** Costs are presented merely for food, exclusive of the costs of network distribution, administration, and local operating expense necessary to program them. Foods in Costa Rica Preschool Feeding Program are already mostly local.

TABLE 27

NUTRITIVE VALUE AND NET DIETARY PROTEIN CALORIES PERCENT (NDP CAL %) OF DAILY RATIONS IN FIVE CARE PRESCHOOL FEEDING PROGRAMS COMPARED TO FAO REQUIREMENTS AND AVERAGE NUTRIENT GAPS

Country	Ration Calories	% of FAO Calorie Requirement *	% of Average Calorie Gap	Ration Protein Gms.	% of FAO Protein Requirement*	% of Average Protein Gap	% Calories from Protein
Colombia (Take-Home)	305	22	80	18.3	49	113	24
Costa Rica (On-Site)	737	54	225	30.0	81	211	16
Dominican Republic (Take-Home)	337	25	70	17.9	48	104	21
India (On-Site)	340	25	62	16.0	43	86	19
Pakistan (Take-Home)	298	22	83	7.5	21	46	10

* For these purposes the FAO requirements were averaged for the entire age group and are estimated to be 1360 calories and 37 grams of protein.

and 30 grams protein per day. The Costa Rican ration could fill 54% of the daily calorie requirement and 81% of the protein requirement. This ration equaled 225% of the calorie gap, and 211% of the protein gap.

The Pakistan ration was the smallest, at 1.6 kilograms per month, providing 298 calories and 7.6 grams protein per day (only 10% of calories from protein). The ratio of protein was too low. A ratio of 15% to 20% of calories from protein for foods distributed to malnourished preschoolers (Graham 1967) was recommended in Chapter Two. All of the evaluated CARE programs except Pakistan provided rations with an NDPCal% greater than 15. This is not surprising, as most of the PL-480 foods available for distribution are soy-fortified, high-protein foods with NDPCal% scores higher than 15.

The rations provided were largely adequate in protein but insufficiently dense in calories. Thus, research is needed to find the best ways to increase the calorie content of present rations, possibly through the addition of oil or sugar, or to formulate new commodities with higher caloric density. (See in this series - Study III, Formulated Foods.) Costa Rica had the only ration which met the AID Food for Peace 1976 recommendation of a minimum of 510 calories in rations for preschoolers in supplementary feeding programs. If larger rations were distributed, consideration would have to be given to the likelihood that local governments could not continue to provide similar levels of food assistance if PL-480 inputs were withdrawn. Rations of high caloric density would also be needed to counteract the bulk constraint on the young child's digestive capacity.

2. Total Calorie and Protein Intake and Ration Consumption

A 24-hour-recall dietary survey was conducted on a subsample of program participants in each country, primarily to estimate whether or not the ration was closing the calorie and protein gaps. For the sake of consistency, mothers were asked to recall for the interviewer everything that the child had eaten on the day prior to the interview. Although all mothers interviewed were participants in the feeding program, a sizable number of children in each country had not eaten any CARE foods on the previous day. Thus, it was possible to use the reported diet of this group of children, who had not eaten the ration, as a basis for estimating the normal home diet in the absence of the ration. By comparing this diet with that of the children who ate CARE foods, the need of children for supplementary calories and protein and the effect of the current rations on meeting that need could be estimated.

In order to simplify the calculations, a caloric allowance of 1360 was used to score the adequacy of all diets. This allowance, taken from the FAO/WHO (1973) tables for children from one to three years, is derived by multiplying an estimated 101-calorie-per-kg requirement with an average body weight of 13.4 kg. The weight corresponds to an average 92% of weight for age for children equally distributed within the 12- to 60-month age range. Because the children in all of the samples are stunted in average height, this caloric allowance is not an unreasonable estimate of the amount required to maintain them at adequate weight for the lower heights that are the norm in their population groups.

It would not be enough to promote catch-up growth in cases of acute malnutriton or weight loss caused by illness. Children recovering from acute conditions are well known to be able to use up to two and a half times this number of calories per kilogram. Use of the lower average figure for estimating adequacy within the population as a whole does, however, allow for the fact that some children are eating double the amount during recovery, while others are eating only half because they are ill.

A 1360 calorie allowance also would not be sufficient to promote catch-up growth in height among low-income children to the level of the well-nourished children of the upper classes in their own countries or to the level of international reference standards. Catch-up growth in height has been achieved in other feeding programs in Colombia (Wray 1978b) and Guatemala (Martorell et al. 1978). It requires careful education and motivation of the mother, who must be persuaded to feed the target child in an amount that she perceives to be more than his fair share. It may be necessary for her to view the extra food as a medicine required to treat the child's condition. Such recovery was not a specified goal of the CARE programs.

Scrimshaw (1978) has demonstrated that the FAO/WHO protein allowances should be increased to allow for recovery from frequent diarrhea and respiratory infections. These episodes that occur at the weaning age reduce appetite and nutrient absorption and increase protein losses from the body. New allowances established by the UN working group (Scrimshaw 1978) specify that 11% to 12% of calories should come from protein in preschool diets based on grains and legumes. Thus, if the calorie allowance is 1360, 11%, or about 150, of these calories should come from protein. Since each gram of protein has about four calories, the protein allowance should be about 37 grams. This figure was used to score the adequacy of the diets of all children surveyed.

The use of both calorie and protein allowances based on an average requirement should produce reasonable average estimates in the absence of interactions between age and: (a) adequacy of consumption in general, (b) consumption of the ration in particular, and (c) measurement of consumption. The first interaction is problematic for the 12- to 24-month-old group, who are known in South India (Cantor 1974), for example, to consume a significantly lower proportion of requirement than older preschoolers. As mentioned previously, however, very few of this most needy group are reached by the feeding programs (and those reached may be atypical), so that the study does not attempt to present conclusions specifically applicable to them. As mentioned previously, a slightly larger percentage of older children were eating the ration in all countries, but these differences were not statistically significant. The 24-hour-recall data gathered for older preschoolers was found by Goldman and Overholt (1978) in Colombia to be less reliable than those for younger children, perhaps because mothers fed the younger ones personally, while the older ones could seek food from several sources.

In all countries, the children's diets consisted mainly of staple cereals, legumes, and some dairy products. Fruits and vegetables were noticeably absent from the diets in all five countries. It can be seen in Table 28 that average deficiencies, when home diets without the ration were compared to FAO requirements, ranged from a low of 327 calories and 6 grams protein in Costa Rica to a high of 549 calories and 12.6 grams protein in India.

When the diet included the CARE ration, estimates suggested that a sizable calorie gap still remained in all countries except Costa Rica, and a sizeable average protein gap in all countries except Costa Rica and Colombia (Figure 5). The relative excess of protein in the Costa Rica ration is not to be recommended because it may place a burden on recipients' kidneys and require that they drink more water. Furthermore, if caloric intake is insufficient, protein cannot be used for growth and maintenance, but will be converted to calories to meet the body's primary need for energy. Conversion of expensive protein foods to energy sources is not a very cost-effective approach to the problem of caloric deficiency.

Statistical averages can be deceiving, as they mask high and low values. Therefore, it is important to view the actual number of children affected with calorie and protein deficiencies (Tables 29 and 30). Without the ration, nearly all of the children (78% to 91%) in the feeding programs had diets deficient in calories, with the lowest percentage in Costa Rica and the highest in the Dominican Republic. Similar but slightly smaller numbers were affected by protein deficiency, ranging from highs in India and Colombia of 82% affected to a low in Costa Rica of 70%. The feeding programs were clearly reaching children with inadequate home diets. Severe calorie deficiency without the ration, as evidenced by intake of less than 700 calories (approximately half the FAO requirement), affected a high of 50% of the children in the Indian program to a low of 19% of the children in Costa Rica. Again, severe protein deficiency (intake less than or equal to 15 grams protein per day) affected fewer children, ranging from a high of 28% in India to a low of 4% in Costa Rica.

In Colombia and Costa Rica, consumption of the ration produced a significant decrease in the percentages of children with calorie and protein deficiencies. In India, the proportion with severe calorie deficiency was reduced, but the percentage of children with mild calorie deficiency was higher with the ration. However, the average calorie gap of the mildly deficient children was reduced from 677 calories without the ration to 430 calories with the ration. In other words, more children were affected by calorie deficiency after eating the ration - possibly because of the high rates of substitution of the rations for the home diet, as found in India - but the average calorie deficiency of the affected children was less.

Consumption of the ration in all countries reduced the estimated average calorie gap among deficient children anywhere from 59 to 247 calories, except in the Dominican Republic, where the calorie gap among deficient children seemed to remain the same with and without the ration, probably owing to high rates of substitution of the ration for the home

TABLE 28

DAILY TOTAL CALORIE AND PROTEIN INTAKE WITH AND WITHOUT RATION AND NUTRIENT GAP, USING FAO REQUIREMENTS FOR PRESCHOOLERS, IN FIVE CARE FEEDING PROGRAMS*

	Total Intake Without Ration			Gap Without Ration		Total Intake With Ration			Gap With Ration	
Country	Calories	Protein(gm)	N	Calories	Protein(gm)	Calories	Protein(gm)	N	Calories	Protein(gm)
Colombia	978±347	25.7±13.4	149	382	11.3	1,170±384	35.8±17.2	97	190	1.2
Costa Rica	1,033±385	31.0±16.0	105	327	6	1,495±349	53.0±12.0	61	0	0
Dominican Republic	877±351	24.7±14.0	130	483	12.3	925±384	25.8±12.3	116	435	11.2
India (Tamil Nadu)	811±451	24.4±15.4	60	549	12.6	972±239	32.9±7.7	193	388	4.1
Pakistan	1,004±424	27.8±15.2	207	356	9.2	1,187±598	29.0±16.8	47	173	8.0

* Most children were within the 12 to 47-month age group and would require 1360 calories and 37 grams protein per day by FAO standards. Means are presented ± standard deviation.

FIGURE 5
PERCENT OF REQUIREMENTS FILLED BY ESTIMATED TOTAL DAILY DIET INCLUDING RATION FOR PRESCHOOLERS IN FIVE CARE FEEDING PROGRAMS

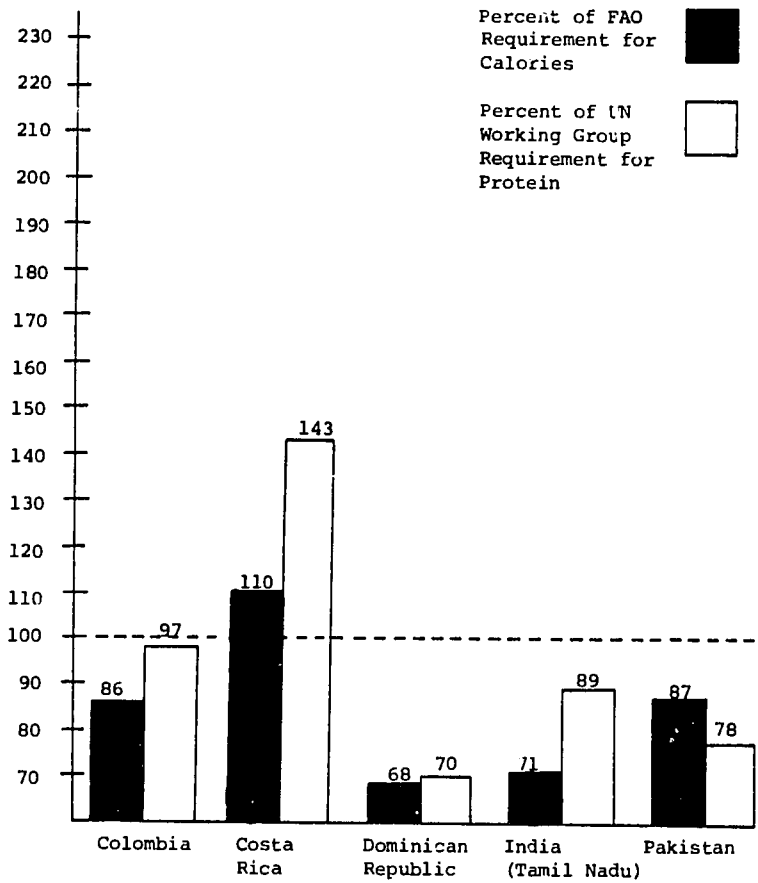


TABLE 29

PREVALENCE OF DAILY DIETS DEFICIENT IN PROTEIN AND CALORIES AMONG PRESCHOOLERS AND AVERAGE PROTEIN AND CALORIE GAP OF DEFICIENT CHILDREN IN FIVE CARE PRESCHOOL FEEDING PROGRAMS*

	Without Ration					With Ration				
		Percent Deficient in:		Average Gap Among:			Percent Deficient in:		Average Gap Among:	
Country	N	Calories	Protein	Calorie Deficient	Protein Deficient (Gms.)***	N	Calories	Protein	Calorie Deficient	Protein Deficient (Gms.)
Colombia	147	84**	82**	481	16.2	97	71**	64**	388	11.8
Costa Rica	105	78**	70**	492	14.2	61	44**	11**	289	2.1
Dominican Republic	130	91	82	559	17.3	116	85	82	557	15.5
India (Tamil Nadu)	60	88**	82**	677	18.7	193	93**	75**	430	7.5
Pakistan	207	82	76	506	16.4	47	72	62	447	16.0

* Deficient diets are those with less than the FAO requirements for 12- to 47-month-old children of 1360 calories and 37 grams protein per day. The protein and calorie gaps represent the difference between average intake and FAO requirements.

