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A FIELD GUIDE FOR EVALUATION OF NUTRITION EDUCATION

PREFACE

Despite the fact that nutrition education programs have been conducted for many years by local and national governments and by international and voluntary agencies, their actual effectiveness has not been adequately documented. One reason for this is the absence of an accepted and tried evaluation methodology which is simple to apply. This Guide tries to fill this gap.

The Field Guide derives from a thorough literature review (conducted under AID contract by the University of Iowa), which indicated that nutrition education can be effective under certain conditions in improving food behavior and that an accepted and tried methodology to evaluate such programs did not exist. Following this review, AID contracted with the Synectics Corporation to develop an evaluation methodology which was subsequently reviewed by a technical panel and then field tested in Brazil on three nutrition education approaches—person-to-person, group teaching, and mass media. It was then slightly modified and again reviewed by a technical panel.

The Field Guide is intended as an evaluation tool for planners and nutrition educators who are concerned with the cost-effectiveness of specific nutrition education programs in improving food behavior or in comparing the cost effectiveness of different programs.

This version of the Field Guide probably will be refined further with wider use. For this reason, we refer to it as "experimental." In this regard, the Office of Nutrition would welcome views on its application from those who use it to evaluate nutrition education programs.

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CHAPTER 1: INTRODUCTION

Malnutrition in lesser developed countries is to a very large extent the result of ignorance and inappropriate food habits. This fact presents a singular challenge to the educator. Food technologists can develop low-cost nutritious foods; agricultural researchers can improve production capabilities; government and commercial interests will solve problems of processing and distribution of food. But, unless and until fundamental changes can be effected in dietary habits of the developing country populations, neither the infusion of new food types nor the improved local production can be expected to have a nutritional significance.

One of the major concerns of the United States Agency for International Development has been the lack of definitive techniques for determining to what extent nutrition education is effective in bringing about fundamental changes in dietary habits as related to desirable food consumption. Equally important, if maximum effectiveness is to be achieved in all nutrition education programs, is the need for techniques to determine which of two or more alternative approaches has the greatest effect in causing fundamental change.

Dietary surveys which seek to measure food consumption practices are both costly and require techniques which are beyond the capabilities of most nutrition education programs. Further, there are no means through which relationships between education programs and the nutrition of the persons surveyed can be determined. A review of the literature on evaluation practices in the field of nutrition education reveals that the vast majority of applied techniques measure knowledge rather than "food consumption." Techniques which would go beyond the measurement of knowledge stop short of the details of measurement and handling of the data.

The Role of Evaluation in Nutrition Education

The end purpose of nutrition education is to bring about positive changes in food behavior as these changes relate to food consumption. In order to eat, one must have food. To have even the opportunity to be well nourished, one must have access to certain amounts of a variety of different foods. And, given access to foods, adequate nourishment can be provided only if the nutrients are protected, through appropriate processes of food storage and food preparation, and if the foods are consumed according to the individual needs of each family member. Thus, nutrition education must attend to many different objectives to achieve its purpose. One program may teach youth to plant and care for kitchen gardens; another may teach farmers how to build storage bins to protect grain; and others may teach how to prepare foods and which foods to feed infants and children to insure health and proper growth and development. But the end purpose of all nutrition education is improvement of dietary intake.

There are many alternative approaches to nutrition education. Examples include the use of mass media, classroom instruction, person-to-person teaching in the home, informal group instruction, and special teaching as an adjunct to health care or community development programs. Costs associated with one approach can be far greater than those associated with another. Program planners need to know which approach will be least costly and most effective with their particular program audiences. They can derive this information only through systematic evaluation.

Similarly, within any given program approach, planners are faced with a series of decisions. How long or how much education must be given to bring about lasting changes? Can one expect as great an effect using trained volunteers as from paid professionals, or from a staff using both volunteers and professionals? These and similar questions are answerable with information derived from an evaluation activity.

Evaluation is a special program activity used to determine whether or not the nutrition education program is having the intended effects. Examples of some of the effects which might be intended are:

- ✓ Cognitive changes. Desired cognitive effects may include increased knowledge about food and nutrition; greater understanding of the relationship between nutrition and health; and positive changes in attitudes and opinions with respect to food, nutrition, and health.

- ✓ Behavioral changes. Desired behavioral effects may include the acquisition of adequate amounts and types of foods to nourish family members; the storage, handling, and preparation of foods in ways which protect their nutritive value; and, adequate consumption of foods according to the nutritional needs of family members.

- ✓ Effects on morbidity and mortality. The ultimate goal of nutrition programs is to eliminate the morbidity and mortality which are associated with malnutrition.

Education is only one of many forces which influence what type and how much food people will eat. Thus, the role of evaluation extends beyond simple determination of whether or not the desired effects of education are being achieved. It must be sensitive to the forces associated with achievement or nonachievement. Given reliable information as to whether or not desired effects are being achieved, and given knowledge of the forces associated with achievement or nonachievement, the educator may adjust expectations, adjust the educational approach, or both. Thus, systematic use of the evaluation information as a basis for planning continuous changes to improve a program is a critical factor in the success of nutrition education.

Purpose of the Field Guide

The purpose of this Field Guide is to encourage and support useful evaluation in the field of nutrition education. It does not tell persons how to plan and implement education programs[1]. It assumes that persons have made use of available instruction, gathered appropriate information about the community, defined educational goals and objectives, and selected a method or combination of methods of education by which they hope to achieve their objectives.

The intent of the Field Guide is to extend the capability for evaluation beyond the measurement of cognitive effects. Methods for measuring cognitive effects are generally available and frequently used. One cannot, however, assume that persons who have learned which foods contribute to good health, growth, and development will put this knowledge to practice by eating appropriately or feeding a family appropriately.

Behavior, particularly the behavior of food consumption, is the critical link between the cognitive effects of nutrition education and the ultimate goal of all nutrition programs--elimination of malnutrition-related morbidity and mortality. Practical methods for measuring the behavioral effects have not been commonly available and are rarely used. This Field Guide presents a tested methodology and basic tools for:

- ✓ Determination of effects of education in changing food habits.
- ✓ Determination of the cost-effectiveness of any individual nutrition education program.
- ✓ Determination of which of two or more programs, representing different approaches, has the greatest positive effect on food habits at the least cost.

It is not intended that the measures of behavioral change should replace measures of knowledge, attitude, and opinion. Rather, they should be used in conjunction with such measures, and with information about the community, as a basis for planning continuous changes to improve the cost-effectiveness of nutrition education.

Throughout this Field Guide the discussion and examples concern the behavior of food consumption. However, the concepts of study design, the techniques of measurement, and the quantification of field data are equally applicable for evaluation of other behavioral effects of nutrition education. If the behavioral objective concerns food preparation, sanitation, or some other behavior--the basic tools contained here can be adapted for the measures and criteria required. Thus, the methodology represents a generalizable approach to the measurement of behavioral effects of nutrition education.

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[1] An excellent guide to planning is presented in the FAO Nutritional Studies series No. 26, "Planning and Evaluation of Applied Nutrition Programmes," Dr. Michael C. Latham, M.D.

Organization of the Field Guide

The Field Guide is organized to support the sequence of important decisions the user must make about evaluation. The first, and perhaps the most important, decision is whether or not to measure behavioral effects. The implications of such a decision are the subject of Chapter 1. A series of additional decisions must then be made. Figure 1 illustrates how major sections of the Field Guide are organized to support these decisions.

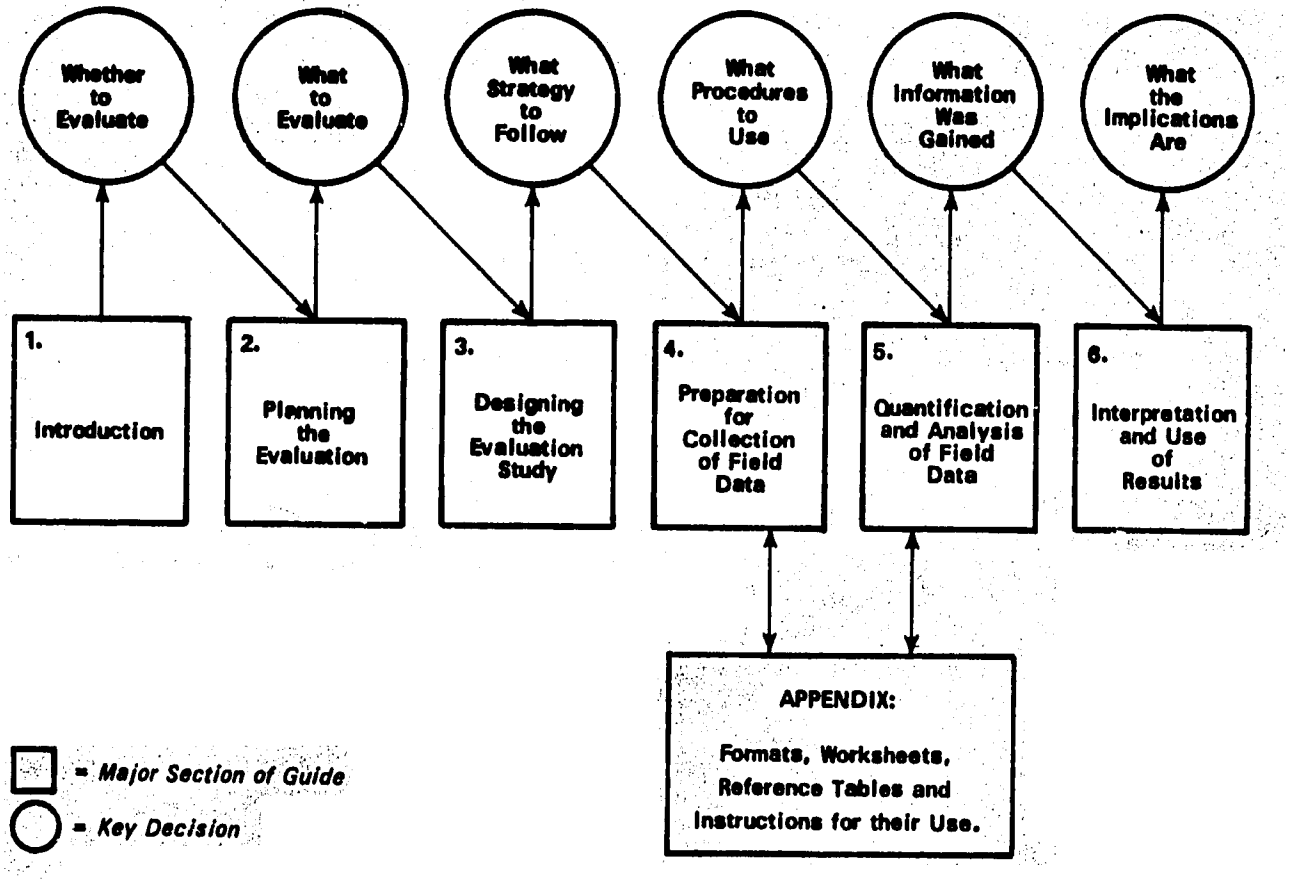


Figure 1. Organization of the Field Guide to Support Decision Making

The discussion of what behaviors to evaluate, Chapter 2, helps the evaluator to define measurable objectives and to limit the scope of evaluation to those measures essential for decisions about the education program. Chapter 3 describes basic study designs which can be applied to evaluate behavioral effects. The discussion helps the evaluator determine what strategy to follow to assure confidence in the results.

Chapters 4 through 6 provide practical demonstrations of how the basic tools for evaluation are used to conduct evaluation. Beginning with the decisions about who and how many persons will be studied, the user is led from the preparation for field work to the use of results for improvement of the nutrition education program.

The basic tools for evaluation are presented in the Appendix. They include: formats for collection of field data; worksheets for summarization, quantification, and analysis of the field data; and reference tables required to apply the methodology. Step-by-step instruction is provided for each tool.

Summary of the Methodology

Evaluation is not a form of magic by which programs are made more effective. It can be an expensive, time consuming, and sometimes complex process. If the evaluation is to be useful, procedures must be designed and carried out in ways which give the evaluator reasonable confidence that the results demonstrate true conditions. The methodology presented in this Field Guide provides a generalizable model in which the user can have confidence. The important features of the methodology are summarized in the paragraphs which follow.

The methodology represents an experimental approach. An experiment is a test designed in a scientific way to prove or disprove a belief. For example, you believe your education program will result in fundamental changes in food habits. You conduct an experiment, to prove or disprove your belief, by comparing the changes observed in persons who participate in your education program with changes in persons who do not participate. If the food habits are similar, even though changes have occurred, you cannot assume that changes in the food habits of your participants are the result of your education program. If the food habits differ--that is, if there are positive changes in habits of those receiving education, but not in those who did not receive the education--you can be confident it is the result of your education program only if you place certain controls over the conditions under which changes are measured. Controls over the conditions of measurement are defined by an experimental design. The more precise the controls, the greater the confidence you can place in the findings. Guidance in selection of an experimental design is a part of this methodology.

The 24-hour food recall is used to sample food behavior. One can usually know about the dietary habits of a community only through sampling. That is, one determines from a sample of the population what foods they eat

over a certain period of time. To determine the behavior through direct observations is rarely feasible; it is too time consuming. Further, the persons observed are likely to behave differently when the observer is present, and the behavior would not be representative. In this methodology, the sample of food behavior is made by asking the person to recall what foods were eaten during the full day preceding the data collection visit. A simple report is asked of the family member who controls dietary intake. If the food consumption report is for an adult, that adult may be asked to report. If concern is for the feeding of an infant or small child, the report may be asked of the person responsible for feeding the infant or child. Guidelines are included to assure the most accurate recall possible.

The methodology is concerned with fundamental changes in food habits. A fundamental change is a change which is in the desired direction--for example, from inappropriate to appropriate diets--and which is sustained over a long enough period of time to be considered a lasting change. Behavioral change almost always takes place over a longer period of time than does cognitive change. Thus, measurement of behavior should be taken at least two and preferably three times, over a period of six to eighteen months, to evaluate if fundamental change has been achieved.

The user is permitted to set the criteria for evaluation. Criteria describe the behavior which will be accepted as evidence that the educational objectives are or are not being achieved. They are closely tied to the educational objectives. For example, if the educational objective is to ensure adequate protein foods are consumed by elementary school children, the criteria describe the foods a child must eat to have the needed protein. Or, if the objective is to ensure that young adults consume a balanced diet, the criteria describe what patterns of food consumption will be accepted as evidence of a balanced diet. Criteria will, of course, differ from one area to another depending upon the educational objectives of the program and the behaviors expected of the participants.

Separate data collection formats are provided for: youths and adults, infants and children under five years of age, family characteristics, and family food resources. The data handling procedures are simplified by the use of worksheets to guide the user through the summarization and analysis of field data. The primary statistics employed are: sums of cases, percentage distributions, and the Chi Square test of differences. Manual handling of the data is assumed throughout the Field Guide. However, should the user wish to use machine processing, a sample format is provided in the Appendix.

Cost analyses are designed to make use of cost estimates which are readily available to the evaluator. Techniques are provided for including in the cost-effectiveness analyses the cost-equivalence of services or materials which are donated and do not require monetary expenditures.

Implications of the Decision to Evaluate Your Education Program

Ideally, evaluation of behavioral effects should be built into a nutrition education program from its beginning. The methodology in this Field Guide is equally appropriate for use as an integral part of the initial program plan or at some subsequent point in time. But, when persons make the decision to use the methodology they should be fully aware of the implications and willing to commit the needed resources.

An evaluation activity will always impact to some extent on the nutrition education staff. Even if one hires one or more specialists for evaluation, staff time will be required to coordinate the activity, to provide needed information, and for conferences to discuss progress and results.

If contractor services are contemplated, the advantages and disadvantages should be carefully considered. Advantages of using a contractor are (a) that it can sometimes lead to greater objectivity, and (b) it can reduce the amount of program staff time required for the evaluation. The major disadvantages are (a) the cost will almost always be far greater, and (b) there is potential that the activity may take directions not intended. In general, excepting for very large scale evaluations, it is better to avoid the use of contractors to conduct the evaluation.

There will always be costs other than personnel costs. Examples are: nominal costs associated with reproduction of data collection and analysis worksheets, travel to the sites and homes to collect the data, and miscellaneous supplies. Administrators must be aware of these requirements and be prepared to provide them.

Some General Guidelines

✓ Treat the evaluation as a special and continuing part of the education project.

✓ Commit personnel time to the evaluation activity. If evaluation activity is in addition to other duties, adjust the regular work load to allow persons assigned to evaluation on a part-time basis to participate when needed.

✓ The person selected to direct the evaluation should have high interest, ability, and probability of remaining with the program. At least one person assigned to the evaluation team should be fully knowledgeable about nutrition and about the objectives of the education program.

- ✓ If more than one location or organization is involved in the education evaluation, assign responsibility for coordinating evaluation activities.

- ✓ Where staff resources are limited, consider hiring community persons or students on a part-time basis for the special work of data collection. If such persons are used they should be thoroughly trained preceding each data collection.

CHAPTER 2: PLANNING AN EVALUATION

Assembling Background Information

Three categories of background information are important for the evaluation activity: descriptive information about the community as it relates to food availability; baseline information about the food habits of the target audience; and information about the cost of operating the program or programs which are to be evaluated. Most, if not all, of the information will already be available in some form within the education program. How much of it you should assemble for the evaluation activity can best be judged if you are aware of the purposes the information can serve.

Types and Uses of Community Information

Measurements of food behavior must be interpreted in relation to conditions which prevail in the community.

✓ What foods are available? What a person eats is in large part determined by what foods are available. Costs of certain foods may make them unavailable to the target population. Foods which can be grown in the community may be available only at certain times of the year. Droughts and floods can destroy crops. The evaluators must be fully aware of conditions over which the education program has no control, but which may limit the effects of education.

✓ What resources does the target audience have for food? If the education is to result in changes in food habits, the families must have food resources. Do they have the money to buy needed foods at current prices? Do they have the land, the seed, the livestock to grow food? Do they have the skill to obtain food from forest or waterways? Are there feeding programs or other sources of free food? Your expectations of results from educational activity must take realistic account of the target audience's physical and economic resources to acquire food.

✓ What are the food customs? Malnutrition is sometimes as much a problem of "non-use" or improper use of food as it is of "no food." What are the food taboos? What are the traditions in the ways people handle and prepare foods? Awareness of the way persons in the target audience think and talk about foods is also essential. Within a small urban community of mixed ethnic backgrounds, for example, a single food type may be known by many different names. By what names are foods known in the area where you are evaluating? What ingredients are put into commonly used food mixtures? How do homemakers refer to amounts of food

when preparing dishes or when serving the family? Who are the authority figures in matters of feeding the family? Awareness of these various food customs will be needed in planning the data collection, training data collectors, and in the interpretation of measures of food behavior.

Types and Uses of Baseline Information

Baseline information describes food habits as they are at the beginning of the education program. Ideally, the evaluation activity is initiated at the same time the education program is initiated. Where the two activities are initiated concurrently, the baseline information established for purposes of planning the education program may also be used for the evaluation baseline. Where the two activities are not initiated concurrently, or where the baseline used for the education plan is too broad or complex, the first measurement made in the evaluation activity should be used as the evaluation baseline.

When and how can the existing baseline be used? The baseline for planning the educational program is often in the form of a dietary survey or a health survey. Even though it may contain many classes of information not directly useful in the evaluation, it can serve the evaluators in several ways.

✓ It can serve as a useful reference in setting evaluation objectives. The baseline information will identify which of many nutrition problems are the most critical. The education program may be directed to many objectives, but not have sufficient resources to evaluate its effects for all objectives. The evaluation can be limited to the nutrition problems identified in the baseline information as most critical.

EXAMPLE: The survey baseline indicates multiple nutrition problems and cites Vitamin A deficiency as one of the most critical problems for the target audience of your education program. Your education program has a number of objectives, including the objective of getting persons to eat those foods which contribute Vitamin A to the diet. In your evaluation of results you may elect to limit measurement to only those foods which contribute Vitamin A to the diet.

✓ Only when the survey baseline contains recent and easily accessible information about food habits of your particula target population can it be used as a baseline measure for the evaluation.

EXAMPLE A: An education program is designed to teach mothers in low income families in a rural area to feed their infants a nutritious weaning formula. The survey baseline includes recent data about food habits in rural areas, and categorized information about the feeding of

children under five and in families of different income levels. The information is tabulated by types and amounts of food, and frequency of feedings. In this instance, the survey baseline is compatible with the methodology and the information needed is readily accessible. It can be used as an evaluation baseline.

EXAMPLE B: An education program is designed to teach women in a remote tribe in the interior of a country to prepare high protein foods and feed them to their families. The national survey baseline identifies food habits by age group, income levels, and regions of the country, but does not describe food habits for this particular tribe. None of the dietary patterns reported in the survey is clearly representative of the special target audience for this education program. Therefore, the survey should not be used as an evaluation baseline. Rather, the evaluator should use the initial measurement made in evaluation as a baseline.

For large, multi-unit education programs, the situation will generally be like that in Example A and a survey baseline can be used. For small education programs the situation will generally be like that in Example B.

Types and Uses of Cost Information

Different costs are associated with different approaches to nutrition education. A one-minute radio message broadcast once a day for six months will cost far less than a person-to-person demonstration of food preparation which reaches the same number of people over a six-month period. The important question for the evaluator is: "Which of the two approaches results in fundamental changes in food habits for the greatest number of people at least cost?" Or, said another way: "Which approach is more cost-effective?"

Measurement of the results of nutrition education is the central thrust of the methodology. The number of persons whose food behavior is positively affected is readily derivable. The evaluator who desires also to determine "cost-effectiveness," or to compare the cost-effectiveness of different program approaches, needs to assemble cost information which can be associated with delivery of the education. The factors which make up cost will differ from program to program. Some general guidelines:

- ✓ It is not necessary to do separate or elaborate cost accounting for evaluation purposes.
- ✓ Identify the cost factors which are included in the total cost if possible. Generally the total will include cost of salaries, facilities, equipment, food, fuel, and transportation.
- ✓ Costs are generally high during the early stages of a program but level off later. Purchase of equipment or facilities at

a point in time can grossly distort costs. These costs are called capital costs. They can be prorated over the years they are to be used.

EXAMPLE: A nutrition education program is started January 1972 to operate for three years. Actual cost during 1972 is $2,530. It includes both capital cost items and expendable cost items, as follows:

Capital Costs		*Expendable Costs*	
Shelter construction	*$1,000*	*Food supplies*	*$ 200*
Tables and chairs	*200*	*Fuel*	*50*
Stove	*50*	*Materials*	*20*
Cooking utensils	*10*	*Salaries*	*1,000*
Total	*$1,260*	*Total*	*$1,270*

To present a more realistic annual cost of the program, the capital costs are prorated over the expected three years of program operation, as follows:

	1972	*1973*	*1974*
Prorated capital costs ($1,260 ÷ 3 years = $420 per year)	*$ 420*	*$ 420*	*$ 420*
Food supplies	*200*	*200*	*250*
Fuel	*50*	*50*	*60*
Materials	*20*	*20*	*25*
Salaries	*1,000*	*1,000*	*1,010*
Total	*$1,690*	*$1,690*	*$1,765*

✓ In multipurpose projects, portion out the cost which is attributable to the nutrition education activity.

EXAMPLE: A rural program has the purposes of community development, education in leadership, and nutrition education. Administrative records show only a single cost record totalling $10,000 for one year. Costs for different program activities are not separately identified. The workers estimate that an average of 20% of their time is devoted to nutrition education. The cost estimate for nutrition education is 20% of the total program cost, or $2,000 (20% x $10,000) for the year.

✓ Prepare a narrative description of all volunteer services, donated equipment, food, fuel and other items which are used in the nutrition education but which do not require the expenditure of monetary resources. Make an estimate of the monetary value of these items so that cost information will also reflect what the program would cost if these items were purchased.

Setting Evaluation Objectives

Evaluation objectives are directly tied to the objectives of the nutrition education program.

- ✓ The educational objectives describe the conditions one expects to result from the educational activity.
- ✓ The evaluation objectives describe how one expects to learn whether or not the desired conditions have been achieved.

Effective planning for evaluation demands that the evaluation objectives be clearly stated. This task is made difficult by the fact that objectives of nutrition education programs are frequently presented in very broad terms, or may relate only to changes in knowledge about nutrition. It is further complicated where program objectives are numerous and of varying levels of importance.

It is almost never possible to evaluate all of the legitimate objectives of a nutrition education program. Therefore, some systematic way of limiting the scope of the evaluation activity is needed. This evaluation methodology places an important limitation upon the selection of program objectives to be evaluated: by design, it does not measure administrative efficiency of a program; it does not measure the knowledge gained by the participants; it measures food behavior. Even with this limitation, however, the number of possible objectives may quickly exceed the resources available for evaluation. One must examine each educational objective in terms of:

- ✓ The changes in food behavior which are implied by the objective
- ✓ The relative importance of the objective to the nutritional well being of the target group. Cues as to which nutrition problems are most critical can generally be found in the survey baseline data which was used to plan the nutrition education program.
- ✓ The prospects that the information can be used to make decisions about the nutrition education program.
- ✓ The availability of resources--time, personnel, funds--to carry out the procedures required to evaluate the objective.

Limiting the Scope of the Evaluation

Educational objectives should always be presented in terms of the behaviors which are expected to be exhibited as a result of learning. Thus, if a program seeks to teach persons the nutritive value of four basic food groups, the objective is expressed as: "The participants must be able to relate nutrients to the four basic food groups." Only when objectives are

expressed in terms of a behavior can the evaluator determine whether or not the objective is being achieved.

The example used above is an objective related to knowledge about nutrition. As has been pointed out earlier, knowledge is, in general, a prerequisite to practice and is therefore an important objective. But even more important are those objectives which relate to positive changes in food habits.

In Table 1 we present five objectives as found in descriptions of nutrition education programs in Latin America. All five objectives are written in behavioral terms, but the behavior required demonstrates only knowledge about nutrition. In the columns to the right we present food behaviors which might be expected if the participants put the knowledge they gained to practice. If one examines all of the behaviors described in Table 1, one will recognize that only the end behaviors relating to food consumption directly affect the nutritional well-being of the participating families.

Let us assume that the evaluator has narrowed the objectives to those relating to positive changes in food behavior. There are two additional ways in which the scope of the evaluation activity can be reduced.

1. By limiting concern to only selected portions of the target population--a particular age group, sex, or to persons whose health status places them in a high-risk group.

> *EXAMPLE A: A nutrition program in a highly urban area has as its objective to teach homemakers to feed their families a balanced diet. Background information about the community and target population reveals that it is customary for a mother to feed all other family members first and to feed herself only when and with what food is left. Thus, by custom, the mother is a highly vulnerable member of her family. The scope of the evaluation was reduced by using measurement of the changes in the mother's eating habits as a basis for determining the effects of education.*

> *EXAMPLE B: A mothercraft center teaches mothers to prepare food, feed and care for all her children. Baseline information about the target population indicates the family member most vulnerable to morbidity and death due to malnutrition is the infant in the under 5 years of age category. The scope of the evaluation was reduced by using measurement of changes in the feeding of children 5 years of age or under.*

Table 1
SAMPLES OF INTERIM VERSUS END OBJECTIVES

EDUCATIONAL OBJECTIVES AS PRESENTED IN EDUCATION PROGRAM PLAN	EXPECTED INTERIM BEHAVIORS	EXPECTED END BEHAVIORS RELATED TO FOOD CONSUMPTION
1. "Participants must be able to relate nutrients to the four basic food groups."	a. Getting foods which provide a balanced diet (through purchase, planting - harvesting, gathering, etc.) b. Preparing meals which include all food groups.	The participants will eat a balanced diet, and feed their familiss a balanced diet.
2. "Participants must be able to identify illness caused by poor diets and describe ways of curing the illnesses through proper feeding."	a. Recognition that a family member is malnourished or undernourished. b. Getting foods which will provide the needed nutrients to correct the problem.	Malnourished or undernourished members of participating families will eat foods which provide the special nourishment needed to correct the deficiencies.
3. "Participants must be capable of elaborating an appropriate menu for all the family members--considering all physiological characteristics, health, activities, prices, harvest season, et cetera."	a. Selection of amounts and types of foods to nourish the family. b. Appropriate distribution of the food according to the needs of each family member.	Each member of the participating family will eat foods in amounts and types according to his or her nutritional needs.
4. "Participants must be capable of identifying the characteristics of natural and processed foods which are in a good condition of preservation, and the characteristics of those which are not."	a. Selection of foods which are in a good condition of conservation. b. Appropriate storage and handling of foods to conserve nutritional value.	The participants will eat and feed their families only foods which are in good condition of preservation.
5. "Participants must be able to describe the correct method for preparing the soil, planting and caring for a vegetable garden."	a. Prepare the soil correctly. b. Get seeds or plants for vegetables. c. Plant, care for, and harvest the vegetables.	Participants will eat vegetables.

2. By limiting concern to selected types of foods. Even where the central objective of the program is to bring about consumption of a balanced diet, it is sometimes possible to limit evaluation concern to only selected food categories.

> *EXAMPLE: A non-formal education project in a rural community teaches the relationship between nutrition and health, the importance of a balanced diet, gardening as a source of food, food storage and preservation, food preparation, sanitation. Baseline information demonstrates that the target audience has very poor diets. Background information demonstrates that economic conditions and food production capabilities will not permit immediate achievement of adequate and balanced diets for the target audience. The educationists believe they will have achieved major progress if they can get persons in the community to eat vegetables, since vegetables can be grown in the gardens and some can be preserved. The scope of the evaluation was limited to measurement of changes in food habits as they relate to consumption of green and yellow vegetables, dried lentils and peas.*

The evaluation may include at least limited diagnostic intent. That is, within a program using only one general approach--such as a mothercraft center--program persons may want to learn through evaluation how long or how much education is necessary to bring about fundamental changes. Thus, an evaluation objective might be simply to determine whether infants whose mothers participate in more than 20 training meetings are more appropriately weaned than infants whose mothers participate in less than 20 training meetings. Or, program persons may want to know if young mothers respond more to the teaching than do mothers in their thirties and forties. In this case, an evaluation objective might be to determine if infants of young mothers are more appropriately weaned than are infants whose mothers are in their thirties or forties.

Preliminary Statement of Evaluation Method

Careful definition of the program objective you have selected for evaluation may be enough to support immediate definition of the measures, comparisons to be made, and evaluation procedures to be followed. Generally, however, it will be helpful to set down a brief statement about how the evaluation objectives will be achieved.

> *EXAMPLE: Figure 2 presents a sample set of objectives for a community project to provide means of increasing the availability of protein-rich foods. As a first phase of the project, egg production was introduced. Note that there are a great number of objectives to be accomplished. The project managers reviewed the objectives and decided that evaluation should be concerned with the one related to egg consumption. In order to tie the objective more closely to the intent of the evaluation, the following statement was prepared:*

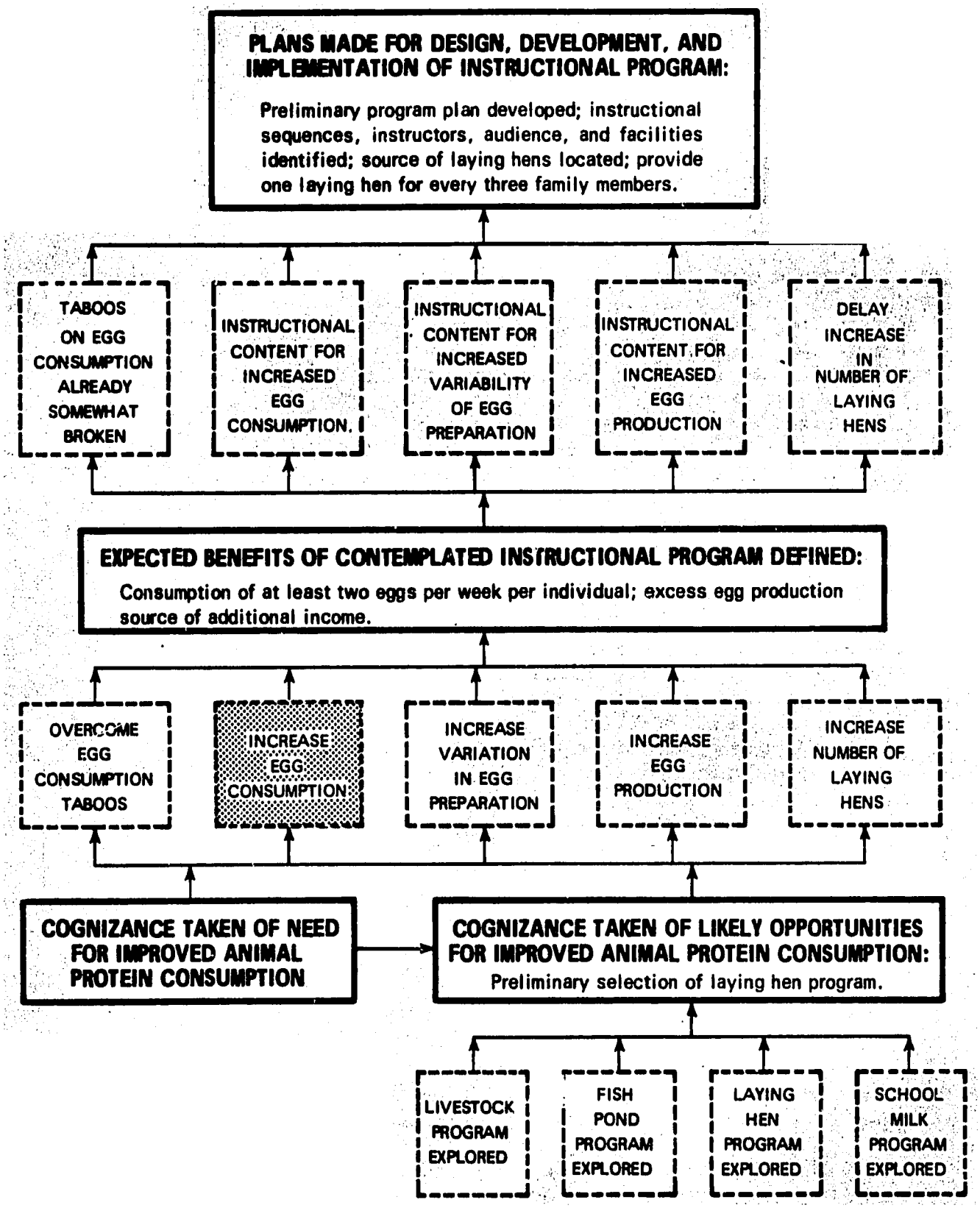


Figure 2. Sample Program Objectives for an Egg Production Project

"The average number of eggs consumed per person per week will be compared immediately before and six months after participation in the program. The difference in consumption before and after participation will be compared with differences for a selected group of persons who did not participate in the program but who were measured at the same time as those who did."

In the example above the evaluation was concerned with a single project approach--the egg production project--and whether or not it resulted in a change in food consumption. Where the purpose of the evaluation is to determine the comparative effectiveness of different approaches to nutrition education, the statement of the objective should be equally definitive.

EXAMPLE: A program is initiated to educate community people to eat high protein foods such as groundnuts, legumes, milk, meat, and fish. Separate projects are started using different approaches. In Community A demonstrations and discussions with individual families are carried out in their homes. In Community B the nutrition education is carried out in the schools, as part of the elementary education and with special classes for adults in the evening. Community C has a population similar to that of Communities A and B, and the same types of nutrition problems. But the program managers do not want to start a project there until they can determine which approach is more effective. The objective for the evaluation activity was described by the following statement:

"The differences in consumption of high protein foods by persons in the Community A project, before and after instruction, will be compared with the differences before and after instruction for persons in the Community B project. Differences in both Communities A and B will be compared with differences shown by measurements taken at the same times for a control group selected in Community C."