** Indicates a very significant difference ($p < .01$) in percent with protein or calorie deficiency among the group who ate the ration and the group who did not.

*** Sample sizes for calculation of protein gap were slightly smaller than listed N values because of elimination of some cases with missing values.

TABLE 30

PREVALENCE OF SEVERE PROTEIN AND CALORIE DEFICIENCY AMONG PRESCHOOLERS IN FIVE CARE FEEDING PROGRAMS*

	Without Ration			With Ration		
		Percent Consuming			Percent Consuming	
Country	N	≤ 700 Calories	≤ 15 gms Protein	N	≤ 700 Calories	≤ 15 gms Protein
Colombia	147	20.4 **	20.4 **	97	5.1 **	7.3 **
Costa Rica	105	18.7 **	3.7	61	1.1 **	0
Dominican Republic	[illegible]0	35.1	22.3	116	28.4	22.4
India (Tamil Nadu)	60	50.0 **	28.3 **	193	9.3 **	0 **
Pakistan	207	23.2	16.9	47	17.0	17.1

* Severe protein and calorie deficiency equal consumption of less than or equal to 700 calories and 15 grams protein per day. This represents approximately half of the FAO requirement of 1360 calories and 37 grams protein for 12- to 36-month-old children.

** Indicates a very significant difference, $p < .01$, in percent with severe calorie or protein deficiency among the group who ate the ration and the group who did not.

diet. The estimated decrease in calorie gap was twice as great in the on-site feeding programs in Tamil Nadu and Costa Rica as in the take-home feeding programs in the other countries.

Estimates by country of the proportion of children with protein deficiency ranged from 70% to 82% on the regular diet and from 11% to 82% with the supplement. The proportion with severe deficiency - i.e., less than 15 grams per day - remained unchanged in Pakistan and the Dominican Republic after consumption of the ration, but was eliminated in Costa Rica and India, according to the estimates.

The foods were reaching children with severe calorie and protein insufficiency, and helping to reduce the numbers with deficiency as well as to reduce the size of the gaps of the deficient children.

It can be seen in Table 31 that ration consumption was higher in the on-site feeding programs than in the take-home feeding programs, thus providing a higher proportion of the child's total caloric intake (35% to 49%) than the estimated consumption in take-home feeding programs, which provided from 11% to 16% of the total daily calories. The foods provided 49% to 57% of the total protein intake in on-site feeding, and 17% to 30% in take-home feeding. The greater consumption of the intended ration in on-site feeding is probably due to the fact that intrafamilial sharing of the food does not occur, as it does in take-home programs. There appears to be a greater reliance on the ration foods in on-site feeding programs. Another interesting difference is that the foods provided a larger percent of the total caloric intake in diets of deficient children than in diets of children whose caloric intake was adequate, thus confirming the fact that mothers of deficient children are more dependent on donated foods than mothers of well-nourished children, perhaps reflecting income differences.

3. Sharing with Other Family Members

In the on-site feeding programs in Costa Rica and India, the children were reported to consume the entire ration they were served, and this ration was assumed to be the actual consumed ration in all estimations (although figures including a measure of plant wastage would have been more accurate). However, it should be noted that in India, a number of children took the cooked meal home. In take-home feeding programs, mothers reported consumption by their children equal to only half the amount they were given by the center (Table 32). The rate was consistent among all take-home feeding programs studied, and agrees with the previous finding among preschoolers in the take-home feeding scheme of Project Poshak, in which reported average daily consumption was only 43% of the distributed ration (Gopaldas et al. 1975). This may be due in part to the fact that in take-home feeding programs, the ration intended for one child was shared by an average of two family members, thus making only half the intended amount available to the child.

TABLE 31

PERCENT OF TOTAL DAILY CALORIC AND PROTEIN INTAKE PROVIDED BY RATION CONSUMED IN FIVE CARE PRESCHOOL FEEDING PROGRAMS

Country	Sample Size	Total Caloric Intake ± S.D.	Ration Calories ± S.D.	% of Total Calories From Ration	Total Protein Intake ± S.D.	Ration Protein ± S.D.	% of Total Protein From Ration
Colombia (Take-Home)	97	1,170±384	165±147	14.1	35.8±17.2	9.6±9.3	26.8
Costa Rica (On-Site)							
Lunch Only	28	1,198±325	504± 0*	42.1	41.0±15.3	18.6± 0*	45.4
Breakfast and Lunch	61	1,495±349	737± 0*	49.3	53.0±12.0	30.0± 0*	56.6
Dominican Republic (Take-Home)	116	925±384	153±120	16.5	25.8±12.3	7.8±5.5	30.2
India (Tamil Nadu) (On-Site)	193	972±239	340± 0*	35.0	32.9±7.7	16.0± 0*	48.6
Pakistan (Take-Home)	47	1,187±598	131±98	11.0	29.0±16.8	4.8±3.7	16.6

* Costa Rica and India conducted on-site feeding programs, and every participant was provided approximately the same amount of calories and protein in the ration.

TABLE 32

RATION CONSUMPTION IN THREE
CARE TAKE-HOME FEEDING PROGRAMS FOR
PRESCHOOLERS

Country	Sample Size	MEAN DAILY RATION CONSUMPTION			
		Calories±S.D.	% of Calories Distributed*	Protein±S.D.	% of Proteins Distributed*
Colombia	97	165±147	54.1	9.6±9.3	52.5
Dominican (wet)	98	153±120	44.8	7.8±5.5	43.6
Republic (dry)	22	166± 76	49.2	8.8±3.9	49.2
Pakistan	47	131± 98	44.0	4.8±3.7	63.1

* Calculated on basis of total ration distributed for daily consumption.

The number of people sharing the ration emerged as one of the trongest factors associated with low nutritional impact in two - Colombia nd the Dominican Republic - of the three take-home feeding programs, where he number of people sharing the ration was higher at low impact centers. others in the present study were very uninhibited in answering that everal family members shared the ration, perhaps indicating that little ffort had been made by the centers to impress them with the fact that the ation was intended for the target child only. There is a need for more ducation along these lines when the food is distributed to the mothers. evertheless, many question the feasibility of changing the family eating attern by getting mothers to prepare special foods for one child, espe-ially given the strong economic motivation for sharing. For this reason, t has been recommended that rations be doubled in take-home feeding rograms, to provide enough food to compensate for the effects of intra-amilial distribution.

Substitution and Supplementation Effects of the Ration

Use of the ration as a substitute for foods normally fed to the hild at home plays a large role in reducing the net effect of the ration n closing the nutrient gap in both on-site and take-home feeding programs. herefore, the ration's effect on the normal home diet through increased alories and substituted calories was studied. It should be pointed out hat the figures presented for increased and substituted calories represent hugh estimates derived by the following calculations:

Increased Calories = Average caloric intake of children who ate the ration

Minus

Average caloric intake of children who did not eat the ration.

Substituted Calories = Average ration calories consumed

Minus

Increased calories.

The data reported here are of a cross-sectional nature and repre-nt gross calculations. Having been derived from two different groups of ildren, they are not as precise as data gathered on the same group of ildren before and after eating the rations would be. Such baseline data re not available in the survey. Nevertheless, the two groups being com-ared for the dietary calculations appeared to be the same on most param-ters,[1] except that some ate the ration on the previous day and some did t. The substitution effect of the ration on the home diet varied con-derably from site to site in each of the countries studied, ranging from substitution to total substitution; however, the sample sizes at each te were too small to make these estimates reliable. Therefore, only the erall program estimates for each country will be presented.

There appeared to be little or no substitution of the ration for the normal home diet in either Colombia or Pakistan (Table 33). This is understandable in Pakistan, as so few children ate the ration and the mothers' low opinion of the received foods would not lead them to consider these foods equivalent substitutes for normally given foods. However, the finding of no substitution in Colombia is surprising, as other studies there have shown substitution to be a major factor in take-home feeding. Some possible explanations are as follows. Among all five countries, the calorie gap among the calorie-deficient children, both before and after eating the ration, was the lowest in Colombia, and the rate of acute malnutrition was also the lowest, although the proportion with chronic malnutrition was as high as that in Pakistan. The percent of children with no calorie gap after eating the ration was one half the rate in all other countries except Costa Rica. All these factors point to a more adequate family food situation, making the need for substitution less urgent. More families are involved in subsistence agriculture in Colombia than in the other countries, so the amount of food in the home is less likely to be influenced by purchases; when the family produces its own food supply, the amount of money to be saved by substitution would be greatly reduced. One final possible explanation is that the nutrition education component was strongest in the Colombia feeding program, compared to the others; mothers there exhibited the most knowledge as to cause and treatment of malnutrition. Greater nutritional knowledge, combined with a more adequate family food supply, would seem to be a plausible explanation for the minimal substitution found in the Colombia program.

In the other three countries, 37% to 69% of the consumed ration was substituted for the normal home diet, with the lowest percent in Costa Rica and the highest in the Dominican Republic. The rates of substitution seem to parallel the size of the calorie deficit in the normal home diet; in cases of high deficiency, substitution was higher. The calorie gaps were very large in both the Dominican Republic and India, which would explain the need to substitute a large part of the ration for the normal diet. These data confirm the commonly held suspicion that there is widespread substitution in supplementary feeding programs.

It is likely that substitution will always be a major factor, particularly in on-site feeding programs, because of the mother's notion that a cooked meal consumed at the center obviates the need to cook another meal for the child at home. A suggestion has been made that scheduling on-site feeding activities more as snack programs at an hour of the day not normally associated with a meal might reduce the substitution problem. Other measures to counteract the substitution problem are increased rations and education. More research into the determinants of the problem is warranted.

Because of the substitution effect, the net increase in calorie intake was less than the caloric value of the ration consumed, and because of sharing, the increase was considerably less than the amount of calories distributed to the mothers and intended for daily consumption. The estimated net calorie increase is represented here as a percent of the intended increase according to program design from the rations distributed:

PLANNED AND CONSUMED RATIONS COMPARED TO
CALORIE GAP FOR PRESCHOOL CHILDREN USING FAO REQUIREMENTS
IN FIVE CARE FEEDING PROGRAMS*

Country	Calorie Gap (FAO)	Planned Ration		Consumed Calories/ Ration	% Who Ate Ration**	Ration Effect on Diet		Days per Month No Food Provided	Net Daily % Calorie Gap Closed For Group***
		Calories	% of Gap Closed			Increased Calories	Substituted Calories		
Colombia (Take-Home)	382	305	80	165	50	165	0	0	21.6
Costa Rica (On-Site)	327	959	293	737	79	462	275	6	88.2
Dominican Republic (Take-Home)									
Wet Daily	465	337	72	151	51	37	114	0	4.0
Dry Monthly	557	337	61	166	47	92	74	0	8.0
India (Tamil Nadu) (On-Site)	549	383	70	340	86	160	180	6	28.2
Pakistan (Take-Home)	356	298	83	131	18	131	0	0	6.6

* On the basis of body weight, most children would require an average 1360 calories per day (FAO/WHO 1973) and 37 grams protein (Scrimshaw 1978).

** Mothers who used CARE foods in total dietary intake of child on the day prior to the 24-hour-recall.

*** Increased calorie intake divided by calorie gap and multiplied by percent of the month when food provided (100% in take-home programs) and by percent who ate ration.