In each of the examples, the statement about how the evaluation objective will be achieved represents the beginning of a study design for conduct of the evaluation. The section which follows presents a discussion of study designs which will help you to decide which type of design is appropriate for achieving your evaluation objectives.

CHAPTER 3: DESIGNING THE EVALUATION STUDY

The basic design of the evaluation study attends to the organization of measures in ways to permit demonstration of achievement or nonachievement of the intended effects of the program. Decisions about the basic design will determine how much confidence you can place in the findings that your education program is or is not resulting in positive changes in food behavior.

The purpose of the study design is to focus the attention of the evaluation on effects which result from nutrition education, as opposed to effects which might result from factors other than the nutrition education. The individual who designs and conducts the evaluation faces an especially difficult task, for field conditions will almost always impose severe limits on the kinds of studies which can be successfully carried to completion. Two principles are suggested:

- ✓ Be realistic about your resources and constraints. It is better to have a simple study whose requirements can be met than to have a more sophisticated design whose requirements must be compromised in the course of gathering field data.
- ✓ Use the best talent available to verify the study plans. It is better to know the limitations of a design before heavy investment in field data gathering than not to know them at all, or to know them only after the investment has been made.

Basic Terms

Understanding of study designs requires familiarity with the basic concepts involved. Table 2 presents definitions of the terms which are commonly used in discussion of study designs. Read them carefully before proceeding to the next discussion.

Sample Study Designs

Table 3 presents a graphic summary of four basic study designs. They are numbered in order of increasing levels of confidence one can place in the study results. Designs 1 and 2 represent case studies or studies in which no control group is used. Designs 3 and 4 represent experiments and make use of a control group. An experiment, using a control group, can provide greater confidence in the results of evaluation than a case study. Notice also that designs 2 and 4 include measurement both before and at some point in time after the educational treatment.

Table 2
DEFINITION OF TERMS
USED IN DISCUSSION OF STUDY DESIGNS

TERM	DEFINITION	COMMENTS
TREATMENT	The process whose effects the evaluator wishes to investigate.	The treatment referred to in this methodology is nutrition education.
CONTROL	A condition where the treatment is known not to be present, or is present to some lesser degree.	In evaluating nutrition education, a control is a condition where either no education or a lesser amount of education is given.
EXPERIMENTAL GROUP	Some set or number of individuals who have received the treatment.	An example would be a group of persons who are participating in a nutrition education program.
CONTROL GROUP	Some set or number of persons who have not received treatment or who have received a lesser amount of it than has the experimental group.	A control group should always be drawn from a similar population type as is the experimental group.
SAMPLE	A subset or smaller number of persons from a definable population which is selected to represent the total group.	It is rarely feasible to study the total population with which the education program is concerned. A representative sample is studied.
MEASUREMENT	The assignment of some standard qualitative or quantitative descriptors to observations.	Pretreatment measures are measures made before the nutrition education is initiated. Posttreatment measures are those made at some point in time after the program has begun.
RANDOMIZATION	Decision making which is guided strictly by chance or in which each person in a given population has an equal chance of being selected for the sample.	Random selection of persons to participate in the study is used to assure that the sample is representative of the population being studied. Random assignment to experimental and control groups is used to assure that measured effects result from the treatment
GENERALIZABILITY	The extent to which one can assume that results of a study of one group are applicable to other groups which were not involved in the study.	Randomization is used to obtain generalizable results.

Table 3

GRAPHIC SUMMARY OF BASIC STUDY DESIGNS

◯ = Design Code Number T = Treatment

M = Measurement A = Assignment to Groups

⟶ = Lapsed Time

PRETREATMENT MEASUREMENT?	CASE STUDIES	EXPERIMENTS
No	① T ⟶ M	③ A < T ⟶ M ; M
Yes	② M ⟶ T ⟶ M	④ A < M ⟶ T ⟶ M ; M ⟶ M

The methods and formats presented in this Field Guide are built around an experiment and make use of a control group. If resources and constraints are such that only a case study is possible, the methods and formats can be used for that purpose also. The following discussion of the four basic designs provides guidance to help you select the best design for your particular evaluation study.

True Experiments versus Quasi-Experiments

Both design 3 and design 4 can be either a true experiment or a quasi-experiment. A true experiment requires that individuals be randomly assigned to groups--a group or groups which are to receive nutrition education and a control group which is not to receive the education. It is possible for the design of a field evaluation to meet the requirements of a true experiment. For example, a project might be undertaken for the sole purpose of testing the effects of new approaches to nutrition education. A true experimental design, involving random assignment of individuals to groups, would be central to the project.

A true experiment is almost always more accurate than a similar quasi-experiment in which assignment to groups is on some basis other than strict randomization. Pretreatment measures are usually not required in true experiments (as illustrated in design 3) because differences between groups in posttreatment measures should be due only to treatment effects and chance

In the broad field of nutrition education, true experimentation is rarely practical. Participants in nutrition education are not chosen for purposes of experimentation. They enter the programs voluntarily and out of felt need for guidance about food and nutrition; or, they are brought together from a select population to whom a particular education program--such as a Mothercraft Center--provides special services. If quasi-experimentation is the best course available, it is important that every effort be made to define experimental and control groups that are as similar as possible. Pretreatment measures (as shown in design 4) should be taken since without the pretreatment measure it will probably be impossible to determine how similar the experimental and control groups are prior to the educational program.

Case Study Design 1: T ⟶ M

In its simplest form, this design represents one measurement of food behavior for persons particpating in the education program and taken at some point in time after they have been exposed to the education.

> *EXAMPLE: Managers of a steel mill are concerned about the health of their workers who are often absent because of illness. They hire a nutritionist to teach workers about foods and nutrition. Each worker is required to attend a one-hour class, every working day, for a period of six months. At the conclusion of the instruction, a measurement of food behavior of all the workers is made.*

As can be seen, the design has severe limitations. In the absence of information about the food behavior of the workers before they attended the classes there is no way to know whether positive changes in food behavior have been achieved. Thus, it is difficult, if not impossible, to know if any change has occurred or to assess the degree to which the observed behavior resulted from nutrition education.

Case Study Design 2: M ⟶ T ⟶ M

This design includes measurement both before and after exposure to the educational treatment. It has some potential for assessing the effects of nutrition education in that, by comparing the pretreatment measure with the posttreatment measure, one can observe if positive change has occurred. Its major limitation is that there is no control to permit assessment of the possibility that the observed change was influenced by factors other than the educational treatment.

EXAMPLE: Let us assume that the nutritionists began the education program during the dry season when foods were scarce, and completed it during the harvest season when foods were abundant at very low cost. In the evaluation a comparison of the pretreatment and posttreatment measures showed great changes in the food behaviors of the workers. But, the nutritionists could not determine to what extent the improved diets were the result of the education and to what extent they were the result of the increased availability of low cost foods.

If design 2 is to be used, some added confidence that the observed results are related to treatment effects can be achieved by extending the pretreatment and posttreatment measures as shown below:

$$M \longrightarrow M \longrightarrow T \longrightarrow M \longrightarrow M$$

This extension of the design does not directly control for non-treatment effects. It does, however, give the evaluator the opportunity to observe behavior over longer periods of time, and to sort out those behaviors which are associated with normal variability over time from those which might be related to the exposure to education.

<u>Experimental Study Design 3</u>:

$$A \begin{cases} T \longrightarrow M & \text{(Experimental)} \\ \longrightarrow M & \text{(Control)} \end{cases}$$

This design requires use of both a control and an experimental group, but does not include pretreatment measures for either group. It can be an excellent design if assignment of individuals to groups is strictly random--that is, if it is a true experiment.

<u>EXAMPLE</u>: The nutritionists want to determine experimentally what effects nutrition education will have before making the investment to teach all workers. A sample of workers is selected <u>randomly</u> from the total population of workers in the mill. They attend the course in nutrition education. At the end of the education course, food behavior measures are taken for <u>all</u> workers in the mill. Measures for the group who attended the nutrition education course (experimental group) are compared with those for all other workers (control group).

This example represents a true experiment. The random assignment permits the nutritionists to generalize results to the total population of workers in the mill. Those workers given the education are representative of the population of workers. There is no reason to assume their backgrounds or their experiences differ, excepting for the educational treatment. If a

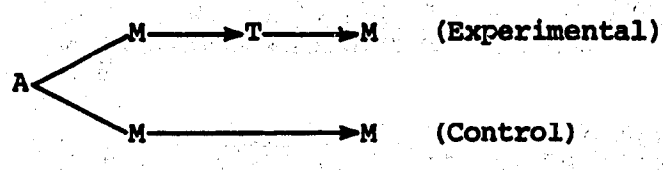
significant improvement in diets for the experimental group is found when compared with diets of the control group, the nutritionist and the managers of the mill can be confident that nutrition education for all workers will produce positive results.

If only a quasi-experiment can be achieved, however, design 3 places strict limitations on the extent of confidence one can place in the results of evaluation.

> ***EXAMPLE:*** *Let us assume that for purposes of the nutrition education the nutritionists are permitted access to only one department or section of the mill at a time. The first department to attend the course are the maintenance men who repair mill equipment. At the end of the education course, food behavior measures are taken for all workers in the mill. Measures for the maintenance men who attended the nutrition education course (experimental group) are compared with those for all other workers (control group).*

This example represents a quasi-experiment. Since assignment to groups is not random, the nutritionists cannot assume that workers in the maintenance department are representative of the total population of workers. Any differences in the food behavior of the two groups at the end of the education course may be differences which existed at the outset and unrelated to the nutrition education. Thus, if conditions for evaluation are such that only a quasi-experiment can be achieved, design 4--which includes a pretreatment measure to assess comparability of the groups--has definite advantages over design 3.

Experimental Study Design 4:



This design requires pretreatment and posttreatment measures for both an experimental and a control group. It is especially appropriate for quasi-experiments, but the following guidelines should be followed:

- ✓ Persons used in the experimental group should not have exposure to the education before the pretreatment measure. Thus, if the evaluation is for an on-going program, a new group of participants should be used.

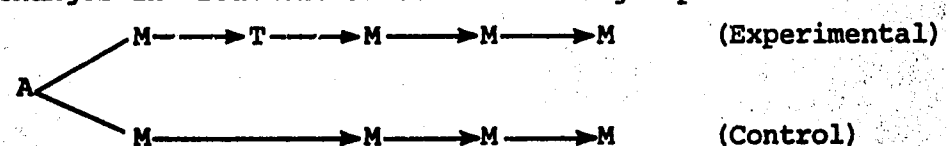
- ✓ The control group should be drawn from a population which is similar to that of the persons in the experimental group. That is, they should be persons of the same socio-economic, educational, age, and cultural backgrounds.

✓ Analysis of the pretreatment measures should be made to verify that the groups are similar. If the comparison of pretreatment measures demonstrates that the experimental and control groups are significantly different in food behavior, the probable explanation is that they are not from the same general population. In this event, the evaluator may take one of two corrective actions:

- If resources permit, the initial control sample should be rejected and a new, more comparable control sample selected.

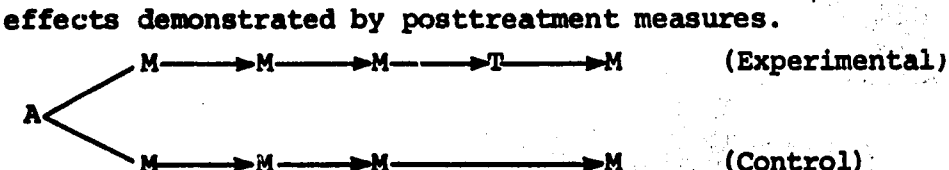
- If resources do not permit selection and measurement of a replacement control group, the practical solution is to abandon experimental design 4 and conduct the evaluation in accordance with Case Study Design 2. Choice of this alternative does not mean that the analysis of pretreatment measures is a complete loss. Rather, the information gained through this analysis should be used to help you understand the particular nature of the population with which you are working. (A sample Worksheet Number 4 for case study analyses is included in the Appendix.)

✓ Extending the design to include additional posttreatment measures, as shown below, will permit you to examine changes in treatment effects over longer periods of time.

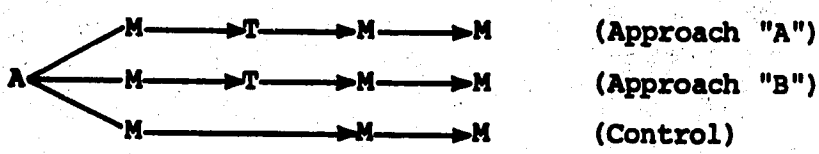


In multiple posttreatment measures, care must be taken to assure that proper account is taken of dropouts so that treatment effects are not confused with the effects of less motivated or less capable persons who tend to drop out of the program.

✓ Extending the design to include additional pretreatment measures, as shown below, will permit you to observe normal variance in food behavior--such as seasonal variance and availability of certain foods only during harvest--and to take such variance into account in interpretation of effects demonstrated by posttreatment measures.



✓ Expanding the design to include two or more experimental groups, as shown below, will permit you to compare the effects of different approaches to nutrition education.



In general, where conditions and resources dictate a quasi-experiment design 4 is preferred. In Chapter 5, which presents a model to demonstrate the quantification and analysis of field data, design 4 is applied in both the evaluation of a single program and comparison of results from two different program approaches.

CHAPTER 4: PREPARATION FOR COLLECTION OF THE FIELD DATA

The study design is the basic framework within which you will conduct the evaluation. You are now ready to consider several questions about the field data needed to build on that framework. How many persons and who will be interviewed? When and where will the interviews take place? What information will you ask for and how will you record the responses? Who will do the interviewing and how can you be sure that it will be done well? Only after you have considered each of these questions and found satisfactory answers are you prepared to undertake the collection of field data.

Sampling: Who and How Many Persons Are to be Interviewed?

Sample Size

For very small programs it may be possible to use all participants for the study, and sampling is not an issue. But if there are a great number of participants, sampling, or using only a portion of the participants, will greatly reduce the cost of evaluation. If the portion selected is too small, the measurement is likely to be a very inaccurate picture of the total group. Increasing the size of the portion will increase accuracy; but beyond a certain size, the rate of improvement begins to diminish. Thus, too large a sample will result in greater increase in cost than is merited by the small amount of improvement in accuracy. Any sample will differ in some way from the larger population. The practical question which the evaluator must ask is: What is the smallest sample I can use and still obtain meaningful measures?

As a general rule, any group which is to be compared with any other group, or to be compared with itself--such as for pretreatment and posttreatment measures--should contain at least 20 individuals. From a practical point of view, a sample that small may be too small. Let us examine some of the factors which could present problems.

If your evaluation objectives indicate interest in food behaviors of individuals with widely differing personal characteristics--such as age or income level--the sample must be large enough to look at each subgroup which represents the different areas of interest.

> *EXAMPLE: A nutrition program in a rural area is conducted by teaching families in the homes. There are 300 families in the program. The evaluator wants to determine the effect of the education on food habits of different family members: children under 5; children ages 6 to 10; youth ages 11 to 20;*

adults ages 21 to 40; and adults over 40. In effect the evaluator has defined five subgroups of participants. A minimum of 100 individuals was set for the sample size, with the condition that there would be 20 persons in each subgroup defined by the age grouping.

If the study design includes multiple measurements, a decrease in the size of groups can be expected to occur from one measurement to another. Individuals may drop out of the education program; some persons will move away from the community, or be inaccessible for other reasons. Therefore, the initial sample size should be increased in size to compensate for expected losses. If the population is reasonably stable, an increase of 5 percent should be adequate. If it is highly unstable, an increase of 10 to 15 percent should be used.

Randomizing the Sample

Remember that the results of evaluation based on a sample can be generalized to the total group of participants only if the sample has been randomly chosen. That is, every participant must have an equal chance of being selected for the sample. Providing equal chance for all participants can be done in any of a number of ways.

If the evaluator has access to a published list of random numbers, the procedure is straightforward.

EXAMPLE: Let us assume that in the rural program described above, the evaluator wanted to use only the food behavior of 20 homemakers as an indication of program effects. The 300 families were assigned numbers, from 1 to 300. The evaluator then used a table of random numbers, selecting the first twenty numbers between 1 and 300 which appeared in the list. The families which were assigned those 20 numbers were used as the study sample.

The results of the evaluation can be generalized to the 300 homemakers, but cannot be generalized to other family members since they were not represented in the sample.

A table of random numbers is presented in Table A in the Appendix. For the example above, a set of three-digit numbers was selected (since the numbers assigned to the families can have as many as three digits). Using the instructions provided for the table of random numbers in Appendix A, the selection process started at the 2nd, 3rd, and 4th digits of the 19th number in column 4 on the first page of the table. The number is "147" and indicates that the first family to be included in the sample is the family which was assigned number 147. Additional members of the sample were selected by searching downward in columns 4, 5, and 6 of the table and selecting in turn

each number which is between 000 and 301 (that is, from 001 to and including 300). The twenty families included in the random sample were those families which had been assigned the following numbers:

147	059	018	286	244	194	293
204	071	155	057	~~244~~	014	053
038	299	054	063	251	203	102

Once a number has been selected, it cannot be reselected. Notice in the above set of numbers, that when 244 was chosen for the second time, it had to be replaced. By this procedure, every family particpating in the educational program had an equal chance of being chosen for the study sample.

If the evaluator does not wish to use the table of random numbers, randomization can be achieved in a number of other ways. A very simple technique is to list the names of participants and number them as was done in the example above. Since there are 300 participants and a sample of 20 is sought, select one number between 1 and 15 and then count down the list and select every 15th name thereafter. However, to avoid any bias because of the way the names of participants are listed, the numbers can be written on slips of paper, placed in a box, and mixed thoroughly. Twenty slips are drawn from the box. They represent a randomized sample.

A Control Sample

Random selection of a control group presents a somewhat different problem. It is not generally practical to obtain the names of all possible members of the population of persons not receiving the nutrition education. One looks first for a subpopulation with backgrounds similar to those of the target audience for the education program. This is not as difficult as one might think. Persons of similar backgrounds tend naturally to cluster together. Persons living in a given block with similar housing will usually be from the same general income group. Persons who work at similar jobs will generally have similar educational backgrounds. Select an area which has a reasonably concentrated population of persons with backgrounds similar to your program participants. Let us assume you have selected an area with about 300 households and you want a sample of 50. Use every sixth house for the sample. A more refined control sample can be achieved by assigning numbers to all the houses in the selected community, and using the table of random numbers or the box of numbered slips of paper as described above.

Assigning Code Numbers

Much confusion can be avoided if you assign a unique code number to each member of the sample. Names sometimes are the same or very similar for two persons. They may also be very long. Therefore, assigning a unique but simple code will reduce both the potential for confusion and the amount of writing involved in handling the field data.

EXAMPLE:

Experimental Group A		*Experimental Group B*		*Control Group*	
A-001	*J. Fozalo*	*B-001*	*L. Mareto*	*C-001*	*D. Dalberm*
A-002	*M. Fraga*	*B-002*	*H. Rolonite*	*C-002*	*J. Lobok*
A-003	*M. Mareto*	*B-003*	*D. Brain*	*C-003*	*D. Doneiro*
A-004	*J. Libok*	*B-004*	*P. Pinheiro*	*C-004*	*D. da Silva*
	et cetera	*B-005*	*I. da Silva*		*et cetera*
			et cetera		

(Note that in the example all numbers assigned to experimental or control groups are coded with a prefix to aid in sorting the field data.)

Schedule for Measurement

Ideally, evaluation should be an integral part of an education program, and measurement a continuous process. But whether evaluation is a built-in part of the program or a special project, a decision must be made about when to measure effects. The decision is a critical one, since measures taken at different times in relation to the treatment can have different meanings.

Let us assume you have a pretreatment measure or some other appropriate baseline data. How does the timing of subsequent measurement affect the interpretation of results when compared with the baseline?

- ✓ Comparison of a posttreatment measure taken early during the educational treatment may lead you to think that the education is <u>less</u> effective than it truly is. Insufficient time and treatment may have been given for measurable change to occur.

- ✓ Comparison of a posttreatment measure taken immediately after completion of the educational experience may lead you to think that the education is <u>more</u> effective than it truly is. The measure may be influenced by temporary effects of a very recent educational experience, but as time passes many of the participants may forget and revert to their old and more deeply rooted food habits.

- ✓ Comparison of a posttreatment measure taken approximately six months after completion of the educational experience will provide a reasonably good picture of the effects of education in changing food habits. A measure taken a year or more after the education will give you even greater confidence that the effect has been a fundamental, or lasting change. (As discussed in Chapter 3, multiple measures also have the advantage of permitting you to separate normal variance in food behavior--such as seasonal factors--from changes resulting from nutrition education.)

There are, of course, some practical considerations. Resources for evaluation may be so limited that multiple measures cannot be afforded. It is easier to take the measure during the educational treatment or immediately following it. As time passes it may become more and more difficult to find the individuals for measurement purposes.

If resources permit, take at least a second posttreatment measure on a subsample of the groups. Compare it with the pretreatment measure; sort out seasonal variations in food behavior. If resources are so limited that a second posttreatment on even a subsample is not possible, make use of your background information about food availability in the community. In the interpretation of evaluation results be sure to take account of known seasonal variations and other factors which affect food behavior.

Classes of Data and Measures

It is helpful to think of the field data in terms of classes of information. The first and most important class contains the information which is most directly related to the evaluation objective, or the basic data set. It describes each individual in the sample of persons used for the study and, on the basis of a 24-hour food recall, provides a picture of each person's food consumption behavior. It is the sum of this class of information that permits comparison of food behavior over time, and, between groups who participate in the education and groups who do not.

The second class of data provides a brief description of the family to which the individual in the study sample belongs. Within the family setting or household, the amounts and types of food which one person eats are greatly influenced by the presence of other family members. Or, one individual's food consumption may be directly controlled by other family members, as is the case for diets of young children and infants. Therefore, at least a minimal family profile is generally needed to aid in interpretation of the basic data set.

A third potentially useful class of data concerns the resources which are available to the family for food. One of the greatest challenges to nutrition education is to achieve an adequate diet for persons who have only limited resources for food. Thus, examination of evaluation results against data about resources not only aids in the interpretation of the results--it can also provide valuable insights into the directions which future education activity should take.

The Basic Data Set: The Individual

Field information for almost any evaluation of nutrition education requires at least the following data about each individual in the sample:

- ✓ Identification data. This information includes the identification of which group the individual belongs to, the individual's name, and the location or address at which the individual may be found for subsequent data collection visits.

- ✓ Individual characteristics. These data permit the evaluator to estimate the dietary needs for the individual--as a basis for judging whether the reported diet is appropriate or inappropriate. They include at least age, sex, physiological characteristics, and identifiable conditions of health.

- ✓ Participation data. This information is taken only for persons who are participating in the nutrition education program or programs being evaluated. It identifies the extent of educational treatment received by the respondent

- ✓ The 24-hour food recall. These data include the description of the food consumed during the preceding day, stated either in terms of the number of times each food was eaten or in terms of the amounts of food.

- ✓ The reporting conditions. This information helps the evaluator to judge whether or not the reported diet is a representative picture of the food habits of the individual.

Figure 3 presents a suggested format for collection of the basic data set when the population of concern is composed of children or adults. The identification information is presented at the top to facilitate sorting of the data into groups in preparation for analysis at a later time. Note that a line has been provided at the bottom of the format for entry of the name of the data collector and the date on which data were collected. If the nutrition education is concerned with the feeding of infants or children under five years of age, some revision of the format for food recall is required. A suggested format is presented in Figure 4.

Validity of the Food Recall Technique

For purposes of evaluating nutrition education, experts judge the 24-hour food recall to be the best compromise between amount of information and efficiency in data collection. There is, of course, potential for inaccuracy in the food recall. Some persons may have difficulty remembering what they ate the day before the interview. Some persons, particularly persons recently exposed to nutrition education, may be more mindful of what they should eat than of what they actually ate. The interviewer may

INDIVIDUAL DATA

A. IDENTIFICATION:

1. Group _____

2. Name _____ Code Number _____

3. Address/Location _____

B. INDIVIDUAL CHARACTERISTICS:

4. Age _____ 5. Sex ☐ Male ☐ Female

6. Observable health status _____

7. Is respondent pregnant? _____ 8. Is respondent lactating? _____

C. PARTICIPATION DATA:

9. Has this person or a family member participated in the Nutrition Education Program? Yes _____ No _____

10. Who is the participant? _____ Position in family _____

11. How many meetings has the participant attended to date? _____

D. FOODS CONSUMED YESTERDAY:

12. FOOD	13. HOW PREPARED	14. NUMBER OF TIMES EATEN

(Space for Scoring the Adequacy of this Diet for this Individual when the Data are Reviewed)

E. REPORTING CONDITIONS:

15. Is the person who is the source of information for this report the person whose diet is being reported?

Yes _____ No _____

16. If no, what is the relationship to the person whose diet is reported? _____

_____

17. Are there any reasons to think the diet reported is not typical? Yes _____ No _____

If yes, give reason. _____

_____

Name of Interviewer _____ *Date of Interview* _____

Figure 3. Sample Format for Collecting Basic Data for an Adult

Infant or Child One-to-Five Years of Age

A. IDENTIFICATION:

1. Group _____
2. Name of Infant or Child _____ Code Number _____
3. Address/Location _____

B. INFANT'S CHARACTERISTICS:

4. Age (months) _____ 5. Sex ☐ Male ☐ Female 6. Weight _____
7. Observable or reported health status _____

C. PARTICIPATION DATA:

8. Has this person or a family member participated in the Nutrition Education Program? Yes _____ No _____
9. Who is the participant? _____ Position in family _____
10. How many meetings has the participant attended to date? _____

D. FOODS CONSUMED YESTERDAY:

11. The infant or child was breast fed? Fully _____ Partially _____ Not at all _____ Number of breast feedings yesterday _____
12. Is the infant or child bottle fed? Fully _____ Partially _____ Not at all _____ Number of bottle feedings yesterday _____
    Bottle formula used _____
13. Did the infant or child consume any foods other than that from breast or bottle? Yes _____ No _____
    If yes, list below:

14. FOOD	15. HOW PREPARED	16. NUMBER OF TIMES EATEN

(Space for Scoring the Adequacy of this Diet for this Individual when the Data are Reviewed)

E. REPORTING CONDITIONS:

17. Who is the source of information for this report? _____
18. What is the relationship to the infant or child whose diet is described? _____
19. Are there any reasons to think the diet reported is not typical? Yes _____ No _____
    If yes, give reason. _____

Name of Interviewer _____ *Date of Interview* _____

Figure 4. Sample Format for Collecting Basic Data for an Infant or Child One-to-Five Years of Age

make the visit at a time when the dietary intake was not typical--for example, the visit may occur on a day following a feast, or at a time when the individual was ill and unable to eat a normal diet.

If you take the precautions to insure you have as complete and valid a food recall as possible, the 24-hour food recall technique will serve your evaluation well. Some guidelines are given below.

✓ Sanction for the data collection activity. Community leaders frequently influence the receptivity of a visitor, particularly in closely-knit community groups. It is advisable to let the community leaders know in advance about the purpose of your intended interviewing activity.

✓ Confidence of the respondent. Take time at the beginning of an interview to explain the purpose of the visit. You are trying to learn about food habits. You need the information to improve an education or health service in the district. You need this person's or this family's help. If you explain it in this way, persons will sincerely try to give you the information you seek.

✓ Question about foods eaten. Ask your questions in terms of what was eaten. A typical way of asking for a food recall is:

> "Can you tell me, please, all of the foods you ate or drank yesterday? Begin with the morning when you got up. ..... What did you have during the day? ..... In the evening? ..... Did you eat or drink anything between those times? ..... Was there anything else? ....."

Do not make suggestions about foods which might have been eaten. Do not hurry the respondent.

✓ Verification of the response. When the individual has completed the report of foods eaten, read the report to the individual and ask again if that is all. This approach gives the respondent time to think and an opportunity to correct any errors. If the report is about an infant or a child, and if more than one person is present during the interview, verify the response with each person to the extent possible.

✓ Representativeness of the recall. The suggested formats for collection of the basic data set include an item on "Reporting Conditions." This item is to help you identify instances in which the diet reported is not representative for that individual. When you have completed taking the recall, ask the respondent if yesterday was a fairly

typical day. If the answer is "no," ask why. Record the answer given. Judgment as to whether the diet is representative or not will be made later, during review of the total set of data.

The Problem of Ingredients of Food Mixtures

Many of the foods reported will be simple foods such as bread, banana lettuce, or milk. Quite frequently, however, the diet report will include one or more mixed dishes such as soup, stew, or salad. Since the ingredients of even the most common dishes will vary from family to family, it is necessary to obtain information about how the dish was prepared. At least the major ingredients of the dish should be reported under "how prepared" (question 13).

Similarly, in the suggested format for collecting data about infants, a question is included (question 12) about the content of formulas used for bottle feeding. If a weaning food is reported, ingredients should be reported under the heading of "how prepared" (question 15).

Amounts of Food

In many programs, frequency or the number of times a day that a person consumes a given food is a sufficient measure for determining the effects of nutrition education on diets. In some programs, however, the evaluator will want to measure in terms of amount of food. Conditions under which amount is very important are: where the behavior of interest concerns only one particular food; and, where the type and amount of food are extremely scarce.

> *EXAMPLE A: A new thiamine-enriched rice is introduced in a community where the disease beri-beri is common. Rice is the staple food. Education is directed to encouraging people to use the new type of rice. The evaluators measure in terms of amounts of thiamine-enriched versus non-enriched rice in the diets.*

> *EXAMPLE B: In an isolated rural community, poor soil and prolonged drought resulted in near-starvation conditions for the people. The education program is concerned with sufficient amounts of food to sustain life.*

EXAMPLE C: The target audience is the very poor people who have migrated from rural areas to a highly urban area. They can no longer grow food or gather it from forest and waterways. They have very little money to purchase food. The education program is concerned with sufficient amounts of food to sustain life.

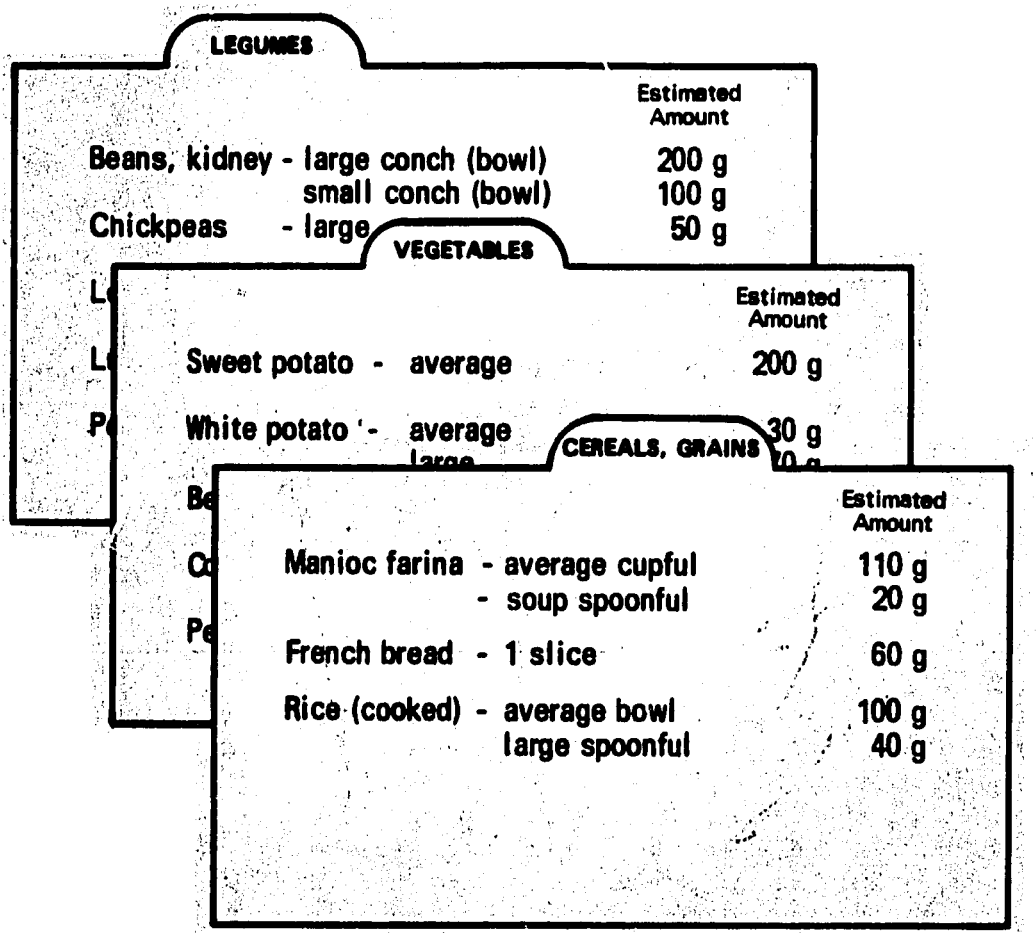
If for the reasons cited above, or for any other reason, persons wish to measure food consumption in amounts, they must be prepared to accept the difficulties involved in obtaining such measures. Central to these difficulties is the wide variance in the ways in which people think about amounts of food. A person responding to questions about food consumption will respond in terms of his or her own way of thinking about the amount of that particular food--one banana, one serving of manioc, one gourd of soup. The evaluator is left with the task of deciding whether it was a very large or very small banana, a large or a small serving, a big gourd or a little one.

The concept of amounts of feeding for infants is likely to be so variable, and the mother's response so inaccurate, that it is usually better to indicate feeding by frequency measures. For other population groups, the simplest solution to the problem is to establish some rules for estimating what amounts of food the different respondents have in mind. To estimate quantities of food one must be very familiar with the customs of the population being studied. How do they measure food? In cups? Plates? By the ladleful? In gourds? What amounts do they consider a serving for different family members? Two steps are suggested to provide the familiarity with customs at the level needed to understand the food amounts reported.

- ✓ Visit a small number of the homes of your participants. Observe what food is served to different members of the family. Talk with individuals about the amounts and make a note of the ways in which they refer to different amounts.

- ✓ Collect samples of the containers used in the households. Fill each container with each of the different types of food for which it is customarily used. Measure or weigh the food required to fill it. Prepare a reference table for use in interpreting amounts when you review and quantify the data.

Figure 5 presents an example of a part of a set of rules prepared by a group of nutritionists in Latin America for judging the amounts of food which were reported in their community. But, almost every community will differ, and you will need to prepare information similar to that shown in Figure 5 but based on the practices of your target audience.



LEGUMES

		Estimated Amount
Beans, kidney	- large conch (bowl)	200 g
	small conch (bowl)	100 g
Chickpeas	- large	50 g

VEGETABLES

		Estimated Amount
Sweet potato	- average	200 g
White potato	- average	30 g

CEREALS, GRAINS

		Estimated Amount
Manioc farina	- average cupful	110 g
	- soup spoonful	20 g
French bread	- 1 slice	60 g
Rice (cooked)	- average bowl	100 g
	large spoonful	40 g

Figure 5. Sample of a Reference Table for Estimating Amounts of Food

The problem of estimating amounts of food is compounded by the difficulty in determining the amounts of different ingredients in mixed foods. One will generally have to accept very gross estimates in these instances, since the cost in time to quantify more precisely can quickly exceed the value of more refined estimates.