	Estimated Net Calorie Increase as Percent of Intended Increase
Colombia (take-home)	54%
Costa Rica (on-site)	63
Dominican Republic (take-home)	
Wet daily	11
Dry monthly	27
India - Tamil Nadu (on-site)	47
Pakistan (take-home)	44

The program with the largest ration, Costa Rica, had the most success in increasing dietary calorie intake. The rates are similar among Pakistan, India, and Colombia, suggesting that net calorie increase can be as great in take-home feeding as in on-site feeding. The Dominican Republic had the least effect because of the high rate of substitution there. The Tamil Nadu Nutrition Study of take-home feeding (Cantor Associates 1974) found the net increase in calorie intake to be 18% of the intended one, and the Poshak study (Gopaldas et al. 1975) found net calorie increases ranging from 32% to 54% of the intended increase at various phases of the study. These figures give a realistic view of the impact of supplementary feeding on total dietary intake of very poor populations, unless rations are greatly increased to compensate for the predictable leakages of sharing and substitution of the ration, unless nutrition education is particularly effective. Even at a very high ration level (Costa Rica) and among a relatively higher income and less nutritionally deficient group, only 63% of the ration represented a net calorie increase.

The net daily percent of the calorie gap closed for program participants as a group is also shown in Table 33. This calculation divides the net calorie increase resulting from the ration by the average calorie gap and multiplies the result by the percent of the total group who actually ate the ration. In effect, this measures the net incremental contribution of the consumed rations toward reducing the target groups' average calorie deficit. The six days per month when food is not provided in on-site feeding programs was also taken into account. These results again show the on-site feeding in Costa Rica to have the greatest effect, as it closes 88.2% of the calorie gap. The next most effective program is on-site feeding in Tamil Nadu, India, which closes 28.2% of the calorie gap. The greater effectiveness of the on-site approach in closing the calorie gap is due to both more ration calories consumed and higher percent of participants eating on a daily basis. Colombia has the greatest calorie impact of the take-home feeding programs, closing 21.6% of the calorie gap. This is largely a result of the low rates of substitution there, but the percent who ate is much lower than in on-site feeding. The Pakistan and Dominican Republic programs appear to have minimal effect on closing the calorie gap because of high substitution in the Dominican Republic and low percent eating in Pakistan. However, it should be noted that the take-home programs reached more target-group individuals; coverage was higher, but impact on the gap was lower.

The dietary intake and supplementation and substitution effects of he ration were studied separately for one- to three-year-old children and hree to five year olds (Tables 34 and 35). In Costa Rica, India, and kistan, the calorie deficiencies of one- to three-year-old children who d not eat the ration were much greater than those of the three to five ar olds. In India and Pakistan, this is a result of the practice of late troduction of solid foods. (And in all cases this finding is partially artifact of using the same calori. requirement for the different age roups.) The ration calories consumed by the different age groups were t significantly different. However, substitution was greater among the ree to five years olds in the three countries where substitution was evalent, i.e., Costa Rica, the Dominican Republic, and Tamil Nadu, India. e percent of ration calories substituted for the normal hone diet in ree to five year olds was 54% in Costa Rica, 74% in the Dominican Republic, d 84% in India. Younger preschool children tend to be fed less and fewer ods in general. Therefore, the ration being given to the mother espe- ally for those children does not replace other foods. This is especially ue in India, where the average one to three year old is severely calorie ficient before he or she receives the ration; with the ration, the calorie p of one to three year olds has been sizeably reduced, by 270 calories. the other hand, the older child consumes more of the adult diet for ich the ration is substituted. Thus, it would appear that supplementary eding is more effective in raising the net calorie intake of children unger than three years than of older children. The one to three year ds are the most nutritionally at risk due to greater caloric deficiencies, d it has already been stressed that priority should be given to enrolling is age group in feeding programs. Thus, targeting to the under threes is tified not only on a nutritional need basis, but also on a nutritional fectiveness basis.

There are a few children whose calorie intake is adequate either fore or after consuming the ration. Therefore, a few program resources e being spent to feed a group whose home diets are already adequate. ever, the children whose diets were adequate in calories consumed more tion calories, and a greater number of these calories were substituted r the home diet in all countries surveyed (Table 36).

To summarize, the major leakages of program inputs which decreased e potential nutritional impact of distributed rations shown in Table 37 sharing, substitution, noncomsumption, and consumption by the well urished. As was discussed earlier, the nutritional impact of the feed- g programs could be increased by distributing larger, more acceptable tions with enough caloric density to close the average calorie gap of ficient children and to compensate for leakages, and by improving nutri- on education. The quantity of food distributed is reduced by sharing thin the family in take-home programs and by substitution for the normal e diet in both take-home and on-site feeding programs. The total quan- ty of the ration needs to be doubled from the present level to compensate r the effects of intrafamilial distribution and replacement of the home t by the ration. Costa Rica, which distributed a ration with twice the oric value of the rations in other four countries, was the only country which the ration plus the home diet closed the calorie and protein gap

TABLE 34

MEAN DAILY CALORIE AND PROTEIN INTAKE ± STANDARD DEVIATION
OF PRESCHOOLERS GROUPED BY AGE IN FIVE CARE FEEDING PROGRAMS

Country	Total Intake Without Ration			Gap Without Ration*		Total Intake With Ration			Gap With Ration*	
	Calories	Protein	N	Calories	Protein	Calories	Protein	N	Calories	Protein
Colombia (Take-Home)										
1-3 Yrs.	988±358	25.7±13.4	68	372	11.3	1218±397	39.2±18.3	46	142	0.0
3-5 Yrs.	970±341	25.2±11.7	78	399	11.8	1125±369	32.6±15.7	50	235	4.4
Costa Rica (On-Site)										
1-3 Yrs.	917±347	30.8±16.0	36	443	6.2	1325±251	51.6±15.6	24	35	0.0
3-5 Yrs.	1063±393	29.8±15.1	68	297	7.2	1403±329	48.7±11.2	65	0	0.0
Dominican Republic (Take-Home)										
1-3 Yrs.	883±352	26.0±15.5	58	477	11.0	925±384	26.1±14.1	47	436	10.9
3-5 Yrs.	884±350	23.6±12.1	53	476	13.4	929±375	25.3±10.8	63	431	11.7
India (Tamil Nadu) (On-Site)										
1-3 Yrs.	667±365	20.7±13.7	26	693	16.3	937±236	30.9±6.7	79	423	6.1
3-5 Yrs.	935±483	27.7±16.4	33	425	9.3	990±237	34.2±8.2	110	370	2.8
Pakistan (Take-Home)										
1-3 Yrs.	947±418	25.7±14.3	104	413	11.3	1086±592	29.0±19.6	19	274	8.0
3-5 Yrs.	1060±442	29.1±16.6	86	300	7.9	1257±603	32.0±12.1	27	103	5.0

* Gap based on FAO requirement of 1360 calories and 37 grams protein for 12- to 47-month-old children.

TABLE 35

SUPPLEMENTATION AND SUBSTITUTION EFFECTS
OF RATION ON THE HOME DIET OF PRESCHOOLERS GROUPED
BY AGE IN FIVE CARE FEEDING PROGRAMS

	Mean Ration Consumed±S.D. Calories	Protein (gms)	Sample Size	Effect on Diet: Increased Calories Mean	% of Intended*	Substituted Calories
Colombia						
Take-Home						
1-3 Yrs.	194±162	11.9±11.1	46	230	75.4	0
3-5 Yrs.	138±126	7.2±6.5	50	155	50.8	
Costa Rica						
On-Site						
1-3 Yrs.	737	30	24	408	55.4	329
3-5 Yrs.	737	30	65	340	46.1	397
Dominican Republic						
Take-Home						
1-3 Yrs.	128±97	6.7±5.1	47	42	12.5	86
3-5 Yrs.	173±131	8.7±5.6	63	45	13.4	128
India						
On-Site						
1-3 Yrs.	340	16	79	270	79.4	70
3-5 Yrs.	340	16	110	55	16.2	285
Pakistan						
Take-Home						
1-3 Yrs.	124±96	4.3±2.9	19	139	46.6	0
3-5 Yrs.	136±101	5.1±4.2	27	197	66.1	0

* Calculated on basis of total ration distributed for daily consumption.

TABLE 36

MEAN CALORIE INTAKE AND THE SUPPLEMENTATION AND SUBSTITUTION EFFECTS OF RATION ON THE HOME DIET OF PRESCHOOLERS WITH AND WITHOUT A CALORIE GAP* IN FIVE CARE PRESCHOOL FEEDING PROGRAMS

Country	Mean Calorie Intake Without Ration	N	Mean Calorie Intake With Ration	N	Mean Ration Consumed	% of Total Calories From Ration	Ration Effect on Diet Calories Increment	Ration Effect on Diet Calories Substitute	Percent Who Ate Ration
Colombia									
Calorie Gap-Yes	879	125	972	68	139	14	93	46	51
Calorie Gap-No	1539	22	1650	28	228	14	111	117	60
Costa Rica									
Calorie Gap-Yes	868	83	1071	42	737	69	203	534	17
Calorie Gap-No	1611	23	1659	53	737	44	48	689	26
Dominican Republic									
Calorie Gap-Yes	801	119	803	95	144	18	2	142	85
Calorie Gap-No	1626	12	1635	17	209	13	9	200	100
India (Tamil Nadu)									
Calorie Gap-Yes	683	53	930	180	340	37	247	93	66
Calorie Gap-No	1776	7	1545	13	340	22	-231	340	93
Pakistan									
Calorie Gap-Yes	854	170	913	34	114	12	114	59	45
Calorie Gap-No	1692	37	1906	13	175	9	214	0	67

* Children with a calorie gap have diets containing less than 1360 calories per day, which is the FAO requirement for 12- to 47-month-old children.

RANGE OF LEAKAGES OF PROGRAM INPUTS AMONG TEN SITES EVALUATED IN EACH OF FIVE CARE PRESCHOOL FEEDING PROGRAMS

Country	Number of People Sharing Each Ration	Percent of Participants With No Calorie Deficit*	Percent of Participants Without Malnutrition** (20 Sites)	Percent of Participants Not Eating Ration***	Percent of Consumed Ration Substituted For Home Diet
Colombia (Take-Home)					
Range	1.6-2.7	0-33	71-100	28-74	Not Available
National	2.2	15	89	50	0
Costa Rica (On-Site)					
Range	No Sharing	0-33	36-93	13-36	Not Available
National	No Sharing	22	73	21	37
Dominican Republic (Take-Home)					
Range	1.8-2.8	0-36	55-93	4-73	Not Available
National	2.2	9	76	50	69
India (Tamil Nadu) (On-Site)					
Range	No Sharing	0-25	20-57	4-44	Not Available
National	No Sharing	12	39	14	53
Pakistan (Take-Home)					
Range	2.3-3.6	5-36	0-71	61-100	Not Available
National	2.8	18	47	82	0

* Comparison of home diet without the ration to FAO requirement of 1360 calories for 12- to 36-month-old children.

** Percent of recent enrollees in program for less than or equal to 9 months with weights less than 90% of NAS reference weight for height.

*** Based on number of mothers who mentioned feeding CARE foods to their child on the day prior to the 24-hour-recall survey. On-site feeding programs precluded sharing of foods.

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of most of the participants. Consequently, the nutritional impact of the program was highest in Costa Rica. Rations in Colombia, the Dominican Republic, Tamil Nadu, India, and Pakistan were all approximately the same in quantity and caloric content, and yet the caloric deficits of the children varied widely among these countries.

Rations should be calculated on the basis of the average calorie gap of the deficient children in each country. The substitution effect was greater when the calorie deficit was larger, and a more ample ration would be needed to compensate for this. The results of the CARE evaluations provide positive evidence for the rationale set forth earlier for determining a ration quantity sufficient to close the calorie gap and compensate for dispersion of the ration through sharing and substitution.

IV. PROGRAM TIMING

The feeding programs evaluated reached many children and mothers during periods of peak vulnerability, e.g., from 6 to 36 months of age for children and during pregnancy and lactation for mothers. However, as previously stated, there were no enrollment criteria which gave preference to these groups. None of the programs was attempting to implement the novel idea of providing children with extra supplementation during seasons of food scarcity. The programs in some instances were located in countries where the "hungry season" may be very severe, such as in Tamil Nadu, India.

In the two take-home feeding programs which distributed rations in dry form (Colombia and Pakistan), mothers were expected to collect the food every two weeks or once a week. In the Dominican Republic, where the take-home rations were distributed already mixed with water, mothers came to collect the food daily except on Sunday. The on-site feeding programs also followed a daily-except-Sunday distribution schedule. In Tamil Nadu, children ate one meal per day at the feeding center, usually around midday, whereas in Costa Rica, children ate both breakfast and lunch at the feeding center. All children in the programs were eligible to receive their ration with the same frequency. No additional distributions were scheduled for the more severely malnourished, a method suggested earlier as a possible means of closing the greater calorie deficit among these children.

Only in the Colombian program were limits beyond those of the usual age eligibility, i.e., up to five years old, set in the length of time that a child could participate in the feeding program. In Colombia, the take-home feeding program was designed to enroll children for only a six-month cycle. This time limit was set primarily because of the financial constraints of the program and the desire to cover as many children as possible. The strong education component in the program, it was hoped, would provide mothers with sufficient knowledge of proper child-rearing practices and good nutrition, to both cure and prevent future malnutrition. However, in reality the six-month enrollment limitation is often not enforced, because there are not enough additional children in the community to enroll in place of the existing participants. Furthermore, it was found in the CARE evaluation that six months was insufficient time to improve the nutritional status of most children. In none of the evaluated

ograms was children's growth monitored in order to determine if they had ached a level of recovery sufficient to warrant their graduation from the ogram, although this would obviously be the most useful approach.

In many countries the coverage of the malnourished preschool popu- tion by feeding programs remains low, and it would seem that limiting length of enrollment, based on the achievement of a certain level of tritional recovery, would allow space for new groups of children to par- ipate. This would be a more cost-effective way to use program resources n the indefinite duration of participation that currently exists. How- r, if the underlying causes of the malnutrition (e.g., feeding habits low incomes) have not changed, then returning the recovered child to the iginal environment may result in a malnutrition relapse. At a minimum, nutritional status of those removed from the program should be moni- ed. Furthermore, giving priority to children in the 6- to 36-month age n would provide protection during that vulnerable period, and would er the probability of severe malnutrition when the older child is oved or excluded from the program.

LOCATION

In general, the location of the food distribution sites was deter- d by existing infrastructure. Programs were frequently tied to the local lth center. This is far more economical than building new locales just food distribution.

Use of existing facilities limited serious consideration of essibility in terms of travel time for beneficiaries, the image of the ale, and the nutritional needs of the area. However, findings showed t one-way travel time to on-site feeding centers averaged ten minutes, reas the average take-home food distribution site was twice as far from eficiaries' homes - 20 to 24 minutes each way. Distance did not present roblem except in the Dominican Republic, where mothers had to collect d daily for take-home consumption and took almost one hour for the round p. They complained of carrying the liquid food home over this distance of the inconvenience of daily trips with all their other chores. tion was also found to be less than ideal at some on-site feeding ters built by CARE in Tamil Nadu, India, because they were situated in tions of the villages that were off-limits to the lower caste groups were the poorest and most nutritionally in need. Greater sociological y of the caste structure and mores of villages could facilitate the ction of a more appropriate locale for feeding centers.

The project definition of an urban area was a community with 5,000 inhabitants. Using this definition, the following percentage sites evaluated were in urban communities: Colombia - 25%, Costa Rica - the Dominican Republic - 25%, Tamil Nadu - 39%, and Pakistan - 90%. n, the number of centers in rural areas was determined largely by the tion of the existing infrastructure used by the feeding programs.

A. Site Facilities

In Colombia, Costa Rica, and Tamil Nadu, India, CARE has assisted the local government in construction of many of the feeding program sites. These feeding centers may be rudimentary structures or sophisticated ones with running water and flush toilets, depending on the level of funding available for their construction. Food distribution sites provided by CARE's counterparts in the Dominican Republic are small but adequate buildings just large enough to house the program administrator and a table for dispensing take-home rations. Mothers must wait outside. In the traditional Indian balwady or day-care center, food is cooked over a simple fire and children sit on the floor to eat their rations. All facilities seemed adequate for the program activities, with the exception of providing nutrition education classes for mothers. For this purpose, some of the sites would have to be enlarged to provide suitable classroom space, particularly during rainy weather.

Reliable measuring devices for assuring the distribution of the accurate ration quantity were not available at some sites. Scales and measuring tapes for determining the nutritional progress of beneficiaries were available at many sites in Colombia, but were seldom seen in other countries. This equipment should be provided to all feeding sites to assure the distribution of the correct ration and to make it possible to monitor the growth progress of beneficiaries. Centers also need greater access to potable water and latrine facilities. The greatest obstacle to equipping and improving center facilities is the high cost of doing so and the expectation that this money will be provided from local funds, which often are not available. Ways are needed to generate funds for these purposes. For instance, often the sale of empty food containers in PL-480-based programs can be used to generate resources.

B. Personnel Administration

The average number of beneficiaries per staff member ranged from 19 to 58, except in the Dominican Republic where the staff load was 272. Program administrators generally received basic training in food distribution procedures, but no instruction in nutrition. This was not the case in Pakistan, where the "lady health visitors" who run the program at the health centers were educated in nutrition and health at special seminars conducted by CARE, and in Colombia, where the women in charge of the feeding centers were assisted by regional nutritionists with university degrees. In general, all feeding center administrators could benefit from additional training on the nutritional goals of the programs and how they can best be achieved, the importance of maintaining accurate records, and techniques for providing mothers with nutrition education. The feeding program administrator is often overworked, particularly in health centers, where he or she has many other duties to perform. The planner should be cautioned against expecting one person to perform too many tasks; there may be a need to hire assistants if program funds are available. Alternatively, mothers could be required to do some of the work, and volunteer workers could be solicited from the community.

VI. LOGISTICS AND CONTROL

In all evaluated sites, the delivery system was functioning relatively smoothly, with food having been received by the beneficiaries for at least nine out of the intended twelve months. Internal food losses were insignificant and never amounted to more than 0.4% of the total commodities handled. CARE is responsible for ordering PL-480 commodities from the United States, the amount based on Annual Estimates of Requirements (AER). These foods are shipped by sea to the various countries, and occasionally shipment delays have caused food shortages that have affected the efficiency of the programs. Such delays are not common and are often unavoidable. Once in the country, food is cleared through customs at the port by CARE personnel and delivered to a central warehouse. Usually at this point government personnel or contracted private transport companies take over and deliver the food to regional warehouses and eventually to food distribution sites. Warehouse conditions are carefully controlled by CARE to prevent food loss through environmental damage or infestation. Occasionally, CARE has assisted in the construction of the warehouses. In the countries studied, food was most frequently delivered by truck, although some use was also made of rail and plane transportation. As stated earlier, carefully negotiated contracts with shippers are necessary to prevent subsequent disputes over terms that result in delivery delays. Such a dispute took place in Pakistan subsequent to the evaluation and paralyzed food deliveries for over six months.

Inventory control and food allocation from the regional warehouse are based on receipt of monthly stock reports from the feeding centers, which list the previous month's balance, the commodities consumed over the reporting period, and the balance, the commodities consumed over the reporting period, and the balance on hand. Food is usually delivered to distribution sites every one to three months. CARE field officers visit warehouses and centers frequently to check on inventories and records.

In Costa Rica, where most of the on-site feeding programs utilize locally purchased foods, delivery is achieved through the commercial channels established by the National Production Council (CNP). Center administrators go directly to CNP outlets in their communities to buy government-subsidized products, especially rice and beans. This use of the commercial delivery system has proved to be very efficient. In Tamil Nadu, India, the preschool program makes use of the well-established and efficient delivery system already in place for the school feeding program. The only problem with this sharing of the delivery system is that when any commodity is in short supply, as was the case with vegetable oil in 1976, the needs of the school lunch program will be met first, because the Education Ministry is in charge of deliveries.

The most commonly encountered problems that hampered the regular delivery of the intended ration to beneficaries were the following:

- late arrival of shipment from the United States, resulting in depleted food stocks in the country.

- commodities comprise too small a load for economic delivery to individual centers.

- trucks used to deliver the foods are not available because they are delivering higher priority commercial goods (especially during harvest season).
- faulty records of food stocks at centers leads to inaccurate or delayed activities.
- budget for food deliveries is diminished toward the end of the fiscal year.
- centers hold damaged commodities and do not know the proper manner to dispose of them.
- lack of standard measuring devices result in distribution of rations of inaccurate quantity.

Most of these obstacles can be overcome by better planning and training of project staff. It is vital that such problems be corrected in order to assure the regular arrival of commodities at the feeding sites and their distribution to mothers and children in the correct quantity.

Other problems of control encountered in the surveys were the lack of accurate and up-to-date attendance records for individual beneficiaries and failure to monitor growth progress of beneficiaries. These records should be made mandatory, and staff should be given careful training in their importance and in how to maintain them accurately.

VII. INTEGRATION

As has been explained previously, it is always desirable to integrate feeding programs with provision of nutrition education, and it may often be necessary to include potable water, immunizations, and environmental sanitation if maximum and permanent nutritional impact is to be achieved. Therefore, the roles of health status and nutrition knowledge were studied in the CARE evaluations. (See also in this series - Study II, Nutrition Education and Study VII, Integrated Nutrition and Primary Health Care Programs

A. The Role of Diarrhea and Morbidity Factors

The interaction of nutrition and infection has been well documented, and this interaction can greatly influence the nutritional impact of any feeding program. Scrimshaw (1975) has stated that "infections of almost any degree of severity worsen nutritional status by interfering with food intake and by causing an increased loss of essential nutrients from the body. Conversely, the most common types of malnutrition, even when subclinical, affect one or more of the mechanisms of resistance to infections or to the resulting infectious disease." Diarrhea plays a synergistic role with infection in malnutrition, particularly in the preschool years, through loss of ingested foods from the body, malabsorption, and withholding of food by the mother. Diarrhea occurs more often and has more serious

consequences among children with malnutrition, and after a bout with diarrhea, a marginally malnourished child may become seriously malnourished (Heller and Drake 1976; Wall and Keeve 1974). Therefore, information was collected on the disease history, diarrhea patterns, and access to protected water and latrines of program participants.

The percent of children who had reportedly suffered from various common communicable diseases of early childhood is presented in Table 38. On the average, 4% to 10% of the children surveyed had had chicken pox, except in India, where the rate was much higher (44%). The incidence of all diseases, especially measles and pneumonia, was lowest in Costa Rica. There is an active immunization campaign against measles in Costa Rica. The highest incidence of measles was in the Dominican Republic, where 44% of the children had been affected. The highest incidence of pneumonia was in Pakistan, where 38% of the children had been affected, according to their mothers. Both measles and pneumonia had affected many children in all countries, and the nutritional consequence of these diseases is known (Scrimshaw 1975).

All mothers in the program and comparison group were asked if their preschool child had suffered from any illness in the past year serious enough to necessitate that the child be bedridden or to keep him or her from eating normally for more than two weeks. Their responses are subject to considerable inaccuracy because of faulty memory and therefore should be interpreted with caution. The rates in this past-illness category were very similar for participants and nonparticipants, except in India, where significantly more serious illness was reported among program participants. However, the rate of serious illness was lowest in India, when compared with all other countries, both participants and nonparticipants. The highest rates of past illness were reported in the Dominican Republic, where the lowest percentage of the program is conducted in health centers (20%). It is not surprising that rates of past illnesses are similar between program participants and nonparticipants, because few health services are delivered to program beneficiaries as integral components of the feeding programs. Of all variables studied, past illness showed the strongest association with malnutrition in India, Pakistan, and the Dominican Republic, and similar findings were reported in Project Poshak (Gopaldas et al. 1975). Therefore, it might be that the weakness of the health-services component of the present feeding program is serving as a deterrent to nutritional impact.

When the prevalence of infectious disease is high, the level of nutrient intake may have limited effect on nutritional status. Beghin and Viteri (1973) have stated that a program to combat communicable diseases is a necessary complement to any nutritional rehabilitation program because of the interference of infections and parasitic disease with the recuperation process. The need to integrate feeding programs with health services has often been stated.

TABLE 38

PERCENT OF PRESCHOOLERS IN FIVE CARE FEEDING PROGRAMS WHO WERE REPORTED TO HAVE SUFFERED FROM VARIOUS DISEASES

Disease	Colombia	Costa Rica	Dominican Republic	India	Pakistan
(Sample Size)	243	200	246	253	254
Chickenpox (%)	4.5	7.0	9.3	43.9	10.2
Measles (%)	27.2	14.5	43.9	20.2	38.6
Pneumonia (%)	28.0	5.5	7.3	10.7	38.2
Past Illness (%)*					
Participants	32.9 (N=897)	26.6 (N=507)	40.6 (N=1,200)	21.5** (N=963)	23.9 (N=794)
Nonparticipants	33.0 (N=536)	26.7 (N=266)	45.5 (N=822)	17.6** (N=859)	27.4 (N=461)

* Past illness equals a general category for any sickness that had the child bedridden or not eating normally for more than two weeks in the past year.

** Difference between groups is significant at $p<.05$.

Preventive health services, particularly immunization, and possibly deworming, are needed. Since at least one fifth (up to 95% in Pakistan) of the food distribution centers evaluated were health centers, it would seem feasible to make a planned effort at integrating health services with feeding activities. The distributed food is probably already serving as an incentive for more mothers to come to the health centers, where they can avail themselves of medical care, but the provision of health services to feeding program beneficiaries should be made routine.