If the decision is made to measure in terms of amounts of food, the heading on the suggested data form indicating "number of times eaten" should be changed to read "amount of food." In addition, the data collector must remember to ask about the amount for every food item reported by the respondent--a cup of milk, or a kitchen spoonful of butter. Failure to enter the amount, once the decision has been made to measure by amounts, will result in loss of data.

The Family Profile

Whether you need a family profile, and how much information you should collect, depends upon your particular evaluation objectives. Figure 6 shows a sample format for collecting information which will be useful in most evaluations.

Identification Data

This information permits you to tie the family to the individual in the sample. It includes the designation of the study group to which the individual belongs, and the name and code number of the individual. It also includes the name of the head of the household, and the address or location where the family lives.

Characteristics of Household Members

The purpose of this information is to help you learn something about the food needs of the household and how those needs might relate to the food behavior of the individual family member in your study sample. Notice that each member of the household is identified in terms of the relationship to the head of the household--a wife, a child, a grandmother, an aunt, or a friend. Names, which are difficult to record and less meaningful in terms of food behavior in a household, are avoided. The remaining items of information--sex, age, education, whether the individual is pregnant or lactating, type of employment--all combine to provide at least a gross insight into the food needs of the household. Or, viewed in a different way, the information provides an insight into what other needs are competing with the food needs of the individual in your sample.

Resources Available for Food

We have said earlier that an educational objective is a statement of the conditions one expects as a result of the educational activity. One bases expectations on knowledge about the field of nutrition--about what foods support good health, growth, and development--considered against knowledge about food habits and health status of the target population. There is always the potential for expectations to be too high in view of the food resources available to the target population. That is, the results of evaluation may demonstrate limited change in food habits, not because the education was ineffective but because sufficient food was not available for the family to reach expected levels of change. Therefore, it is useful to take a measurement of the food resources available to the families in your sample.

Resources include money to purchase food, and food itself. Figure 7 presents a sample format which can be used to collect information about food

FAMILY PROFILE

A. IDENTIFICATION:

1. Group _____
2. Name of person whose food behavior is reported _____ Code Number _____
3. Name of head of household _____
4. Address/Location _____

_____

B. CHARACTERISTICS OF HOUSEHOLD MEMBERS:

5. Relationship to Head of the Household	6. Sex		7. Age	8. Education Level					9. Check if Pregnant	10. Check if Lactating	11. If Individual Employed Indicate Type of Work
				Elementary		Secondary		Higher Education			
	M	F		Complete	Incomplete	Complete	Incomplete				
TOTALS											

Name of Interviewer _____ Date of Interview _____

Updated _____

Updated _____

Figure 6. Sample Format for Family Profile

FAMILY RESOURCES DATA

A. IDENTIFICATION:

1. Group _____ 2. Family Name _____

3. Name of person whose food behavior is reported _____ Code Number _____

B. RESIDENCE:

4. Rural Farm _____ Rural Nonfarm _____ Urban _____

5. Amount of money expended monthly for residence _____

C. INCOME:

6. Estimated monthly income to household, in money from all sources: _____

D. FOODS AVAILABLE IN HOUSEHOLD ON DAY OF REPORT:

7. SOURCE	8. FOOD TYPE	9. ESTIMATED AMOUNT
Grown on the land		
Gathered from field, forest or waterways		
Purchased		
Other		

(Space for Noting Adequacy of Available Food for this Household, for use in Data Review Only)

E. REPORTING CONDITIONS: 10. Are there any reasons to think the types and amounts of food are not typical for this household? Yes _____ No _____. If yes, give reasons. _____

_____

Name of Interviewer _____ Date of Interview _____

Figure 7. Sample Format for Family Resources Information

resources. It provides a gross estimate of the amount of money available to the household for the preceding month, and the amount expended for housing. More detailed information about income and expenditures is difficult to obtain and generally not necessary.

One particularly useful piece of information about the availability of food is an identification of what food is available to the household on the day food behavior is measured. Some added insight can be gained by classifying the foods by sources. Note also that a question has been included to assess whether or not the food supply is typical (question 10).

Pretest of Data Collection Formats

Whether you choose to use only the basic data set or to include one or both of the supplementary classes of data (family data and food resources), pretest of your data collection formats is critical. The formats serve several important purposes. They provide cues to the interviewers about the information they are seeking and the order in which it should be sought. They provide a place to record the information. They organize the information in ways which simplify the data review and analysis tasks. Pretest is simply a way of assuring that the formats serve each of these purposes well.

After you have decided which measures you want to make, draft an interview format. Select six to ten households which are similar to those in your study sample, but not a part of the sample. Explain to the homemaker that you want her to help you refine your method of interviewing. Ask for the information just as though you were conducting an interview for the study sample.

Review the completed interviews with other members of the evaluation team. Did you get the information you needed? Are there better ways questions might be asked? Was sufficient space provided for recording the information? How long did each interview take? Answers to these and similar questions can be used to improve the formats. They can also be used in planning the training for field interviewers.

Selection of Field Interviewers

Even with the most perfect data formats, the quality of your data can be greatly affected by the persons who do the field interviews. The time to take action to ensure quality field data is during the selection and training of the persons who will collect the field data.

Characteristics of Good Interviewers

Interviewing is an art form, and the ability to conduct a successful interview is a gift. Professionals in the business of interviewing suggest some guidelines, however, which will help you identify persons who can best perform the interviews required for evaluation of nutrition education.

- ✓ Individuals who have prior experience in working with the target audience or who have similar backgrounds make better field workers than those who do not. Persons with considerably higher education or far greater language facility than the person being interviewed may confuse the respondent, or, the respondent may falsify information in an attempt to impress the interviewer.

- ✓ Selecting persons who are already familiar with the community in which the data are to be collected can save much time and resources for the field work.

- ✓ Personality of the interviewer is very important. Choose persons who are interested in and enjoy people, individuals who can communicate easily with and are acceptable to the target group.

- ✓ When you talk with applicants for the interviewing job, tell them about the rewarding aspects of data collection, but also tell them about the difficult situations they may encounter. It is better to lose an applicant than to lose an interviewer after the investment in training is made and the field work is underway.

- ✓ If your study design includes multiple measurements, look for persons who might be called upon to pick up this work at a later time.

- ✓ Be sure that the interviewers can write legibly.

If you are hiring several interviewers, look for one who might supervise the field work as well as collect data, and who can do a final check in the field to make sure all data are complete and legible.

The Number of Interviewers

How many interviewers you need depends upon the sample size, the amount of data sought, the dispersion of the sample population, and the transportation available to interviewers. Experience in collecting all three classes of data described in this chapter--the basic data set about the individual, the family profile, and the resources information--demonstrates that, on the average, an interview requires 30 minutes. In an urban area, using public transportation, an interviewer completed an average of 10 interviews a day; in a rural area, using a motor vehicle for transportation, an interviewer completed an average of 6 interviews a day.

The averages cited above provide a starting point for estimating how many field interviewers you will need. They suggest, for example, that 300 interviews might be completed in 10 days with only three interviewers. They also suggest that if the households are far apart, or if travel must be on foot, more interviewers, or more time, or both will be needed. In addition, there is always the potential for one or more interviewers to drop out after they have been hired. It is better to hire and train one or two alternates with the understanding that they will be called upon for field work if needed, than it is to be caught short-handed in the middle of the field work.

Training of Field Interviewers

The importance of a good training program cannot be overemphasized. The way in which training is conducted can heighten the levels of interest and the confidence of the field team. Thus, good training serves both to ensure quality of data and to increase the probability that interviewers will stay on the job throughout the study.

Table 4 presents a suggested training program which covers essential subject areas for most training situations. Note that subject areas progress from general orientation to specific tasks.

Orientation

This session provides an opportunity for the interviewers to get to know one another, and to learn about the nature of the field study. It is in this part of the training that the instructor has the greatest opportunity for structuring attitudes about the work--it's importance, and therefore the importance of the interviewers.

Overview

This session includes discussions, examples, and demonstrations of how one begins an interview, the broad classes of information to be gathered, and how to end the interview. Charts can be used to discuss the importance and purpose of each class of information, such as identification information, individual characteristics, participation data, and reporting conditions.

Techniques

Training in techniques for getting specific information to complete each item in the data format should be done with the data format itself. Written instructions for conducting the interview should be prepared for training purposes. An example of written instructions for completing the basic data set for an individual is presented in the Appendix. If weight measures are to be taken for infants, demonstration and practice in measurement techniques should be provided. The importance of rechecking the form

Table 4
SUGGESTED TRAINING FOR INTERVIEWERS

SUBJECT	CONTENT	APPROACH
ORIENTATION	• Purpose of the field study • Role of the interviewer • Confidentiality of information • Characteristics of target audience • Locations of sample groups • Purpose and sequence of training	Discussion
OVERVIEW OF THE INTERVIEW PROCESS	• Introducing oneself • Explaining purpose of the visit • Getting audience with person most qualified to respond • Gaining confidence of respondent • Classes of data needed • Completing interview and thanking respondent	Demonstration and discussion; examples
TECHNIQUES OF GETTING SPECIFIC INFORMATION	• The interview format • Data within each class • Ways of asking questions for each information item • Avoidance of suggesting responses • Follow up to insure understanding • How to interview unresponsive or over-talkative persons • Methods of recording information • Rechecking to insure completeness and legibility	Use of the interview format, and written instructions; demonstration; discussion and role playing
TAKING THE FOOD RECALL	• Importance of the dietary information • Setting the time frame for recall • Foods in the community • Variations in names of foods • Food mixtures • How to identify suspected false reports • Verification • Special problem areas and how to solve them	Illustration, demonstration; role playing and discussion
CONDUCTING A COMPLETE INTERVIEW	• Getting through the full interview process • Ways of conducting interviews in a variety of anticipated field conditions	Role playing in which trainees practice with one another; discussion
ADMINISTRATIVE REQUIREMENTS	• Assignment of interviewing tasks • Schedules • Daily record keeping • Pay vouchers	Discussion and demonstration

to ensure that all information is legibly entered before the interviewer leaves the respondent should be emphasized.

Food Recall

The task of taking a 24-hour food recall is critical and should receive special emphasis in training. Simple training aids will help in teaching about foods in the community, food mixtures, and variations in the ways persons will describe foods. If amounts of food are required, the interviewers must be trained in whatever rules for estimating amounts have been defined in the evaluation plan. Practice in taking a food recall should proceed from situations which are simple to those which are difficult.

The Complete Interview

All trainees should be given extensive opportunity to practice conducting a complete interview. One of the best techniques for practice is role playing. Each trainee in turn takes the part of a homemaker, or other type of respondent, while another trainee conducts the interview. The dramatization permits exposure to a variety of anticipated field conditions. Discussion following each interview can be used to improve performance. Observation of the role playing permits the instructor to assess the adequacy of training.

Administrative Tasks

The training should include specific instruction on schedules, record keeping, and any additional administrative activities required of the interviewers. If a field supervisor is used, additional instruction for the supervisor's administrative responsibilities is essential.

Length of Training Time

How much training is required depends on the prior experience and personal characteristics of the field workers you have selected. For highly experienced workers, the sequence of training described in Table 4 can usually be completed in two or three days. For persons with little or no experience in interviewing, it will generally require a minimum of four to five days.

CHAPTER 5: QUANTIFICATION AND ANALYSIS OF FIELD DATA

When the field work is completed, the evaluator is faced with the task of deriving qualitative meaning from a collection of hand-written reports about individuals and their food habits. The process of deriving meaning from a set of field data is a step-by-step process which partitions the data into two or more mutually exclusive categories and changes them to quantifiable terms. An example of partitioning the data is the separation of reports which represent appropriate dietary behavior from those reports which represent inappropriate dietary behavior. An example of quantification is the assignment of numbers to indicate how many field reports demonstrate appropriate food consumption and how many do not. Analysis is the manipulation and examination of the quantified data to determine its meaning in relation to the nutrition education.

Basic Terms

Understanding of the procedure for quantification and analysis of field data requires familiarity with the basic concepts involved. Table 5 presents definitions of the terms which are commonly used. Read them carefully before proceeding to the next discussion.

An Example of the Analytic Problem

This chapter provides a model to demonstrate the step-by-step procedure for quantification and analysis of field data. All of the reference tables, formats, and worksheets used in the model are also in the Appendix to this Field Guide. For purposes of the demonstration, let us assume the following conditions:

✓ A nutrition education program is carried out by a group of nutritionists in the low income districts of a large urban area.

✓ To evaluate the program the nutritionists chose an experimental approach which:

- Uses the La Loma district where a class is about to be initiated, as an experimental group;
- Uses the Cassiano district as a control, since that community is very similar to La Loma but has no nutrition education program;

Table 5

DEFINITIONS OF TERMS USED IN DISCUSSION OF QUANTIFICATION AND ANALYSIS OF FIELD DATA

TERM	DEFINITION	COMMENT
CRITERIA	The rules by which one judges whether or not the objectives of nutrition education are being achieved.	In the discussion, criteria refer to the rules established by a nutritionist for judging whether a diet reported in the 24-hour food recall is appropriate or inappropriate for the individual.
DATA CATEGORY	A class of information which is selected from the data for quantification and analysis.	The data categories referred to in this Chapter are classes of information about consumption of different types of food.
NUMBER (N)	The total number of persons or things in a group or subgroup.	The "N" may refer to the number of persons in a group or to the number of persons whose food behavior relates to a given data category.
DIRECTION OF DIETARY CHANGE	An indication of whether an individual's diet does or does not improve over time, as demonstrated by sequential measures of food behavior.	Examples of dietary change are: from inappropriate to appropriate (− → +) or from appropriate to inappropriate (+ → −).
CHI SQUARE	A statistical technique which uses categorized data to test the observed results of evaluation and establishes the level of confidence for those results.	The technique converts the measures to a statistic which can be compared with differences which would occur by chance alone (without the educational treatment, for example).
DEGREES OF FREEDOM	The number of independent data categories into which an individual may be placed as a result of measurement.	For example, where the dietary measure is defined as either appropriate or inappropriate diet, a given diet can only be one or the other.
PROBABILITY (P)	The frequency with which an event can be expected to occur by chance alone, generally expressed in terms of a ratio of times out of 100. For example, "P = 0.10" indicates that the event is expected to occur by chance alone once every ten times, or 10 out of every 100 times.	In analysis of field data we are concerned with probability as a basis for judging whether observed differences in food behavior are significant differences.
SIGNIFICANCE OF DIFFERENCES	The level of confidence one has that the difference observed in measurement is a real difference and not a difference which could result solely from chance.	Significance is based on the probability level. A Chi Square value with a probability of 0.10 is an indication of no real difference. Confidence that a real difference exists begins with a P value of 0.05 and increases as P equals 0.01 and 0.001—the latter indicating very high confidence.
DIRECTION OF RESULTS	Evidence that the observed differences do or do not represent improvement in food behavior as a result of education.	The <u>desired</u> direction of results is evidence of improvement in dietary behavior as a result of nutrition education.
COST OF UNIT OF BEHAVIORAL CHANGE	The cost associated with the nutrition education required to bring about positive change in the food behavior of one individual.	Costs associated with nutrition education for persons not positively affected are taken into account in calculating unit cost.

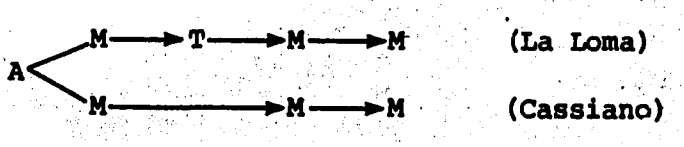
Includes both pretreatment and posttreatment measures, with approximately six months between measurement periods.

✓ The nutritionists use the format for the basic data set, illustrated in Chapter 3, to collect information about 86 homemakers in La Loma at the time they enroll in the class. The 86 La Loma homemakers represent a 40% randomly selected sample of the 215 homemakers included in the nutrition education program. They select a random sample of 86 homemakers in Cassiano and interview them during the same week they interview the La Loma homemakers. When the pretreatment interviews are completed they have a total of 172 reports.

✓ Six months later the sample of homemakers is interviewed again to provide a posttreatment measure.

✓ Twelve months following the pretreatment measure a second posttreatment measure is taken.

The study design required for the conditions described above is Experimental Design 4 discussed in Chapter 3. The basic design has been extended by adding a second posttreatment measure. Symbolically it is expressed as:



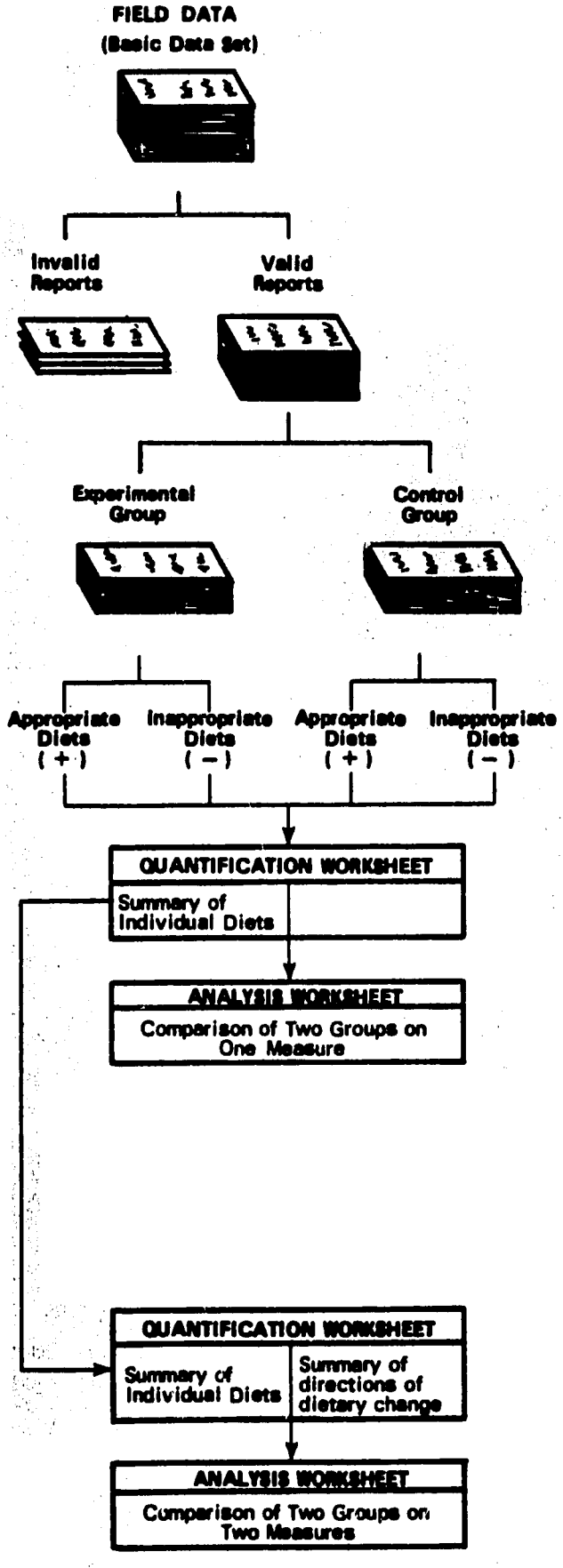
Overview of the Data Handling Procedure

The step-by-step procedure for handling the field data collected in La Loma and Cassiano is summarized in Figure 8. Examine the figure carefully. The paragraphs below present an overview of data handling procedures for the pretreatment data and posttreatment data.