Furthermore, there is a need to encourage greater acceptance of family planning among program mothers, through education and ready access to services. Family size remains large, and the number of people sharing limited financial resources increases the likelihood of malnutrition in the preschooler. Larger family size and a greater number of people sharing the ration within the family has been linked to reduced nutrition impact in the present study.

As mentioned earlier, diarrhea is a major factor which may affect the nutritional status of the preschool child (Wall and Keave 1974). The prevalence of diarrhea and the access to protected water and latrines among program participants are presented in Table 29. Diarrhea was defined as four or more loose bowel movements per day. Mothers were asked if their child had diarrhea, and whether the child had ever suffered from severe diarrhea or dysentery. It should be stressed that since the diarrhea information is based merely on the mother's recall, it may be subject to some degree of error. Other studies have shown, however, that recall of diarrhea is reasonably accurate up to one week after its occurrence (Heller and Drake 1976).

The findings obtained in this survey reveal a general but inconsistent trend. In Pakistan and Costa Rica, where access to protected water and latrines was highest, reports of current diarrhea and diarrhea in the past week were lowest. In contrast, in India, where 19.5% and 5.6% of the families had access to water and latrines, current diarrhea and diarrhea in the past week were about the same, as in the Dominican Republic, where over 39% had access to protected water and most families have latrines. In Colombia, Costa Rica, and Pakistan, significantly fewer participant than nonparticipant families had access to protected water and latrines. The lack of a significant association between diarrhea rates and quality of water is plausible because no association has been found in most studies that have examined such issues. Furthermore, rates of diarrhea were not significantly lower among participants at feeding centers connected to health posts.

The results of the present study show an average prevalence of 8% for current diarrhea and are in agreement with rates reported by others, i.e., 7% (Mata et al. 1967); 7.4% (Kielmann and Uberoi 1972); and 8% (Briscoe 1976 and Van Zijl 1966).

TABLE 39

PREVALENCE OF DIARRHEA AMONG PRESCHOOLERS AND ACCESS TO PROTECTED WATER AND LATRINES IN FIVE CARE FEEDING PROGRAMS

	Colombia	Costa Rica	Dominican Republic	India	Pakistan
Sample Size	243	200	246	254	253
Current Diarrhea (% Yes)	9.1	9.0	16.3	13.4	5.9
Diarrhea in Previous Week Percent Yes	14.8	15.0	32.1	34.6	13.4
Mean Days Diarrhea in Previous Week ± S.D	2.8±1.4	2.9±1.7	3.5±2.0	3.5±1.9	3.5±1.8
Severe Diarrhea (% who have had)	65.0	50.7	80.6	42.7	54.3
Sample Size	897	507	1201	963	794
Access to Protected Water (%)	28.3 (41.9)*	78.1 (86.8)*	39.2 (38.7)	19.5 (14.8)	82.2 (88.7)
Access to Latrines (%)	32.6 (42.3)*	87.8 (89.8)	71.6 (65.4)**	5.6 (4.8)	59.0 (74.7)

() Values for nonparticipants presented for the sake of comparison.

* Indicates very significant difference at $p<.01$ between participants and nonparticipants.

** Indicates significant difference at $p<.05$ between participants and nonparticipants.

Diarrhea is known to affect dietary intake, particularly through the mother's withholding food from the preschooler during the episode, as well as through the child's loss of appetite. However, in the present study, the percent of children who ate the ration on the previous day was not significantly lower among children who currently had diarrhea, and the size of the ration eaten was also not significantly decreased due to diarrhea. However, the total calorie and protein intake with and without the ration was consistently lower by 100 to 200 calories per day among children who currently had diarrhea, and significantly so in the Dominican Republic, India, and Pakistan (Table 40). This reduction in nutrient intake associated with diarrhea may increase the child's calorie gap by one third to one half and, combined with the nutrient losses due to malabsorption, may have serious consequences on nutritional status. The largest calorie deficiencies - 483 in the Dominican Republic and 549 in Tamil Nadu, India - were found in the two countries with the highest rates of diarrhea in the past week, 32% in the Dominican Republic and 35% in India (similar agreement was found between size of the calorie gap and rates of current diarrhea). Child malnutrition may be more sensitive to increased food supply when incidence of diarrhea and infectious disease is low.

CARE feeding programs might have a greater nutritional impact if actions were taken to reduce the prevalence of diarrhea in the participants and to treat cases of diarrhea through oral rehydration to reduce duration and fatalities. Theoretically, possible methods of reducing the incidence of diarrhea include installation of latrines and potable water systems in communities served by the feeding programs, and education of the mothers in sanitary practices that will prevent diarrhea. However, the literature "offers little explanation of the health impact of water which confirms the existence of an association between improved quality and increased quantity of domestic water and a reduced incidence of enteric disease" (Wall and Keeve 1974; also see White, Bradley, White 1972).

B. Nutritional Knowledge and Education

Nearly all the surveyed feeding centers claimed to be providing nutrition education to the mothers, which is consistent with the global survey results reported in the Nutrition Education Study. However, little evidence of nutrition education was observed, except in Colombia, where nutrition education was an integral component of the feeding program. Mothers were not supposed to receive food in Colombia if they did not attend the nutrition education classes, but this rule was not enforced. It was encouraging to see that of all five countries, nutrition knowledge was highest among program mothers in Colombia. This judgment was derived from the high percentage of mothers who correctly described the cause and treatment for malnutrition when shown a photograph of a severely malnourished child (Table 41). Nutrition knowledge was next highest in the Dominican Republic and lowest in Pakistan. More mothers knew the cause of malnutrition than what they could do to treat it.

TABLE 40

EFFECT OF CURRENT DIARRHEA ON TOTAL CALORIE AND PROTEIN INTAKE AND RATION CONSUMPTION OF PRESCHOOLERS IN FIVE CARE FEEDING PROGRAMS

Country	Percent Who Ate Ration	Daily Intake Without Ration			Daily Intake With Ration			Mean Ration Consumed	
		N	Calories	Protein	N	Calories	Protein	Calories	Protein
Colombia									
With Diarrhea	65	11	936	24.3	11	1097	33.2	184	7.7
Without Diarrhea	48	136	981	25.9	85	1180	36.1	162	9.9
Costa Rica									
With Diarrhea	83	8	906	27.6	10	1408	51.8	737	30
Without Diarrhea	74	98	1039	31.3	85	1398	49.2	737	30
Dominican Republic									
With Diarrhea	46	21	796	21.8	18	774	22.3	132	7.1
Without Diarrhea	47	109	893	25.2	98	953	26.4	157	7.9
India (Tamil Nadu)									
With Diarrhea	77	5	742	21.2	10	763	26.4	340	16
Without Diarrhea	86	55	817	24.7	183	983	32.7	340	16
Pakistan									
With Diarrhea	24	26	895	24.2	8	928	25.9	100	4.0
Without Diarrhea	18	181	1020	28.3	39	1241	29.9	137	5.0

TABLE 41

NUTRITION KNOWLEDGE OF MOTHERS
OF PRESCHOOLERS IN FIVE CARE FEEDING
PROGRAMS

	Sample Size	Described Cause of Malnutrition Accurately (%)	Described Treatment of Malnutrition Accurately (%)
Colombia	243	83.1	74.1
Costa Rica	200	68.5	41.2
Dominican Republic	245	74.7	46.7
India	253	52.2	50.6
Pakistan	251	46.6	35.1

Almost none of the visited centers were measuring children. Therefore, growth charts were not being used to monitor the progress of beneficiaries nor to educate mothers regarding the nutritional status of their children. Growth charts were available for use in several countries, but their value was not seen by the center administrators. In Colombia, although weight and height measurements of most beneficiaries were taken, these were not shared with the mothers or used for educational purposes.

Growth charts have been found to be an effective means of recording a child's health and development as well as of educating mothers and supervisory medical and paramedical staff (Wray 1972; Jacob 1973 and 1975; MacKay, Capone, and Jacob 1974; CRS 1975; Brown 1974; Hendrata 1976). However, growth charts have been found to be of little use if not accompanied by an education campaign to explain their significance thoroughly to the mother (Gopaldas et al. 1975; Cantor Associates 1974). Children should be measured on a regular basis so that there is some means of evaluating feeding program impact, and these measurements should be recorded on growth charts that are given to or shared with the mothers (Wray 1970).

Nutrition education for mothers should be part of all supplementary feeding programs if recuperation of malnourished children is to take place and be sustained once the child leaves the program. Messages that especially need to be stressed in the nutrition education component of feeding programs, based on the findings of the CARE surveys, are: (a) the importance of breast-feeding and its continuation as long as possible, (b) the identification and treatment of malnutrition, (c) the need for fruits and vegetables in the diet, (d) the importance of introducing an adequate quantity of solid foods by age six months, (e) the prevention of diarrhea through sanitary practices, (f) the treatment of diarrhea through oral rehydration, and (g) the importance of feeding the ration daily to the intended child in the intended quantity, without cutting back on other foods normally fed at home. As stated earlier, some of the nutrition education should be directed not at the mothers, but at those in charge of the child's care in cases where the mother is working. Many mothers listened to the radio daily in all the countries except India, so a mass-media nutrition education campaign might be a good way of creating awareness about certain nutrition concepts. The rates of listening to the radio daily were as follows: Colombia - 68%, Costa Rica - 65%, the Dominican Republic - 53%, Tamil Nadu, India - 23%, and Pakistan - 57%.

VIII. COST AND COST EFFECTIVENESS

The total cost per child per year of each of the five feeding programs, including the costs of food network distribution, administration, and local operating expenses, is shown in Table 42. Food was the most expensive component in all the programs, representing from 54% to 76% of the total cost of the program. Total costs of all programs except in Costa Rica ranged from approximately $14 to $25 per participant per year, with Costa Rica being far more expensive at $95 per year. In countries with both biweekly or monthly take-home distribution of dry foods and prepared on-site

TABLE 42

COST PER CHILD PER YEAR OF
CARE PRESCHOOL FEEDING PROGRAMS IN
FIVE COUNTRIES, IN U.S. DOLLARS

Country	Total Cost Per Child Per Year	Food	Distribution	Administration	Local Operating Expenses
Colombia Take-Home	24.75	13.41	2.01	4.56	4.77
Costa Rica On-Site	94.54	70.58	0.00	2.46	21.50
Dominican Republic					
Dry Take-Home	13.55	10.34	0.72	1.42	1.07
Wet Take-Home	15.24	10.34	0.72	1.46	2.72
India (Tamil Nadu)					
On-Site	14.46	10.69	0.21	0.69	2.87
Take-Home	14.38	13.30	0.21	0.68	0.19
Pakistan Take-Home	23.51	16.64	0.54	5.50	0.83

daily distribution, i.e., India and the Dominican Republic, the dry distribution was $1.69 to $2.69 cheaper overall per child per year when equal rations were distributed.

However, the largest difference in cost between on-site feeding and take-home feeding emerged in the category of local operating expenses. In India, the local operating expenses were fifteen times higher in on-site than in take-home feeding, and in the Dominican Republic, the local operating expenses for prepared food distribution were almost three times as high as for any distribution. This is an important consideration, because the availability of local funds for operating programs is often one of the largest constraints on program expansion. Another factor that must be taken into consideration in weighing the cost effectiveness of on-site feeding versus take-home feeding is that take-home programs reach over four times as many children as on-site feeding programs.

Costs of all programs per kilogram of food and unit of nutrients delivered are shown in Table 43. Again, the range in cost of one to two cents per 100 calories delivered was close among all countries except Costa Rica, where the cost was five cents. Cost per ton grams protein delivered varied more among countries, depending on the protein content of the ration, with a low of two cents in the Dominican Republic and a high of eleven cents in Costa Rica.

Table 26 shows the proportion of total program cost presently provided by local funds and the cost of local foods of equivalent caloric value to PL-480 inputs. Almost the entire Costa Rican program (94%) was locally funded because 95% of the distributed foods were purchased domestically by the government. Local input was the least in Pakistan, where only 6% of the cost was paid by the government. The percent of total cost currently paid by the local government gives some indication of the feasibility of the feeding programs' continuation under totally local support if PL-480 assistance were withdrawn.

Since none of the programs were targeted only to malnourished children, it was important to calculate the excess cost incurred in feeding well-nourished children while attempting to reach the malnourished (Table 44). The cost per year per malnourished child reached remained low in India ($24) and Pakistan ($45) because the majority of participants were malnourished, but rose to very high levels in Latin America, particularly in Costa Rica ($290) and in Colombia ($261), because of the low rates of malnutrition among participants there. However, most of the participants in all the programs were calorie deficient, and therefore cost per child with a calorie deficiency was only slightly higher than the normal cost per child per year (Table 44). Fewer children were protein deficient, so the cost per child with a protein gap increased the base cost of all programs (Table 44).

These findings are in agreement with the analysis of Reutlinger and Selowsky (1976) from which they conclude that "target group-oriented programs are potentially much more cost effective and are probably the

TABLE 43

COST PER KILOGRAM AND NUTRIENT OF FOOD DELIVERED IN CARE PRESCHOOL FEEDING PROGRAMS IN FIVE COUNTRIES, IN U.S. DOLLARS

Country	Cost Per Kilogram of Food Delivered	Cost Per 100 Calories Delivered	Cost Per 10 Grams Protein Delivered
Colombia			
Take-Home	0.825	0.022	0.037
Cost Rica*			
On-Site	0.985	0.045	0.109
Dominican Republic			
Take-Home			
Wet Daily	0.470	0.012	0.023
Dry Monthly	0.418	0.011	0.021
India (Tamil Nadu)*			
On-Site	0.463	0.015	0.031
Pakistan			
Take-Home	1.224	0.022	0.084

* Costs in the Costa Rican and Indian on-site feeding programs have been adjusted because food is served only six days a week (288 days per year), whereas in the other programs food is provided daily for take-home consumption.

TABLE 44

COST PER YEAR PER MALNOURISHED CHILD AND PER CHILD WITH CALORIE OR PROTEIN GAP OF FIVE CARE PRESCHOOL FEEDING PROGRAMS, IN U.S. DOLLARS

Annual Cost	Colombia Take-Home	Costa Rica On-Site	Dominican Republic Take-Home Dry	Dominican Republic Take-Home Wet	India (Tamil Nadu) On-Site	Pakistan Take-Home
Per Malnourished Child*	260.53	290.00	66.10	74.34	23.94	45.39
Per Child with Calorie Gap**	29.11	121.21	14.89	16.75	16.43	28.67
with Protein Gap**	30.18	135.06	16.52	18.58	17.63	39.93

* Malnourished = percent of recent enrollees (≤ 5 months in the program) with weights less than 90% of NAS reference weight for height. This rate was applied to the total program to approximate the number of malnourished children prior to the effects of the program.

** Children whose home diet without the CARE ration is less than the estimated daily requirement of 1360 calories (FAO/WHO 1973) and 37 grams protein (Scrimshaw 1978).

ly feasible means to eliminate undernutrition in subgroups of the popula-
on." Nontargeted programs can cost up to ten times as much as those
aching only the malnourished.

In two of the programs evaluated - Colombia and the Dominican
public - the local government charged a fee to mothers to participante,
ile the other three programs were free of charge. In these two countries,
thers' fees were used to fund the operating expenses of the center. While
e Dominican Republic did not generally exclude mothers who could not pay
e fee, this did occur in Colombia and further reduced the likelihood of
aching the most needy. When the possibility of charging fees to mothers
s explored, Project Poshak in India found it difficult to reach the
tritionally vulnerable members of families below the poverty line on a
gular basis, even with heavily subsidized food distribution (Gopaldas
al. 1975).

Gopaldas and co-workers (1975) have observed that in Indian
munities that are severely disadvantaged economically and socially, free
eding for the "at risk" groups may be the only answer for some time to
me. It would appear that these generalizations would also hold true for
milies below the poverty line in Latin America.

In all five countries, mothers stated that they were in fact
ending less on foods for their family since being enrolled in the CARE
eding program, but no information was gathered on what is done with the
vings. The high rates of substitution of the ration for the home diet
serve as proof of the savings resulting from participation in the pro-
m. Thus, feeding programs in one sense are indirect income subsidies
may, through these released funds, be having a positive impact on the
her development goals. The possibility of finding a method to harness
e food budget savings and direct these funds toward nutritional
provement goals could be explored.

Various cost-effectiveness measures of the feeding programs are
sented in Table 45, and the footnotes to the table explain the method
calculation. The cost per net daily increase in intake of calories and
tein, or for closing the entire calorie or protein gap, was greatly
fluenced by the amount of the ration which was substituted for the home
t, and the percent of the participants who ate the ration daily. In
eral, the Indian program was the most cost effective in increasing
lorie and protein intake and closing the gap, because the program was
cheapest, the net calorie increase was high, and 86% of the children
the ration daily. Nevertheless, it would still cost $73 per child per
r to close the calorie gap, based on the present program operations.

On the other hand, the programs in the Dominican Republic (wet
tribution) and Pakistan were the least cost effective in increasing
tein and calorie intake and closing the gap, because substitution was
h in the Dominican Republic and few children ate the ration in Pakistan.
programs were to continue in their present mode of operation, the annual
ts per child of closing the calorie gap would be exorbitant, at $376 in
Dominican Republic and $355 in Pakistan. Intermediate levels of cost

TABLE 45

COST-EFFECTIVENESS OF CARE PRESCHOOL FEEDING PROGRAMS
IN FIVE COUNTRIES, IN U.S. DOLLARS/DAY

	Colombia (Take-Home)	Costa Rica (On-Site)	Dominican Republic (Take-Home) Wet Daily	Dominican Republic (Take-Home) Dry Monthly	India (On-Site)	Pakistan (Take-Home)
Per Child Total	0.068	0.328	0.042	0.037	0.050	0.064
(Percent Eating Ration Day Prior to Interview)	50	79	51	47	86	18
Per 100 Calorie Net Intake Increase*	0.082	0.090	0.221	0.086	0.036	0.273
(Actual Calorie Increase)	165	462	37	92	160	131
Per Closing Average Child's Caloric Gap (FAO 1360 cal/day requirement)	0.314	0.294	1.029	0.478	0.200	0.972
(Actual Calorie Gap)	382	327	465	557	549	356
Per Gram Protein* Net Intake Increase	0.013	0.019	0.091	0.039	0.007	0.298
(Actual Protein Increase gms.)	10.1	22.0	0.9	2.0	8.5	1.2
Per Closing Average Child's Protein Gap (37gm./day requirement)**	0.147	0.114	1.083	0.558	0.088	2.742
(Actual Protein gap gms.)	11.3	6.0	11.9	14.3	12.6	9.2
Per Child Improved*** Calorie Gap Closed	0.471	0.753	0.596	0.619	0.810	1.263

TABLE 45 (continued)

	Colombia (Take-Home)	Costa Rica (On-Site)	Dominican Republic (Take-Home) Wet Daily	Dry Monthly	(Combined)	India (On-Site)	Pakistan (Take-Home)
Protein Gap Closed	0.378	0.469	0.467	0.411		0.238	0.914
(Actual % of total participants with no gap after eating ration)							
Calories	14	44	7	6		6	5
Protein	18	70		9		21	7

* Cost Per Calorie or Protein Net Intake Increase =
Total Cost Per Day ÷ Daily Increased Calories or Protein x % Who Ate

Increased calories or protein represent supplementary effect of ration on the usual home diet (without ration). Substitution for normal home diet has been taken into account.

** The cost of closing the protein gap (required) was calculated by multiplying the actual gap by cost per gram net protein intake increase. The cost (actually spent) equals the total daily cost of the current programs.

*** Cost divided by percent of total program participants who had no calorie or protein gap after eating the ration.

effectiveness for increasing protein and calorie intake and closing the gap were found to be similar in Colombia, Costa Rica, and the dry take-home distribution in the Dominican Republic. The cost per child per year of totally closing the calorie gap in these programs ranged from $107 to $174.

Cost effectiveness could be greatly increased if ways could be found to get more children to eat the ration daily as an increment to and not as a substitute for the home diet. These factors seem to be largely the prerogative of the mother, or of the father, who is often fed first, and may lie beyond the control of the program, unless rations are greatly increased to compensate for these leakages.

Cost per child whose calorie gap was closed after eating the ration was also very high. In this category, Colombia was the most cost-effective program because among the programs of similar cost (all except Costa Rica) it had the highest percent of beneficiaries with no calorie gap after eating the ration, and the least amount of substitution. Still, the Colombia program would cost $172 per year for every child improved to a no calorie deficit position. In other countries the cost would be more, rising to a high of $461 per year in Pakistan because of the low percent of the participants who actually ate the ration.

Cost effectiveness is considerably higher when based on number of children with adequate protein intake after ration consumption because the incidence of protein deficiency and the size of the protein gap is much less than in the case of calories. If the goal of the programs was merely to close the protein gap, cost could possibly be reduced by lowering the protein content of the rations to the level necessary to close the gap, as the current rations are excessive in protein compared to the deficiencies of the children, particularly in Costa Rica and India. However, delivering protein in the face of calorie deficiencies would not necessarily improve the recipient's biological status.

IX. EFFECTS

The cost effectiveness of supplementary feeding also needs to be reviewed in terms of the cost per child whose nutritional status improved, and other criteria of program effectiveness. However, the lack of baseline anthropometric data on the children in the present survey made it impossible to assess actual rates of improvement in growth, and thus the cost effectiveness of the various programs in actually improving physical nutritional status. Nonetheless, an attempt was made to gather and use some anthropometric data for evaluation.

Three anthropometric measurements were obtained on all children: weight, height, and arm circumference. The results were analyzed by computer using an anthropometric subroutine developed by the Center for Disease Control of the U.S. Department of Health, Education, and Welfare for nutrition assessment surveys, which they recently conducted in Nepal, Sri Lanka, and Sahelian Africa. The U.S. National Center for Health Statistics (NCHS) reference measurements were used as a standard throughout the study for consistency.

The impact of feeding programs on the nutritional status of participants was estimated both by comparing the measurements of participants with a sample of nonparticipant children, and by comparing measurements of groups of children within the program by length of participation, i.e., newcomers versus long-time participants. This latter analysis was found to be especially useful because of the lack of baseline measurements of program participants at the time they first enrolled in the feeding program. The control group approach to estimating program impact assumes that the starting rates of malnutrition among the two groups are the same, and that the primary difference between groups is the receipt of food by the program beneficiaries. This assumption may prove to be false, and programs which enroll children with higher malnutrition rates than their comparison group may be judged as ineffective when it is indeed possible that they are making significant progress in lowering initially high malnutrition rates.

The measurements of children in the program sample who had participated in the program for five months or less (average of three months) were used to estimate the starting malnutrition rates of program children. The five-month cutoff point was set arbitrarily to provide a sample large enough for comparing groups. The malnutrition rates of the newcomer group were compared with those of the nonparticipant group to see if recent enrollees in the program tended to be more or less malnourished than children from the community-at-large. It was assumed that if the program is effective in improving nutrition, then the nutritional status of long-time participants will be better than that of recently enrolled children.

It should be stressed here that this study was purely cross-sectional and that all the groups being compared were composed of different children and not the same children measured over time. Thus, other variables such as different community circumstances at various times of enrollment, the nutritional status of program dropouts, and the reasons why the recent enrollees had not started in the program earlier cannot be ruled out as possible explanations for differences in malnutrition among the groups. Furthermore, length of participation data were obtained from mother's recall and center records and therefore were subject to some degree of error. With these caveats in mind, it is felt that the malnutrition rate of children in the program for five months or less can serve as a useful estimate in the absence of baseline data. The malnutrition rate of children in a nutrition program for less than a year was used successfully as an estimate of baseline nutrition rates in the Candelaria study in Colombia (Drake and Fajardo 1976). The assumption that there will be little impact in the first few months of participation in a feeding program seems to be a safe assumption based on the findings of Project Poshak (Gopaldas et al. 1975) and the Tamil Nadu Nutrition Study (Cantor Associates 1974) in which the programs had little effect in the first six to seven months. This was primarily because of the time lag between initial enrollment and the establishment of a regular pattern of feeding the ration to the child, during which the mother experimented with the ration and gradually became convinced that it was acceptable for her child. That this is not always the case was shown in Candelaria, Colombia (Wray 1976).

The measurements of the newcomer group were also compared with those for program participants as a whole, and, in particular, with those of long-time participants who had been in the program for an average of twenty-two months (all enrolled for more than nine months). Thus, the newcomers served as a second comparison group for measuring program impact because as participants in the program and residents of the same community they tended to share background characteristics more similar to those of the other participants than did the nonparticipant group from the community at large, or from a nearby community.

The nutritional status findings of nonparticipants and of program participants by different duration of participation were presented in Table 23 and Figures 6 through 8. The table shows the number of children whose reference weight for age, weight for height, and height for age are below acceptable limits expressed as a percentage of expected values. Average age differences between groups were only three months and none exceeded six months, except between the recently enrolled participants and more than nine-month participants in Costa Rica where the age difference was 8.5 months. Differences in nutritional status between groups, therefore, are not likely to be due to the natural effect of aging.

Few differences in nutritional status among the various groups within each country are large enough to be significant on any of the measures as can be readily seen from the graphic presentation of results in Figures 6-8, which show the percentage of children who are malnourished according to weight for height, height for age, and weight for age, respectively.