Handling Pretreatment Data

Beginning at the top of Figure 8, the pretreatment data are partitioned to sort out valid and invalid reports. The individual reports for the experimental and control groups are reviewed by the nutritionists against preestablished criteria which define the dietary patterns they will accept as appropriate and those which they will consider inappropriate. Thus, the first three steps partition the data into mutually exclusive categories.

Step 4 quantifies the data in terms of the total number of individuals in each group who demonstrate appropriate diets and the total number who do not. This step accomplishes two purposes. First it provides a quantitative



PRETREATMENT MEASURE

STEP 1. Partitioning. Review the individual field reports against rules for valid data. Discard invalid reports.

STEP 2. Partitioning. Separate the reports into experimental and control groups.

STEP 3. Partitioning. Review each individual report against criteria and determine whether reported diet is appropriate or inappropriate for that individual.

STEP 4. Quantification of dietary measures. Record the individual dietary measures, add totals by measurement category, and calculate percent in each category.

STEP 5. Analysis. Apply the Chi Square test to compare the dietary behaviors of the experimental and control groups.

POSTTREATMENT MEASURE

STEP 1.
STEP 2.
STEP 3.
STEP 4.
} Same as for Pretreatment Measure

STEP 5. Quantification of dietary change. Determine the direction of change in individual diets, add totals by category of change, and calculate percent in each category.

STEP 6. Analysis. Apply the Chi Square test to determine if diets of persons in the Education Program improved at a greater rate over time than did diets of persons not in the Education Program.

Figure 8. Summary of Steps Required to Quantify and Analyze the Field Data

description of the diets of the experimental and control groups which can be used as a reference point, or baseline, with which future measures can be compared to determine changes over time. The second purpose is to organize the data in ways that permit comparison of the experimental and control groups. The quantification required by Step 4 is accomplished on a quantification worksheet.

Step 5 analyzes the data by making a statistical comparison of the experimental and control groups with respect to appropriate and inappropriate diets. This comparison is important since results which may appear to be different may not represent real differences between the two groups. The Step 5 analysis permits one to examine observed differences in terms of how frequently these differences might have occurred by chance alone. If, for example, an observed difference could be expected by chance only once in a thousand times, or even once in a hundred times--the difference can be assumed to be a real difference. If, on the other hand, a difference could be expected every other time, or even every tenth time, one would have no confidence that any real difference exists. The method used for analysis of the quantified data is the Chi Square test. The analysis required by Step 5 to test the pretreatment data for two groups--the experimental and the control group--is accomplished on an analysis worksheet. The numbers required for this step are transferred directly from the bottom of the quantification worksheet.

Handling Posttreatment Data

The steps required to quantify and analyze the field data for the posttreatment measure are summarized in the lower half of Figure 8. Note that the initial handling of the posttreatment measure is the same as that for the pretreatment measure. In Steps 1 through 4 the data are partitioned and changed to quantifiable terms. The same worksheet which is used for recording and quantifying the data for pretreatment measures can be used for recording posttreatment measures.

The question of interest to the nutritionists is: "Do diets improve as a result of nutrition education?" To determine the answer to that question one first determines whether or not individual diets changed between the pretreatment and the posttreatment measurement. This determination is accomplished by Step 5 of the procedure for quantifying and analyzing posttreatment data. The sample quantification worksheet used in this demonstration is divided into two parts. The left half of the worksheet is used to record the individual dietary measures of appropriate and inappropriate, and to summarize the data by groups. The right side of the worksheet is used to record the <u>direction of change</u> in dietary behavior for each individual in the sample, and to summarize directions of change for each group. Thus, the end product of Step 5 is a quantitative description of the experimental and control groups in terms of:

- ✓ How many persons changed from inappropriate to appropriate diets (- → +)?
- ✓ How many had appropriate diets on the first measure but changed to inappropriate on the second measure (+ → -)?

✓ How many had appropriate diets on the first measure and did not change (+ → +)?

✓ How many had inappropriate diets on the first measure and did not change (- → -)?

Step 6 analyzes the dietary change data provided by Step 5. The summary information about directions of dietary change, provided at the bottom of the quantification worksheet, is transferred to an analysis worksheet. The analysis uses the Chi Square test to determine the significance of any differences in dietary change between experimental and control groups.

Handling Multiple Posttreatment Measures

In the example of an analytic problem the nutritionists planned a second posttreatment measure twelve months after the pretreatment measure to determine if the observed changes are lasting changes in food habits. The procedure for handling the data is the same as for the first posttreatment measure. Comparison of change in relation to the baseline established by the pretreatment measure can be made for the second and all subsequent posttreatment measures by the analysis described in Step 6.

Quantification and Analysis of the Pretreatment Measurement

Step 1. Review of the Individual Reports to Sort Out Invalid Data

Prerequisite to this step is the establishment of rules for valid data or defining the basis on which you will decide that a food recall is or is not representative for a given individual. Examples of reasons for which you may elect to reject a report as invalid include:

✓ The diet reported includes far more food than is normally eaten by persons in the target audience; the respondent said that they were celebrating a wedding in the family and friends brought foods for the feast.

✓ The diet reported includes far less food than is normal; the respondent said she was very ill yesterday and could not eat any food.

✓ The measures for evaluation are in terms of amounts of food, but the interviewer forgot to ask the respondent about amounts.

✓ The respondent is in the experimental group but has attended only one or two of the education meetings.

✓ The respondent is in the control group but indicated she had attended a nutrition education program last year.

The nutritionists in our example applied these rules in their review of the 172 field reports in their study sample. Six of the reports in the experimental group were rejected as invalid; one report in the control group was rejected. Thus, 80 homemakers remain in the experimental group; 85 remain in the control group.

Step 2. Separate the Experimental and Control Data

The name of the group and the code numbers associated with names in the identification of individual field reports are used to separate the experimental and control groups. The reports are ordered sequentially, using the code numbers, within each group. Names and code numbers are entered on Worksheet Number 1 in preparation for quantification of the field data. An example of the entries for the control group is shown in Figure 9. A similar worksheet is prepared for the experimental group.

SUMMARY SHEET FOR RE
CHANGES IN DIETS

GROUP: Cassiano (control group)

		DIETARY MEASURES										
		FOOD CATEGORIES										
		1				2				3		
NAMES	Code Numbers	Measure 1		Measure 2		Measure 1		Measure 2		Measure 1		Me
		+	−	+	−	+	−	+	−	+	−	+
D. Dalberm	c-001											
J. Lobok	c-002											
D. Doniero	c-003											
D. da Silva	c-004											
J. Garcia	c-005											
C. Cruz	c-006											
K. Manisi	c-007											
P. Johnas	c-008											
L. Domingo	c-009											
et cetera												

Figure 9. Example of Identification Data Entry in Worksheet Number 1

Step 3. Review Each Individual Report to Determine if the Diet is Appropriate or Inappropriate

Prerequisite to this step is the establishment of criteria or rules by which a reported diet is judged to be adequate or inadequate for the individual. That is, the nutritionists must be able to say in a clear and precise way what they consider to be a good diet for their target audience and what they consider to be a bad diet. The definition of good and bad diets must, of course, be made in light of the conditions which prevail in the community, such as types of food which are available, and with regard to the dietary needs of individuals.

From their work in the low-income districts of this urban center the nutritionists have determined that the staples of family diets are bread, cereals, and manioc. This fact is verified by dietary surveys conducted by the health department. The objectives of the education program are concerned with increasing consumption of other foods to provide a more balanced diet. Therefore, the nutritionists establish the following criteria for judging the appropriateness of reported diets:

- ✓ Any 24-hour food recall which includes milk or a milk product such as cheese, meat or a meat substitute such as dry beans, fruit, and one green and one yellow vegetable will be considered an appropriate diet.

- ✓ Any 24-hour food recall which does not include all of the food types described above will be considered an inappropriate diet.

The criteria established by the nutritionists are severe; but they know they can also examine the food categories separately to determine achievement in each category.

Figure 10 illustrates the scoring process.[2] Note that the space for scoring the food recall is divided into four blocks. In the example the individual has not reached the criteria for an appropriate diet, but has partially achieved it by eating meat and fruit. By scoring each food category separately the nutritionists have made a record of events which will aid in later analyses of the data.

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[2] In the example, measurement is in terms of frequency. If the evaluation is concerned with amounts of food, data collectors ask respondents to report amounts of food. The nutritionists use the guidelines in Chapter 4 to establish rules for estimating the grams (weight) of the amount reported, and criteria are defined in terms of the amount which will be accepted as evidence of appropriate food consumption. Any reported amount which is less than the amount defined by the criteria would be scored as inappropriate.

D. FOODS CONSUMED YESTERDAY:

12. FOOD	13. HOW PREPARED	14. NUMBER OF TIMES EATEN
coffee	plain	5
manioca	boiled, with sugar	2
bread	plain	2
pork	fried	1
beans, white	in soup	1
orange		3
beer		1

CATEGORY 1. Milk or milk substitute [−]

CATEGORY 2. Meat or meat substitute [+]

CATEGORY 3. Fruit [+]

CATEGORY 4. One green, one yellow vegetable [−]

Figure 10. Example of Scoring of a Diet, Using Four Categories of Data

Step 4. Record and Summarize the Individual Dietary Measures

The purpose of this step is to quantify the dietary measures for the experimental and control groups. That is, individual diet scores are tallied to determine how many and what percent of the total number of persons in the group were judged to have an appropriate diet, and how many and what percent were judged to have an inappropriate diet.

The step is illustrated in Figure 11 for the La Loma or experimental group and the Cassiano or control group. The left half of Worksheet Number 1 on which names and code numbers of persons in the experimental and control groups have already been recorded, is used to check whether persons in the sample have demonstrated appropriate or inappropriate dietary behavior in reports for the pretreatment measure. Checks are made in columns for the first measurement to indicate whether the dietary behavior of each individual is appropriate or inappropriate for each food category defined in the criteria

At the bottom of Worksheet Number 1, the number of persons in each data category is entered and the percent calculated by dividing the number checked in each category column by the total number in the sample. In the example, 21 of the 80 persons or 26.2%, in the experimental group had appropriately eaten milk or milk products, 15 or 18.7% had eaten meat or meat substitutes, 43 or 53.8% had eaten fruit, and 35 or 43.7% had eaten vegetables. These summaries at the bottom of Worksheet Number 1 are used to analyze the pretreatment measurement.

GROUP: Cassiano (control group)

NAMES	Code Numbers	DIETARY MEASURES — FOOD CATEGORIES 1 (MILK & MILK PRODUCTS) Measure 1 +	Measure 1 −	Measure 2 +	Measure 2 −	2 (MEAT & MEAT SUBSTITUTES) Measure 1 +	Measure 1 −	Measure 2 +	Measure 2 −	3 (FRUITS) Measure 1 +	Measure 1 −	Measure 2 +	Measure 2 −	4 (VEGETABLES) Measure 1 +	Measure 1 −	Measure 2 +	Measure 2 −
D. Dalberm	C-001		✓				✓				✓			✓			
J. Lobok	C-002		✓				✓				✓				✓		
D. Domier	C-003		✓			✓				✓					✓		
D. [illegible]	[illegible]	✓													✓		
[illegible] Rodrigues	C-00[illegible]																
P. dos Santos	C-083						✓			✓							
J. dos Santos	C-084		✓				✓				✓			✓			
M. Nara	C-085		✓			✓				✓					✓		
a. Total Number in each Column		26	59			25	60			36	49			31	54		
b. Total Number of Individuals in Group *		85				85				85				85			
c. Percent: (a ÷ b) × 100		30.6	69.4			29.4	70.6			42.4	57.6			36.5	63.5		

GROUP: La Loma (experimental group)

NAMES	Code Numbers	DIETARY MEASURES — FOOD CATEGORIES 1 (MILK & MILK PRODUCTS) Measure 1 +	Measure 1 −	Measure 2 +	Measure 2 −	2 (MEAT & MEAT SUBSTITUTES) Measure 1 +	Measure 1 −	Measure 2 +	Measure 2 −	3 (FRUITS) Measure 1 +	Measure 1 −	Measure 2 +	Measure 2 −	4 (VEGETABLES) Measure 1 +	Measure 1 −	Measure 2 +	Measure 2 −
J. Fazola	A-001	✓				✓				✓				✓			
M. Fraga	A-002	✓					✓				✓				✓		
M. Ma[illegible]	A-003	✓					✓				✓				✓		
[illegible]	[illegible]		✓												✓		
[illegible] Joseph	A-7[illegible]																
A. Angenti	A-78		✓				✓				✓						
B. Rogas	A-79		✓				✓			✓				✓			
S. Hanier	A-080	✓					✓				✓				✓		
a. Total Number in each Column		21	59			15	65			43	37			35	45		
b. Total Number of Individuals in Group *		80				80				80				80			
c. Percent: (a ÷ b) × 100		26.2	73.8			18.7	81.3			53.8	46.2			43.7	56.3		

Figure 11. Summary of Individual Diet Scores for the Pretreatment Measures

Step 5. Test of Similarity Between the Experimental and Control Groups

The statistical comparison of the summary dietary measures for the La Loma and Cassiano communities is demonstrated using sample Worksheet Number 2 in Figure 12.

- ✓ The number (N) and percents (%) of persons in the experimental group who had appropriate food behavior are entered in row "a," those who had inappropriate food behavior are entered in row "b. The "total" number in the experimental group is entered in row " These data are transferred from the bottom of Worksheet Number 1 for the La Loma or experimental group.

- ✓ Similar data are transferred from Worksheet Number 1 for the Cassiano or control group and entered in rows "d" through "f."

- ✓ The nutritionists complete the calculations defined by rows "g" through "y" and the addition required by row "A." The row "A" entries are the Chi Square values for respective data categories or food types.

- ✓ Note that in row "z" the number of degrees of freedom for each data category is 1. That is, for a given food group the behavior can be only one of two things: it is either appropriate or inappropriate.

- ✓ Meaning is given to the Chi Square values in Row "A" by reference to Table B in the Appendix which presents the levels at which Chi Square values become significant, given different degrees of freedom. In Table B, the nutritionists find that with 1 degree of freedom, Chi Square values have the following significance:

  2.70554 = 0.1 or once in ten times
  3.84146 = 0.05 or once in twenty times
  6.63490 = 0.01 or once in a hundred times
  10.828 = 0.001 or once in a thousand times

- ✓ By comparing the observed Chi Square in row "A" of Worksheet Number 2 with those in the Table, the nutritionists find that all the Chi Square values are lower than the least significant value (lower than 2.70554). They conclude that there is no difference in food habits between the La Loma and the Cassiano homemakers.

Rows "C", "D", and "E" are used to test the difference when all the data categories are combined. By referencing Table B, the nutritionists determine that their observed Chi Square of 4.53 is lower than the least significant value for 4 degrees of freedom (lower than 7.77944). They conclude that, overall, the dietary behaviors in La Loma and Cassiano are the same.