When the newcomer group in the program was compared to the nonparticipant group, it was found that in the Colombia and Costa Rica programs there were more malnourished children enrolled in the programs than the comparison group. In Colombia, there were significantly more stunted children (less than 90% height for age) and more children with first-degree malnutrition (75%-90% of weight for age) among the newcomers than in the nonparticipant comparison group. In Costa Rica, the newcomers had significantly lower weights for their heights (both less than 90% and less than 80% of the reference) and more children with second-degree malnutrition (60%-75% of weight for age). In fact, newcomers to the program in Costa Rica were the most malnourished by weight for height and weight for age of all the children in this group in the Latin Countries. Thus, these two programs were reaching a higher proportion of the malnourished children in the community, but there were many who were not enrolled. In the Dominican Republic, the program was reaching a group whose malnutrition rates were approximately equal to those of the comparison group from the community at large; there was more second- and third-degree malnutrition among newcomers in the program than nonparticipants but the difference was not significant.

The Tamil Nadu, India, program was reaching the highest proportion of malnourished children of any of the countries surveyed. The Pakistan program was also reaching a group with very high malnutrition rates. However, high as the malnutrition rates were among participants in Tamil Nadu and Pakistan, the children not enrolled in the program were even more

FIGURE 6
NUTRITIONAL STATUS BY LENGTH OF PARTICIPATION IN FIVE CARE PRESCHOOL FEEDING PROGRAMS AS MEASURED BY PERCENT OF PRESCHOOLERS WITH WEIGHTS LESS THAN 90% OF THE NAS REFERENCE WEIGHT FOR HEIGHT

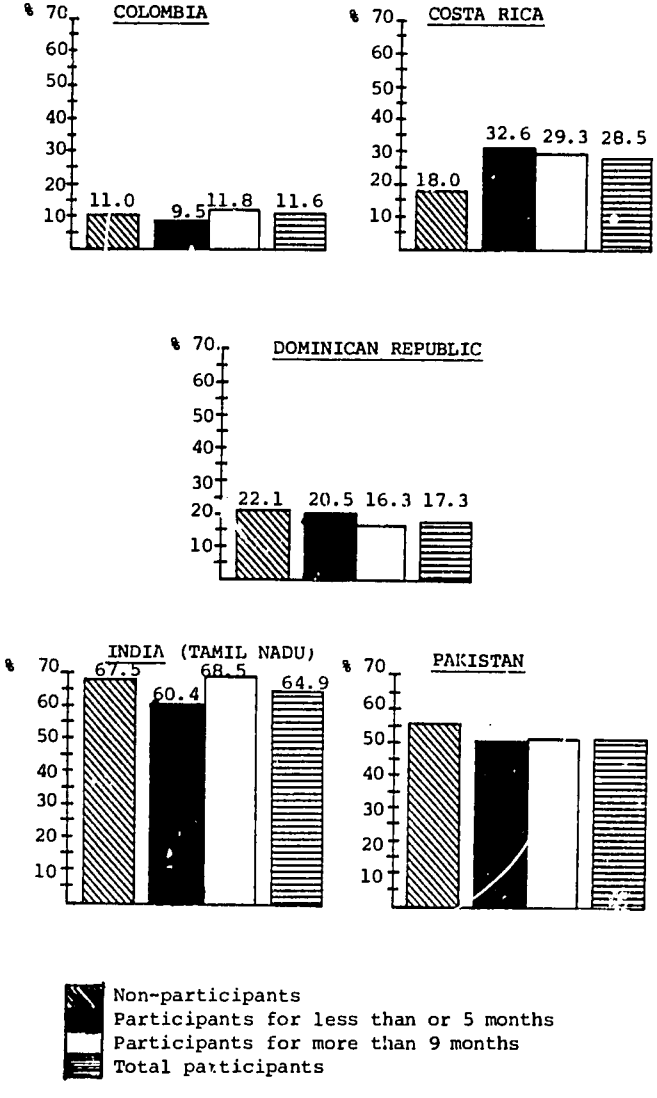


FIGURE 7

STUNTING BY LENGTH OF PARTICIPATION IN FIVE CARE PRESCHOOL FEEDING PROGRAMS AS MEASURED BY PERCENT OF PRESCHOOLERS WITH HEIGHTS LESS THAN 90% OF THE NAS REFERENCE HEIGHT FOR AGE

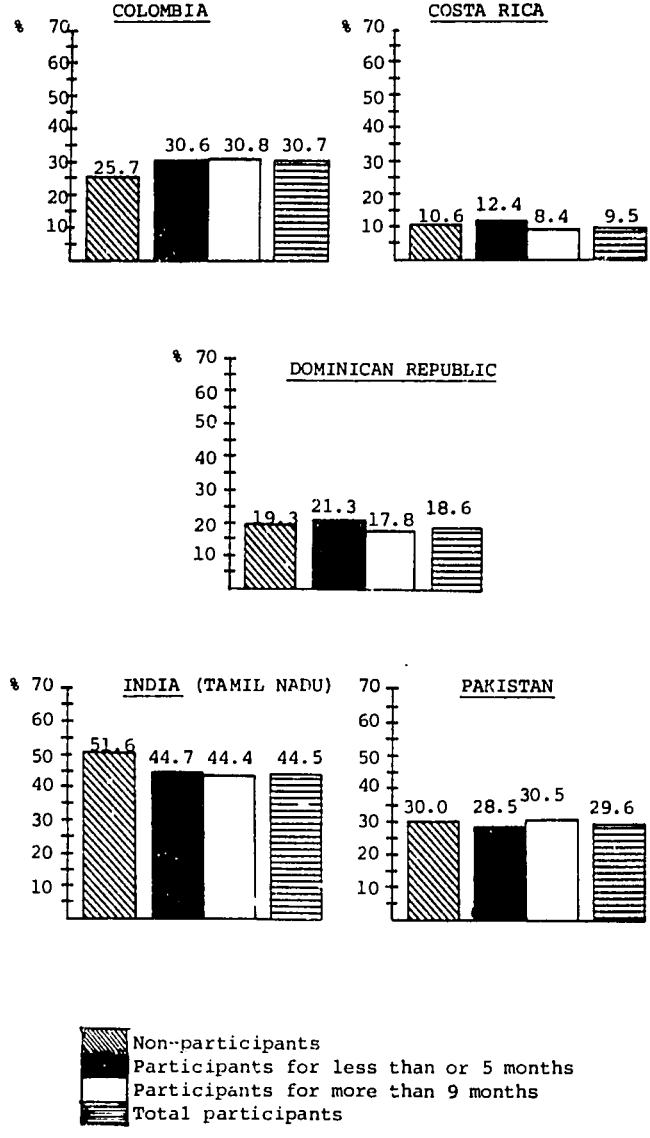
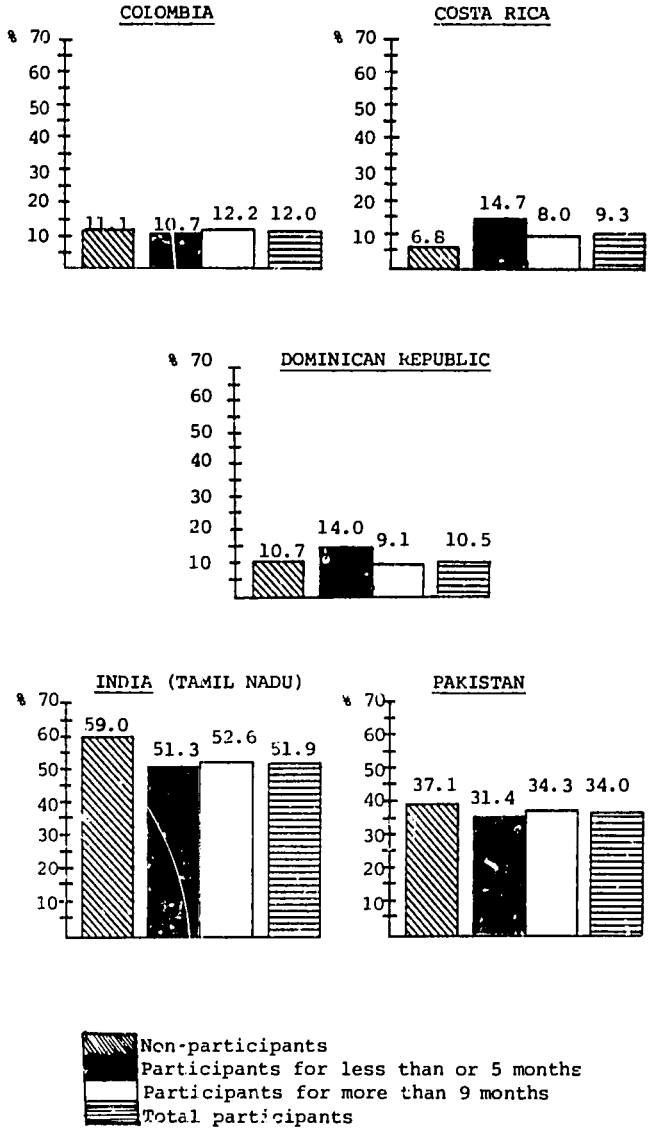


FIGURE 8

NUTRITIONAL STATUS BY LENGTH OF PARTICIPATION IN FIVE CARE PRESCHOOL FEEDING PROGRAMS AS MEASURED BY PERCENT OF PRESCHOOLERS WITH WEIGHTS LESS THAN 75% OF THE NAS REFERENCE WEIGHT FOR AGE (RATES OF SECOND AND THIRD DEGREE MALNUTRITION--GOMEZ CLASSIFICATION)



malnourished. There was significantly less second-degree malnutrition and stunting among newcomers to the program in Tamil Nadu than among children in the community at large. In Pakistan there was less third-degree malnutrition among newcomers than in the comparison group.

Although the Latin American programs were reaching far fewer malnourished children than the India and Pakistan programs, they were reaching a higher proportion of the more malnourished children in the community, but in the Asian countries malnutrition rates were so high as to make comparisons difficult. The lower proportion of malnourished children among program participants might suggest that children enrolled in the program are better off than nonparticipants. The fact that rates are higher among long-time participants than among newcomers leaves the issue in doubt: are children in the program getting worse or were they worse to start with?

These apparent initial differences in rates of malnutrition between participants and nonparticipants must be kept in mind when comparing the nutritional status of the total program group to the nonparticipant group. It would appear that all the significant differences in nutritional status between the participants and nonparticipants can be traced to the initial differences in rates of malnutrition among newcomers to the program and nonparticipants. Thus, significant differences in nutritional status between the program and the comparison group do not appear to be due to a nutritional impact or lack thereof from the feeding program but rather to initial differences in the types of children which the program tends to enroll.

A comparison of malnutrition rates of newcomers who have been in the program for five months or less (an average of three months) and long-time participants who have been enrolled for more than nine months (an average of twenty-two months) produces interesting results. No significant reduction in rates of malnutrition by weight for height criteria were seen by length of participation in the program, except in the Dominican Republic where fewer long-time participants (0.9%) were affected by acute malnutrition (less than 80% weight for height) than newcomers (3.2%). Figure 6 and Table 23 show that although not significant, the trend was toward holding malnutrition rates by weight for height constant or slightly reducing them among long-term participants, except in Tamil Nadu where the rate of malnutrition was significantly higher among long-time participants (68.5%) versus newcomers (60.4%). It must be noted, however, that Martorell et al. (1978), in a careful longitudinal study of the anthropometric response to food supplementation, showed that changes in height for age and weight for age were much more pronounced and concluded that those two measures of program impact were more sensitive than weight for height. This failure of the India program to lower or hold stable the malnutrition rates may be due to the practice of substituting the ration for the home diet among long-time participants who are slightly older.

Striking differences in rates between rations emerged with two to five times as many children less than 90% of the reference weight for their height in all groups in South Asia compared to those in Latin America. The highest rates of malnutrition were found in the Tamil Nadu children.

The program had no significant effect on lowering rates of stunting (less than 90% of reference height for age) among newcomers and long-time participants (Figure 7 and Table 23). However, there was a trend toward lowered rates of stunting among long-time participants in Costa Rica and the Dominican Republic. The rate of stunting which is an indicator of past malnutrition or current chronic malnutrition was highest in India and lowest in Costa Rica. Rates were similar in Pakistan and Colombia and slightly lower in the Dominican Republic. As previously pointed out, it may take years, if the program succeeds at all, to correct the chronic malnutrition evidenced by the rates of stunting; stunting implies nutritional deprivation from long-term dietary inadequacies in children whose linear growth is retarded.