WORK SHEET NUMBER 2

GROUP 1 *La Loma* GROUP 2 *Cassiano*

STEPS PROCEDURES	DATA CATEGORIES							
	1 MILK & MILK PRODUCTS		2 MEAT & MEAT SUBSTITUTES		3 FRUITS		4 VEGETABLES	
	N	%	N	%	N	%	N	%
a: (+) Behavior	21	26.2	15	18.7	43	53.8	35	43.7
b: (−) Behavior	59	73.8	65	81.3	37	46.2	45	56.3
c: TOTAL (a + b)	80	100.0	80	100.0	80	100.0	80	100.0
d: (+) Behavior	26	30.6	25	29.4	36	42.4	31	36.5
e: (−) Behavior	59	69.4	60	70.6	49	57.6	54	63.5
f: TOTAL (d + e)	85	100.0	85	100.0	85	100.0	85	100.0
g: a + d	47		40		79		66	
h: b + e	118		125		86		99	
i: g + h	165		165		165		165	
j: c x g ÷ i	22.79		19.39		38.30		32.00	
k: c x h ÷ i	57.21		60.61		41.70		48.00	
l: f x g ÷ i	24.21		20.61		40.70		34.00	
m: f x h ÷ i	60.79		64.39		44.30		51.00	
n: |a − j| − .5	1.29		3.89		4.20		2.50	
o: |b − k| − .5	1.29		3.89		4.20		2.50	
p: |d − l| − .5	1.29		3.89		4.20		2.50	
q: |e − m| − .5	1.29		3.89		4.20		2.50	
r: n^2	1.66		15.13		17.64		6.25	
s: o^2	1.66		15.13		17.64		6.25	
t: p^2	1.66		15.13		17.64		6.25	
u: q^2	1.66		15.13		17.64		6.25	
v: r ÷ j	0.07		0.78		0.46		0.20	
w: s ÷ k	0.03		0.25		0.42		0.13	
x: t ÷ l	0.07		0.73		0.43		0.18	
y: u ÷ m	0.03		0.23		0.40		0.12	
z: Degrees of freedom	1		1		1		1	
A: Chi Square (v +w+x+y)	0.20		1.99		1.71		0.63	
B: Significance of difference	>0.10		>0.10		>0.10		>0.10	

C: Degrees of freedom (Sum of row "z" for Categories used)	4
D: Chi Square (Sum of row "A" entries)	4.53
E: Significance of difference	>0.10

Enter the totals from the bottom of Worksheet 1 for Experimental Group

Enter the totals from the bottom of Worksheet 1 for the Control Group

Use the N's in rows a through f and calculate the Chi Squares

NOTE: If any entry in this block is less than 10, see instructions

NOTE: Disregard plus or minus signs of subtraction within | |

Chi Square for Individual Data Categories

Chi Square for Combined Data Categories

Figure 12. Comparison of Pretreatment Diet Scores for the Experimental and Control Groups

Contingencies in Handling the Pretreatment Data

The first note on Worksheet Number 2 indicates that if entries in that block of the worksheet are less than "10," one should refer to the instructions for using the worksheet. The particular point of the instruction referred to here is that when "expected" N's are small, the validity of the Chi Square test is questioned. Some statisticians place this level at "10 others place it at "5." In the example in Figure 12, there are no expected frequencies which are nearly this small and there is no problem of lack of sufficient "expected" N's for this analysis. As a general rule for this methodology, when one or two expected frequencies are at about "5," one may use the Chi Square results if they are interpreted cautiously.

Quantification and Analysis of the Posttreatment Measure

Six months after completion of the pretreatment interviews in La Loma and Cassiano, a posttreatment measure was taken. These data are used to demonstrate the procedure for quantification and analysis of a posttreatment measure. The following actions are taken:

- ✓ Step 1. The field reports are reviewed for validity. All of the posttreatment reports for those persons included in the pretreatment data are considered valid.
- ✓ Step 2. The 165 posttreatment reports are sorted into experimental and control data.
- ✓ Step 3. Each report is reviewed against the criteria established by the nutritionists for appropriate dietary behavior.
- ✓ Step 4. The results are recorded on Worksheet Number 1 under the column titled "Measure 2."

The nutritionists are now ready to proceed to Steps 5 and 6.

Step 5. Determine the Direction of Change in Dietary Measures Over Time

The purpose of this step is to identify the direction of change in individual diets and to quantify the dietary change data so that comparisons between experimental and control group behavior can be made. Figure 13 demonstrates the process for the control group. The directions of change in diets are determined by comparison of the pretreatment and posttreatment data at the left of the page.

SUMMARY SHEET FOR RECORDING SEQUENTIAL MEASURES AND CHANGES IN DIETS FOR INDIVIDUALS IN A GROUP

GROUP: Cassiano (Control group)

NAMES	Code Numbers	DIETARY MEASURES																DIRECTION OF CHANGE IN DIETS OVER TIME														
		FOOD CATEGORIES																FOOD CATEGORIES														
		1				2				3				4				1				2				3				4		
		MILK & MILK PRODUCTS				MEAT & MEAT SUBSTITUTES				FRUITS				VEGETABLES				MILK & MILK PRODUCTS				MEAT & MEAT SUBSTITUTES				FRUITS				VEGETABLE		
		Measure 1		Measure 2		Measure 1		Measure 2		Measure 1		Measure 2		Measure 1		Measure 2		− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +
		+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−																
D. Dalferm	c-001		✓	✓			✓		✓		✓	✓		✓		✓		✓							✓	✓						✓
J. Lobok	c-002		✓	✓			✓		✓		✓		✓		✓	✓		✓							✓				✓	✓		
D. Doniero	c-003		✓	✓		✓		✓		✓		✓			✓	✓		✓						✓				✓		✓		
D. da Silva	c-004	✓		✓			✓	✓			✓	✓			✓	✓				✓		✓				✓				✓		
J. Garcia	c-005	✓		✓			✓	✓		✓		✓			✓		✓			✓		✓						✓				
C. Cruz	c-[illegible]	[illegible]								✓		✓			✓		✓			[illegible]		[illegible]						✓				
[illegible]	[illegible]						✓																									
A. Seguero	c-079		✓		✓		✓		✓		✓	✓		✓		✓					✓				✓	✓						✓
P. Alfonso	c-080	✓		✓			✓		✓		✓		✓		✓	✓				✓					✓				✓	✓		
S. de Souza	c-081		✓		✓		✓		✓		✓	✓		✓		✓					✓				✓	✓						✓
J. Rodrigues	c-082		✓		✓		✓		✓		✓	✓			✓	✓					✓				✓	✓				✓		
P. dos Santos	c-083		✓		✓		✓		✓	✓		✓			✓	✓					✓				✓			✓		✓		
J. dos Santos	c-084		✓		✓		✓		✓		✓	✓		✓		✓					✓				✓	✓						✓
M. Nara	c-085		✓	✓		✓			✓	✓			✓		✓		✓	✓					✓				✓					
a. Total Number in each Column		26	59	41	44	25	60	29	56	36	49	41	44	31	54	34	51	25	10	16	34	13	9	16	47	21	16	20	28	16	13	18
b. Total Number of Individuals in Group *		85		85		85		85		85		85		85		85		85				85				85				85		
c. Percent: (a ÷ b) x 100		30.6	69.4	48.2	51.8	29.4	70.6	34.1	65.9	42.4	57.6	48.2	51.8	36.5	63.5	40.0	60.0	29.4	11.8	18.8	40.0	15.3	10.6	18.8	55.3	24.7	18.8	23.5	33.0	18.8	15.3	21.2

*NOTE: The number of individuals in a group may differ for sequential measures.

Figure 13. Summary of Pretreatment and Posttreatment Measures for the Control Group

EXAMPLE: In Data Category 1, milk and milk products, D. Dalberm had inappropriate behavior (-) on the first measure but appropriate behavior (+) on the second measure. The direction of change is from inappropriate to appropriate behavior (- → +). A check is entered in the milk and milk products column for (- → +) on the right-hand side of the worksheet to indicate the direction of change in D. Dalberm's food behavior.

The direction of change in diets is entered for all individuals in the control group. The data are tallied for each category of change and totals entered in row "a" at the bottom of Worksheet Number 1. Percents are calculated by dividing the totals in row "a" by the total number of individuals in the control group.

The same procedure is used to determine the direction of change in dietary measures for the experimental group. The results are illustrated in Figure 14. The summary data in rows "a" and "c" at the bottom of the two worksheets are used to test the difference for the experimental and control groups.

Step 6. Test of Difference in Dietary Change Over Time for the Experimental and Control Groups

The question of interest to the nutritionists at this point is: Did the nutrition education in the La Loma district result in positive changes in food behavior? In order to answer the question they compare the dietary changes observed for the La Loma or experimental group with those observed for the control group. The process, proceduralized on Worksheet Number 3, is demonstrated in Figure 15.

The nutritionists transfer the dietary change data from Worksheet Number 1 for the experimental and control groups rows "a" through "j" on Worksheet Number 3. They complete the calculations in rows "k" through "F" to determine the Chi Square values. The degrees of freedom, row "E," for each data category is 3.[3] The significance of the observed Chi Square values is determined by reference to Table B which shows the levels of significance for Chi Square with different degrees of freedom. The levels of significance of Chi Square with 3 degrees of freedom are:

6.25139 = 0.1 or once in ten times
7.81473 = 0.5 or once in twenty times
11.3449 = 0.01 or once in one hundred times
16.266 = 0.001 or once in one thousand times

---

[3] Any individual in the sample can have only one type of dietary change. If it is not (- → +) it can be any of the other <u>three</u> [(+ → -), (+ → +), or (- → -)].

WORKSHEET NUM

SUMMARY SHEET FOR RECORDING SEQUENTIAL MEASURES AND CHANGES IN DIETS FOR INDIVIDUALS IN A GROUP

GROUP: La Loma (experimental group)

NAMES	Code Numbers	DIETARY MEASURES — FOOD CATEGORIES 1 MILK & MILK PRODUCTS				2 MEAT & MEAT SUBSTITUTES				3 FRUITS				4 VEGETABLES			
		Measure 1		Measure 2		Measure 1		Measure 2		Measure 1		Measure 2		Measure 1		Measure 2	
		+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−
J. Fazola	A-001	✓			✓	✓		✓		✓		✓		✓		✓	
M. Frage	A-002	✓		✓			✓		✓		✓		✓		✓	✓	
M. Mareto	A-003	✓			✓		✓		✓		✓	✓			✓	✓	
J. Libok	A-004		✓		✓		✓		✓	✓		✓			✓		✓
H. Colodite	A-005		✓	✓		✓		✓			✓	✓		✓		✓	
J. Botacim	A-006	✓		✓		✓		✓			✓	✓					
L. Dareeti	A-007								✓								
M. V[illegible]	[illegible]		✓		✓		✓								✓		✓
[illegible]	A-073		✓		✓		✓		✓		✓		✓		✓	✓	
F. Nova	A-074		✓		✓	✓		✓			✓	✓		✓		✓	
R. Bottegal	A-075	✓		✓		✓		✓		✓		✓		✓			✓
V. Vincennes	A-076		✓		✓	✓		✓		✓		✓			✓	✓	
R. Joseph	A-077		✓	✓			✓	✓			✓	✓			✓	✓	
A. Angenti	A-078		✓		✓		✓		✓		✓		✓		✓		✓
B. Rogas	A-079		✓		✓		✓	✓		✓		✓		✓		✓	
S. Hanier	A-080	✓		✓			✓		✓		✓	✓			✓	✓	
a. Total Number in each Column		21	59	36	44	15	65	27	53	43	37	53	27	35	45	51	29
b. Total Number of Individuals in Group *		80		80		80		80		80		80		80		80	
c. Percent: (a ÷ b) x 100		26.2	73.8	45.0	55.0	18.7	81.3	33.7	66.3	53.7	46.3	66.2	33.8	43.7	56.3	63.7	36.3

NAMES	DIRECTION OF CHANGE IN DIETS OVER TIME — FOOD CATEGORIES 1 MILK & MILK PRODUCTS				2 MEAT & MEAT SUBSTITUTES				3 FRUITS				4 VEGETABLE		
	− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +
J. Fazola		✓					✓				✓				✓
M. Frage			✓					✓				✓	✓		
M. Mareto		✓						✓	✓				✓		
J. Libok				✓				✓			✓				
H. Colodite	✓						✓		✓						✓
J. Botacim			✓										✓		
L. Dareeti									✓						
M. V[illegible]				✓				✓	✓						
[illegible]				✓				✓				✓	✓		
F. Nova				✓			✓		✓						✓
R. Bottegal			✓				✓				✓			✓	
V. Vincennes				✓			✓				✓		✓		
R. Joseph	✓				✓				✓				✓		
A. Angenti				✓				✓				✓			
B. Rogas				✓	✓						✓				✓
S. Hanier			✓					✓	✓				✓		
a. Total Number in each Column	23	8	13	36	16	4	11	49	25	15	28	12	27	11	24
b. Total Number of Individuals in Group *	80				80				80				80		
c. Percent: (a ÷ b) x 100	28.8	10.0	16.2	45.0	20.0	5.0	13.7	61.3	31.3	18.7	35.0	15.0	33.8	13.7	30.0

*NOTE: The number of individuals in a group may differ for sequential measures.

Figure 14. Summary of Pretreatment and Posttreatment Measures for the Experimental Group

STEPS PROCEDURES	DATA CATEGORIES							
	1 MILK & MILK PRODUCTS		2 MEAT & MEAT SUBSTITUTES		3 FRUITS		4 VEGETABLES	
	N	%	N	%	N	%	N	%
a: (−) → (+)	23	28.8	16	20.0	25	31.3	27	33.8
b: (+) → (−)	8	10.0	4	5.0	15	18.7	11	13.7
c: (+) → (+)	13	16.2	11	13.	28	35.0	24	30.0
d: (−) → (−)	36	45.0	49	6	12	15.0	18	22.5
e: Total (a + b + c + d)	80	100.0	80	100.0	80	100.0	80	100.0
f: (−) → (+)	25	29.4	13	15.3	21	24.7	16	18.8
g: (+) → (−)	10	11.8	9	10.6	16	18.8	13	15.3
h: (+) → (+)	16	18.8	16	18.8	20	23.5	18	21.2
i: (−) → (−)	34	40.0	47	55.3	28	33.0	38	44.7
j: Total (f + g + h + i)	85	100.0	85	100.0	85	100.0	85	100.0
k: a + f	48		29		46		43	
l: b + g	18		13		31		24	
m: c + h	29		27		48		42	
n: d + i	70		96		40		56	
o: (e x k) ÷ (e + j)	23.27		14.06		22.30		20.85	
p: (e x l) ÷ (e + j)	8.73		6.30		15.03		11.64	
q: (e x m) ÷ (e + j)	14.06		13.09		23.27		20.36	
r: (e x n) ÷ (e + j)	33.94		46.55		19.39		27.15	
s: (j x k) ÷ (e + j)	24.73		14.94		23.70		22.15	
t: (j x l) ÷ (e + j)	9.27		6.70		15.97		12.36	
u: (j x m) ÷ (e + j)	14.94		13.91		24.73		21.64	
v: (j x n) ÷ (e + j)	36.06		49.45		20.61		28.85	
w: $\lvert a - o \rvert^2 \div o$	0		.27		.33		1.81	
x: $\lvert b - p \rvert^2 \div p$	.06		.84		0		.04	
y: $\lvert c - q \rvert^2 \div q$	.08		.33		.96		.65	
z: $\lvert d - r \rvert^2 \div r$	.13		.13		2.86		3.08	
A: $\lvert f - s \rvert^2 \div s$	0		.25		.31		1.71	
B: $\lvert g - t \rvert^2 \div t$	.06		.79		0		.03	
C: $\lvert h - u \rvert^2 \div u$	.08		.31		.90		.61	
D: $\lvert i - v \rvert^2 \div v$	.12		.12		2.65		2.90	
E: Degrees of freedom	3		3		3		3	
F: Chi Square (w+x+y+z+A+B+C+D)	.53		3.04		7.97		10.83	
G: Significance of difference	> 0.10		> 0.10		< 0.05		< 0.05	

H: Degrees of freedom (Sum of row "E" for Categories used)	12
I: Chi Square (Sum of row "F" entries)	22.37
J: Significance of difference	< 0.05

Enter the totals from the bottom of Worksheet 1 for Experimental Group

Enter the totals from the bottom of Worksheet 1 for the Control Group

Use the N's in rows a through j and calculate the Chi Squares

NOTE: If any entry in this block is less than 10, see instructions

NOTE: Disregard plus or minus signs of subtraction within | |

Chi Square for Individual Data Categories

Chi Square for Combined Data Categories

Figure 15. Analysis Comparing Experimental and Control Groups on Two Measures

The nutritionists compare their observed Chi Square values with the values from the table and determine that:

- ✓ The values in Data Categories 1 and 2 are lower than the least significant value (lower than 6.25139). They conclude that there is no difference in the dietary changes in the experimental and control groups with respect to milk and milk products or meat and meat substitutes. The education has not had any effect where these foods are concerned.

- ✓ For Data Categories 3 and 4, however, the observed Chi Square values are higher than the second level of significance (higher than 7.81473). There is a <u>real difference</u> over time between the diets of the experimental and control groups with respect to consumption of fruits and vegetables. But, the nutritionists do not know if the difference indicates improvement for the experimental or the control group.

- ✓ To determine the nature of the difference in Data Categories 3 and 4, the nutritionists examine the percentage entries at the top of Worksheet Number 3. In Figure 15, the entry in row "a" shows that 31.3% of the experimental group changed their diet with respect to fruits from (-) → (+); the row "f" entry shows that 24.7% of the control group changed from (-) → (+). In the category of vegetables 33.8% of the experimental groups changed from (-) → (+); only 18.8% of the control group changed from (-) → (+). In both of these food categories, the control group consistently demonstrated inappropriate behavior far more frequently than did the experimental group. (For fruits, (-) → (-) = 15.0% for the experimental group versus 33.0% for the control group; for vegetables, (-) → (-) = 22.5% for the experimental versus 44.7% for the control group.) Thus, the nutritionists concluded that the difference <u>is in the desired direction</u>--greater improvement for the experimental group than for the control group.

Rows "H," "I," and "J" at the bottom of the worksheet are used to test the difference between the experimental and control groups when all data categories are combined. The observed Chi Square value for combined data categories is 22.37. Reference to Table B shows that this value is higher than the second level of significance (higher than 21.0261) with 12 degrees of freedom. The nutritionists have already determined that the difference is in the desired direction and conclude that the education is having a positive effect on food behavior in La Loma.

Quantification and Analysis of a Second Posttreatment Measure

The procedure used for quantification and analysis of the field data for a second posttreatment measure is identical to that described in the preceding section for the first posttreatment measure. The concern is for

change in diets from the pretreatment measure to the second posttreatment measure. The summary of these results for the experimental and control groups is shown in Figure 16. It demonstrates that the significant differences found in consumption of fruits and vegetables are sustained over time.

	$\lvert u \rvert^2 \div u$				
	D: $\lvert i - v \rvert^2 \div v$				
Chi Square for Individual Data Categories	E: Degrees of freedom	3	3	3	3
	F: Chi Square (w+x+y+z+ A+B+C+D)	1.44	3.18	10.30	21.20
	G: Significance of difference	> 0.10	> 0.10	< 0.05	< 0.001
Chi Square for Combined Data Categories	H: Degrees of freedom (Sum of row "E" for Categories used)			12	
	I: Chi Square (Sum of row "F" entries)			36.12	
	J: Significance of difference			< 0.001	

Figure 16. Summary Results of the Second Posttreatment Comparison of the La Loma Experimental Group and the Cassiano Control Groups

The overall improvement in diets is also sustained when the four food categories are combined. The differences are in the right direction. The nutritionists conclude that their education program has effected a fundamental change in diets in the La Loma community.