Analysis of weight for age variations among newcomers and long-ti participants also suggests little significant nutritional impact of programs in any country except Costa Rica, where the incidence of third-degree malnutrition has been totally eradicated among long-time participants (Figure 8 and Table 23). As in the weight for height results, the trend (although not statistically significant) was toward holding malnutrition rates by weight for age contant or slightly reducing them, except in India where the rate was higher among long-time participants.

Within each country's program, when feeding centers were judged individually as to the nutritional impact they were having on the growth of their beneficiaries, a wide variety in levels of effectiveness emerged. The evaluation methodology was designed to try to identify centers with the most apparent impact and those with the least impact and to explore factors which might be related to the high nutritional impact or lack thereof at various centers.

A system for ranking nutritional impact of all centers, from highest to least impact, was devised based on the difference in malnutrition rates (percent of children less than 90% of the reference weight for their height) between the feeding program participants and the nonparticipant comparison group. Due to the absence of longitudinal data, an attempt was made to estimate the starting rate of malnutrition among newcomers to the program. However, the definition on length of participation of the newcomer group had to be raised from under five months' participation, as used in the national analysis, to a nine-month cutoff point for the analysis by individual sites in order to provide a large enough sample size for comparing groups. The average length of participation of the newcomer groups was thus five months.

A nutritional impact score was assigned to each center by combining the difference in malnutrition rates among participants, as well as the estimate of early program malnutrition rates among participants for nine months or less and the nonparticipant group. The actual formula was:

% < 90% wt. for ht. among participants for < 9 mos. / % < 90% wt. for ht. among nonparticipants	or Proportion of malnutrition between recent participants and nonparticipants
MINUS	
% < 90% wt. for ht. among total participants / % < 90% wt. for ht. among nonparticipants	or Total proportion of malnutrition between participants and nonparticipants

The assumption of the nutritional impact score is that progress toward reducing the initial rate of malnutrition would be reflected in a lower malnutrition rate for the long-time participants than for the newcomer group. The total program malnutrition rate would be less than that of the comparison group except in the cases where program participants are initially more malnourished than the comparison group.

The percent of the centers surveyed in each country which seemed to have a positive nutritional impact are shown in Table 46. Costa Rica had the highest proportion of sites with positive impact (64%) and Tamil Nadu, India, the lowest (21%). Although there were sizeable differences in malnutrition rates among the various groups at many sites, none of the differences in malnutrition rates between total participants, newcomers, or comparison groups was significant. But even if differences were statistically significant, interpretation would be impossible because of uncertainty about the samples.

None of the centers in any of the programs used criteria to target the program only to the malnourished. However, it can be seen in Table 46 that the majority of centers in Colombia and Costa Rica were reaching children with as much or more malnutrition than that found among participants; the rates were lower in the Dominican Republic, where 45% of the centers reached a group that was equally or more malnourished than children in the community at large, and this was true of 41% of the centers in Pakistan. The Tamil Nadu, India, program, on the other hand, was only reaching equally or more malnourished children in 21% of the sites surveyed. Interpretation of this finding is difficult. It is possible, for example, that in such an impoverished population the supplement provided produces a prompt improvement in nutritional status. It is also possible, however, that caste or other social factors inhibit the enrollment of children from the very poorest families. The proportion of malnourished children enrolled is important because of all the factors that seem to be correlated with impact, the strongest one of all was the incidence of malnutrition. In other words, high rates of malnutrition for newcomers in the program seem to suggest high nutritional impact.

The analysis of nutritional status based on mean arm circumference and arm circumference for height is presented in Table 47. Various borderlines have been suggested for diagnosing moderate to severe malnutrition based on arm circumference and height measurements and these were applied

TABLE 46

PERCENT OF CENTERS EVALUATED IN EACH OF FIVE CARE PRESCHOOL FEEDING PROGRAMS WITH POSITIVE NUTRITIONAL IMPACT AND COMPARISON OF THE MALNUTRITION RATE AMONG RECENT ENROLLEES WITH THE RATE AMONG NONPARTICIPANTS

Country	Number of Centers	Percent of Centers with Positive Nutritional Impact*	Percent of Centers with Malnutrition Rate of Participants for ≤ 9 Mos. Greater than or Equal to Comparison Group Rate**
Colombia	20	45.0	55.0
Costa Rica	22	50.0	63.6
Dominican Republic	20	55.0	45.0
India (Tamil Nadu)	29	27.6	20.7
Pakistan	17	41.2	41.2

* Positive Nutritional Impact = Positive Score on the following calculation:

$$\frac{\% < 90\% \text{ wt/ht among participants for} \leq 9 \text{ mos.}}{\% < 90\% \text{ wt/ht among nonparticipants}} - \frac{\% < 90\% \text{ wt/ht among total participants.}}{\% < 90\% \text{ wt/ht among nonparticipants}}$$

** Malnutrition Rate = The percent of children less than 90% of the Reference Weight for their height.

TABLE 47

RATES OF MALNUTRITION BY ARM CIRCUMFERENCE MEASUREMENTS OF PARTICIPANTS AND NONPARTICIPANTS IN FIVE CARE PRESCHOOL FEEDING PROGRAMS IN 1976 (NAS REFERENCE POPULATION

Country	Sample Size	% < 85% Reference Arm Circumference for Height	Mean Arm Circumference (Cms. ± S.D.)	% < 13.5 Cm. Arm Circumference
Colombia				
Participants	897	2.6	15.3±1.2**	5.4
Nonparticipants	536	3.4	15.5±1.3**	5.6
Costa Rica				
Participants	503	1.2	16.3±1.3***	1.6
Nonparticipants	252	0.4	16.7±1.5***	0.4
Dominican Republic				
Participants	1,201	2.4	15.8±1.3	3.5
Nonparticipants	822	2.3	15.8±1.4	3.4
India (Tamil Nadu)				
Participants	963	19.8	14.1±1.2	27.3
Nonparticipants	859	18.3	14.0±1.2	31.7
Pakistan				
Participants	794	14.1*	14.3±1.2*	21.8*
Nonparticipants	464	20.0*	14.1±1.4*	29.7*

* Difference between group is very significant at $P < .01$.

** Difference between group is significant at $P < .02$.

*** Difference between group is significant at $P < .05$.

to the data, i.e., (1) percent less than 85% of reference arm circumference for height (Arnhold 1969) and (2) percent with mean arm circumference less than 13.5 centimeters (Shakir and Morley 1974). Few children in Latin America were identified as malnourished using these parameters, but there was a sizeable number in India and Pakistan.

The data seem to confirm that a cutoff point of 13.5 cm. arm circumference provides a reasonably reliable method for detecting severe malnutrition in countries with a high prevalence of severe malnutrition by weight for height or weight for age measures. Arm circumference measurement is sensitive enough to detect almost all cases of severe malnutrition in preschool children up to five years old. However, this measurement would be of little use in Latin America where few cases of severe malnutrition were encountered. Although arm circumference can be used for screening, careful observation shows that it does not reflect improved growth and therefore it is less useful than weight for program evaluation and monitoring.

The correlation coefficients between calorie and protein intake and the various measurements are presented in Table 48. Small positive correlations were found to be significant between total protein and calorie intake and height for age, as well as weight for age. Weight for height was positively correlated to a significant degree with calorie and protein intake only in Costa Rica, and with protein intake in Pakistan. However, there was no significant difference in mean calorie or protein intake between the malnourished (less than 90% weight for height) and the well-nourished because of the large variation in intake within groups. No statistically significant differences were found in the protein and calorie intake of the malnourished and well-nourished groups in Project Poshak (Gopaldas et al. 1975). Another study of fat and lean children in the U.S. failed to find statistically significant differences in calorie intake (Huenemann 1974).

The overall nutritional status results of all five programs can be summarized as follows:

Colombia was reaching a more chronically malnourished group than children in the community at large and malnutrition rates on all measures were being held constant. Forty-five percent of the centers seemed to have a positive impact on weight for height.

Costa Rica was reaching more currently malnourished children than in the community at large and there was a trend toward improving weight for height and weight for age, and significant improvement in weight for age. A positive impact on weight for height appeared to be occurring in 50% of the centers.

The Dominican Republic was reaching a group of children whose malnutrition rates were approximately equal to those of the nonparticipants, except for the greater incidence of second- and third-degree malnutrition among newcomers to the program. There was a trend toward improving height for age and weight for age, and a significant improvement in weight for height (acute malnutrition). Forty-five percent of the centers appeared to have a positive impact on weight for height.

TABLE 48

CORRELATION COEFFICIENTS BETWEEN TOTAL CALORIE AND PROTEIN INTAKE AND PERCENT OF NAS REFERENCE MEDIAN FOR WEIGHT FOR AGE, WEIGHT FOR HEIGHT, AND HEIGHT FOR AGE IN FIVE CARE PRESCHOOL FEEDING PROGRAMS

	Total Calorie Intake With			Total Protein Intake With		
Country	Wt. for Age	Wt. for Ht.	Ht. for Age	Wt. for Age	Wt. for Ht.	Ht. for Age
Colombia	N.S.	N.S.	.106***	.107***	N.S.	.108***
Costa Rica	N.S.	.193*	.116***	.128***	.189*	N.S.
Dominican Republic	.154*	N.S.	.165*	.158*	N.S.	.150*
India (Tamil Nadu)	.167*	N.S.	.145*	.167*	N.S.	.155*
Pakistan	.255*	N.S.	.258*	.220*	.130**	.208*

* Very significant at $P < .01$.

** Significant at $P < .02$.

*** Significant at $P < .05$.

N.S. = Not significant.

India (Tamil Nadu) was reaching children with less chronic malnutrition (stunting) than the nonparticipants and less second-degree malnutrition.* The program appeared to hold height for age and weight for age constant, but the rate of malnutrition by weight for height was higher among long-time participants. Only 21% of the centers seemed to have a positive impact on weight for height.

Pakistan was reaching children with significantly less severe malnutrition than in the nonparticipant group, and less mild malnutrition as judged by less than 90% weight for height.* The program appeared to be holding malnutrition rates on all measures constant. Forty-one percent of the centers showed positive impact on weight for height.

In summary, the results of the CARE evaluations revealed that countries with higher apparent impact had the following characteristics:

1. Higher malnutrition rates among newcomers to the program (Latin America). In the two programs which seemed to have positive impact, Costa Rica and the Dominican Republic, only 36% and 30% of the sites respectively had less than 15% malnutrition among newcomers, whereas in Colombia where impact was neutral, 60% of the sites had a newcomer group with less than 15% malnutrition. Malnutrition rates of program participants in Tamil Nadu, India, were up to five times higher than those found in Latin America, but the program resources and size of the rations were not increased to deal with the magnitude of the problem. Program beneficiaries in Tamil Nadu received a ration of the same quantity as delivered in Colombia and the Dominican Republic.

2. Higher percent of centers enrolling children with as much or more malnutrition than the comparison group.

3. Higher family income.

4. Higher literacy rates among mothers.

5. Fewer working mothers.

6. Higher proportion of families with access to protected water and latrines.

7. Higher percent of mothers introducing solid foods to their children by six months of age.

Within countries the following factors were associated with higher apparent impact at various sites or with lower rates of malnutrition. (Factors listed were dominant in at least two of the five countries surveyed.)

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*It is not clear, however, to what extent participation in the program had led to improved growth.

1. More malnourished newcomers in the program from poorer families with less educated fathers.

2. Smaller families with fewer people sharing the ration (take-home feeding).

3. Ration consumed more frequently.

4. More nutritionally adequate diets.

5. More knowledge among mothers of the cause and treatment of malnutrition.

6. More mothers who introduced solid foods to their children by six months of age.
7. Less reported serious illness in the past year.

8. Fewer working mothers (Colombia, Costa Rica, and India). More working mothers (Dominican Republic and Pakistan).

The case study has illustrated the importance of carefully planning and implementing a supplemental feeding program in accordance with the program design considerations discussed in the general overview. The nutritional impact of the feeding programs evaluated was limited by the absence of nutritionally based selection criteria to target the programs to the most malnourished; by the provision of rations insufficient to cover the energy deficits of the recipients and to compensate for expected division of the supplement due to sharing and substitution; and by the lack of health services, environmental sanitation, and nutrition education as integral components of the programs. Satisfactory evaluation of program impact was impossible because of the absence of baseline data to determine population in need and thus assess adequacy of coverage; the lack of longitudinal data made it impossible to measure the impact of the supplementation on the nutritional status of children enrolled.

CHAPTER FOUR FOOTNOTE

The comparison characteristics were age, sex, birth order, disease history, family size and income, parents' educational level, mother's nutrition knowledge and child-feeding practices, length of enrollment in the program, and access to protected water and latrines.

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