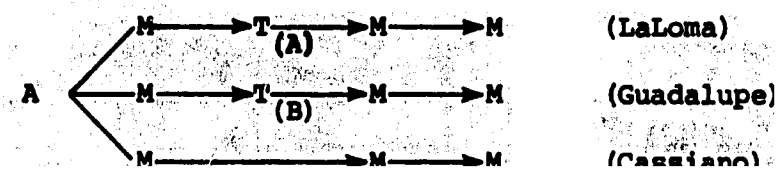
Comparison of Alternative Approaches to Nutrition Education: Cost-Effectiveness Analysis

Alternative Program Approaches

In order to demonstrate cost-effectiveness analysis, let us assume the following conditions:

✓ At the time the nutritionists initiated the classroom approach in the La Loma community, they also began a nutrition education program in the nearby community of Guadalupe using a person-to-person approach with homemakers in their homes. Program objectives and evaluation activities comparable to those established for La Loma were set for the Guadalupe project. The Guadalupe homemakers are from the same social and economic population as those in La Loma. Comparisons of the food behaviors in La Loma (Experimental Group A) with those in Cassiano (Control Group) and with those in Guadalupe (Experimental Group B) are made to examine the relative effects of the two different approaches to nutrition education.

Costs for La Loma and Cassiano are compared to determine the relative costs of the two approaches. The symbolic representation for the experimental design the nutritionists implemented is:



✓ The nutritionists follow the set of steps shown in Figure 8 for quantifying and analyzing the data. Using Worksheet Number 2 they make the following analyses of the pretreatment measures to insure comparability of the groups:

- Comparison of Guadalupe (Experimental B) and Cassiano (Control).

- Comparison of Guadalupe (Experimental B) and La Loma (Experimental A).

(Recall that an earlier analysis has already demonstrated comparability of the La Loma and Cassiano samples.) The results of these analyses demonstrate that the pretreatment dietary behaviors of all three groups are similar. No significant differences are found between any of the groups with respect to consumption of any of the four food groups or when the four food groups are combined.

✓ Comparison of the first posttreatment measures for Guadalupe (Experimental B) and Cassiano (Control), using Worksheet Number 3, yields results similar to those found at this measurement period between La Loma (Experimental A) and Cassiano. Again, significant differences in the right direction are found for fruits and vegetables and for the four food groups combined.

By comparing the first posttreatment diet scores for the two experimental groups, the nutritionists can now determine whether or not one teaching approach has greater effects than the other. The results are summarized in Figure 17.

	$u\|^2 \div u$				
	D: $\|i - v\|^2 \div v$				
Chi Square for Individual Data Categories	E: Degrees of freedom	3	3	3	3
	F: Chi Square $\frac{(w+x+y+z+)}{A+B+C+D)}$	4.30	2.92	11.35	1.89
	G: Significance of difference	>0.10	>0.10	=0.05	>0.10
Chi Square for Combined Data Categories	H: Degrees of freedom (Sum of row "E" for Categories used)	12			
	I: Chi Square (Sum of row "F" entries)	20.46			
	J: Significance of difference	> 0.05			

Figure 17. Summary Results of the First Posttreatment Diet Scores for the La Loma and Guadalupe Experimental Groups

These results indicate that across the combined four food groups there is no significant difference between the results of the two educational approaches, although the Chi Square of 20.46 approaches the minimally acceptable level of significance for 12 degrees of freedom, 21.0261. There is a slightly greater effect with respect to consumption of fruits for the person-to-person approach in Guadalupe than for the classroom approach in La Loma. With a Chi Square of 11.35 and three degrees of freedom, the level of significance is at the minimally acceptable level of confidence of "0.05."

✓ Analysis of the second posttreatment measure for the Guadalupe community reveals that the changes in dietary behavior demonstrated by the person-to-person approach in Guadalupe were sustained over time. Thus, although the dietary changes effected by nutrition education are not as great as the nutritionist had hoped, fundamental changes have resulted from <u>both</u> the person-to-person approach and the classroom approach.

✓ Finally, an analysis is made to determine if there is any significant difference between the measures in La Loma and Guadalupe. That is, given that both resulted in fundamental change in diets, does one effect greater change than the other? Comparison is made, again using Worksheet Number 3. The results are summarized in Figure 18. They indicate no significant difference in effectiveness within food groups or when all food groups are combined. The evaluation has demonstrated that the two approaches to nutrition education have very similar results in terms of changing food behavior.

	$u\|^2 \div u$				
	D: $\|i - v\|^2 \div v$				
Chi Square for Individual Data Categories	E: Degrees of freedom	3	3	3	3
	F: Chi Square (w+x+y+z+A+B+C+D)	5.83	2.13	6.42	0.51
	G: Significance of difference	> 0.10	> 0.10	> 0.05	> 0.10
Chi Square for Combined Data Categories	H: Degrees of freedom (Sum of row "E" for Categories used)			12	
	I: Chi Square (Sum of row "F" entries)			14.89	
	J: Significance of difference			> 0.10	

Figure 18. Summary Results of the Second Posttreatment Diet Scores for the La Loma and Guadalupe Experimental Groups

But, are the approaches equally "effective?" Is it possible that one can bring about these changes in food behavior for a greater number of persons than the other approach, without increasing the expenditure of resources? This question can be answered by analysis of the cost-effectiveness of the two approaches.

Cost-Effectiveness Analysis

The measure of cost-effectiveness is the estimated cost of changing food behavior of one individual from inappropriate to appropriate. A suggested technique for calculating cost-effectiveness is presented in Worksheet Number 5, in the Appendix. Information needed for the calculation includes (a) an estimate of the total costs associated with the nutrition education program, (b) the net number of persons participating in the program (persons initially enrolled minus persons who have dropped out without completing the education), and (c) the net number of persons positively affected (persons demonstrating positive effects minus persons demonstrating negative effects). The latter is derived from Worksheet Number 1. For comparison of cost-effectiveness of two or more projects, the set of cost and program effects data must be obtained on a comparable basis for each project included.

A sample Worksheet for cost-effectiveness analysis and instructions for its use are provided in the Appendix. Let us demonstrate the procedure using data for the two experimental approaches discussed in the preceding

section--the comparison of the classroom approach in La Loma (Experimental Group A) and the person-to-person approach in Guadalupe (Experimental Group B). The procedure for calculating cost-effectiveness is illustrated in Figure 19.

The analysis is performed on the basis of the net percent of participants demonstrating a positive change in behavior. That is, the percent demonstrating a negative shift (+ → -) is subtracted from the percent showing a positive shift (- → +). Percentages of those not demonstrating any shift (+ → +) and (- → -) are deleted from the analysis. To perform the analysis, the nutritionists make the following assumptions to satisfy the requirement for identifying "net percent positively affected" (line "f" on Worksheet Number 5):

- ✓ Improvement in consumption in any food group, as determined by moving from "not meeting the criteria" to "meeting the criteria," would constitute a (- → +) behavior in line "d."

- ✓ Regression in consumption in any food group, as determined by moving from "meeting the criteria" to "not meeting the criteria," would constitute a (+ → -) behavior in line "e."

The nutritionists could have established some different set of criteria for determining "net percent positively affected." The criteria should be established on the basis of program objectives and during the planning stage of the evaluation effort.

The "net percent positively affected" is used to convert the "net participant data" (line "c") to the "net number of persons positively affected" in line "g." This conversion is especially important when the evaluation data are collected on only a sample of the participants. The underlying assumption is that the sample has been drawn randomly and is, therefore, representative of the total program population.

Cost data for the program are assembled and entered in line "h." Costs and cost items will vary over periods of time. Nutrition education programs costs generally include: the facility, furniture and equipment, utensils, fuel, the food supply, other supplies and materials, and salaries. Costs may also be incurred for travel, communication, training materials, and worker training. It is important that all costs are included, and, when comparison of programs or projects is intended, that costs are assembled in a consistent way. That is, to be fully useful, the results of the cost-effectiveness analysis should demonstrate not only how the cost-effectiveness differs from program to program but in what cost categories savings might be achieved. Capital costs for the two programs are prorated over time, as discussed in Chapter 2.

The data are assembled both for each separate time period (in block I of the worksheet) and for the total time period included (in the cumulative time period, block II of the worksheet). The nutritionists calculate the unit measure of cost-effectiveness on a cumulative basis (block III of the worksheet). As shown in Figure 19, the "cost for one person positively affected" is less for the classroom approach in La Loma than for the person-

COST-EFFECTIVENESS ANALYSIS

WORKSHEET NUMBER 5

CALCULATION OF COST PER UNIT OF CHANGE	EXPERIMENTAL GROUP "A" La Loma			EXPERIMENTAL GROUP "B" Guadalupe		
I. SEQUENTIAL TIME PERIOD	1972	1973	1974	1972	1973	1974
a: Number of new participants	424	471	509	122	47	66
b: Number of dropouts	18	19	14	4	1	3
c: Net number of new participants (a - b)	406	452	495	118	46	63
d: Percent of new participants showing (−) → (+) behavior	86.4 %	86.1 %	85.4 %	89.1 %	94.7 %	92.8 %
e: Percent of new participants showing (+) → (−) behavior	33.9 %	35.7 %	27.8 %	39.9 %	38.3 %	36.4 %
f: Net percent positively affected (d - e)	52.5 %	50.4 %	57.6 %	49.2 %	56.4 %	56.4 %
g: Net number positively affected [(c x f) ÷ 100]	213	228	285	58	26	36
h: Cost of program operation	$1690	$1690	$1765	$495	$495	$295
II. CUMULATIVE TIME PERIOD	1972	1972-73	1972-74	1972	1972-73	1972-74
i: Net number of participants to date (add all "c" entries)	406	858	1,353	118	164	227
j: Cumulative number positively affected (add all "g" entries)	213	441	726	58	84	120
k: Net percent positively affected to date [(j ÷ i) x 100]	52.5 %	51.4 %	53.7 %	49.2 %	51.2 %	52.9 %
l: Cumulative cost of program operation (add all "h" entries)	$1690	$3380	$5145	$495	$990	$1285
III. UNIT MEASURE OF COST-EFFECTIVENESS, PROGRAM COSTS ONLY (l ÷ j)	$7.93	$7.66	$7.09	$8.53	$11.79	$10.71
IV. DESCRIPTION OF DONATED SERVICES, MATERIALS, EQUIPMENT:	None			1972 - one volunteer worker. 1973 - one volunteer worker. 1974 - three volunteer workers.		
m: Equivalent monetary value of donated goods and services	—	—	—	$48	$58	$154
n: Program and donated costs (h + m)	$1690	$1690	$1765	$543	$553	$449
o: Cumulative program and donated costs (add all "n" entries)	$1690	$3380	$5145	$543	$1096	$1545
V. UNIT MEASURE OF COST-EFFECTIVENESS, INCLUDING PROGRAM AND DONATED COSTS (o ÷ j)	$7.93	$7.66	$7.09	$9.36	$13.05	$12.87

NOTE: Calculations in rows i, l, and o are made across row entries. All other calculations are made within the column.

Figure 19. Cost-Effectiveness Comparison for the LaLoma and Guadalupe Experimental Groups

to-person approach in Guadalupe. Since the person-to-person approach represents primarily a salary expenditure and also retains the participants over longer periods of time, these "costs per person positively affected" are not only higher than the classroom costs, but tend to remain high or even increase over longer periods of time.

Almost all nutrition education programs make use of some resources which are free and do not require monetary expenditure. Examples of such resources include: food, fuel, equipment which is donated; services of volunteer workers from the community; mass media which may be made available at no cost to the program. The extent to which donated resources are used varies widely from program to program. One program may rely almost totally on donated resources. Another program working with a similar target audience for the same purpose may rely almost totally on monetary resources. Thus, a full description of donated resources and estimates of what those resources would cost if they had been purchased, are critical to the interpretation of cost-effectiveness comparisons of different program approaches.

The procedure for incorporating free services and resources into the cost-effectiveness measure is demonstrated by the entries in Blocks IV and V in Figure 19, which show that:

- ✓ In La Loma, only purchased services and materials were used.
- ✓ In Guadalupe, one volunteer was used during the first two years. The nutritionists' estimate of the equivalent monetary value of the volunteer services (line "m") is $48 for the first year and $58 for the second year.
- ✓ When the estimated monetary value of the volunteer services is taken into account, unit costs in Guadalupe are $9.36 for the first year and $13.05 for the first and second years combined.
- ✓ The use of one volunteer reduces actual monetary costs in Guadalupe by $0.83 for the first year ($9.36 - $8.53 = $0.83) and by $1.26 for the first and second years combined ($13.05 - $11.79 = $1.26).
- ✓ The nutritionists conclude that the use of additional volunteer workers could increase the cost-effectiveness of the person-to person approach. In 1974 they substitute two additional volunteers for two paid workers and increase their cost-effectiveness. The use of three volunteers in 1974 reduces the actual monetary cost associated with positively changing the food behavior of one individual by $2.16 ($12.87 - $10.71 = $2.16).

The example described above, demonstrates how the information can support decisions within a program. Full and complete information about resources and costs is equally important as guidance to other educators who read about the evaluation and seek to achieve similar results within their program.

CHAPTER 6: INTERPRETATION AND USE OF THE EVALUATION RESULTS

The results of evaluation provide objective and empirical information about effects of nutrition education. As was pointed out in the beginning chapter of this Field Guide, the information is not a form of magic which can itself change things. The difficult decisions about your approach to nutrition education remain. But, interpreted in light of other information available to you, the empirical results are extremely valuable to the decision making process.

Let us reference the experiences of the nutritionists described in the model in Chapter 5. The results of their evaluation demonstrated that:

- ✓ The educational treatments in La Loma and in Guadalupe had overall positive results on the food behavior of homemakers.
- ✓ Significant improvements were in the consumption of fruits and vegetables. These changes in dietary behavior were sustained over time and can be considered lasting changes.
- ✓ The educational treatment did not effect improved consumption of milk and milk products or of meat and meat substitutes.
- ✓ The cost per unit of positive change in food behavior in the community of Guadalupe, using the person-to-person approach, was greater than the cost per unit of positive change in the La Loma community where a classroom approach was used.

The empirical results have some good aspects and some not so good. How do the nutritionists interpret these results? How can this information be used to guide future educational activities?

Interpretation and Use of Results of Cost-to-Benefit Analysis

In general, results which demonstrate clearly that one program approach can achieve as much or more change in dietary behavior at less cost than another approach support a decision to use the less costly approach. There is a caution to be observed. Any results of evaluation must be examined carefully in light of all other available information about the community--and in particular, about the target audiences--before a decision is made.

To illustrate how other available information can be used to modify the general rule that lower cost approaches should be used, let us assume

that the nutritionists working in the Guadalupe and La Loma communities have collected Family Profiles on the persons in their evaluation samples.

> *EXAMPLE: Review of the Family Profiles reveals that homemakers in the Guadalupe community have an average family size of 8 children; those in La Loma have an average family size of 5 children. The nutritionists visit a small number of the homemakers in Guadalupe and learn that they cannot attend classes because of the number of small children. Since the person-to-person approach is reaching homemakers who could not be reached in any other way, the nutritionists decide: (a) to use their major resources for the lower cost classroom approach; (b) to recruit and train a small number of volunteers to work in a person-to-person project for hard-to-reach homemakers.*

In the example the nutritionists have evolved a strategy which will both reduce the high cost of the person-to-person approach and reach a broader audience of homemakers.

Interpretation and Use of Results Which Do Not Demonstrate that Nutrition Education is Bringing About Behavioral Changes

Research has repeatedly demonstrated that nutrition education can have a positive effect in bringing about changes in food behavior. Results of specific evaluations will sometimes demonstrate that it does not. The reason may be related to the nutrition education. Or, it may be related to events or conditions completely beyond the control of the nutrition education program. The nutrition education program cannot be faulted for natural disasters--such as droughts and floods--which destroy food resources, or for economic conditions which result in unemployment and limit resources available for foods.

Changes in knowledge about food and health may be achieved, and will generally precede changes in behavior. But, it is the function of nutrition education to teach persons to use the food resources which are available, or can be made available, in ways that persons shall not suffer from malnutrition. Interpretation of evaluation results which indicate failure to achieve desired changes in food habits begins with the sorting out of possible causes of failure. Review the background information assembled in the planning stage of the evaluation. Is there any information which might explain the failure? Think about the food interests, taboos, cultures of the target audience in relation to the way you presented the educational material.

> *EXAMPLE A: In the evaluation project discussed in Chapter 5, the nutritionists failed to achieve a positive change in food habits related to milk and*

milk products. They review the background information about the target audience and note that many of the homemakers believe that milk is associated with a common illness. As a result, the homemakers avoid eating this food or feeding it to any family member. Review of the content of the teaching indicates that not enough attention has been given to sorting out fact from myth or to the importance of milk products as a source of nutrition.

EXAMPLE B: In the evaluation discussed in Chapter 5, the nutritionists failed to achieve positive changes in food habits related to meat and meat substitututes. They did achieve positive effects in consumption of fruits and vegetables. Review of the background information reveals that fruits and vegetables were plentiful in the community and available at low cost. Meat was both scarce and costly. Measures of knowledge taken before and after education, reveal that the homemakers have learned the importance of protein-rich foods in the diet. But, review of the Family Resources data reveals that few, if any, of the families could afford to buy meat. The nutritionists decided upon two courses of action.

1. They would revise their educational materials to place greater emphasis on the use of low-cost meat substitutes.

2. They would share their findings with other agencies to determine if any could initiate projects in the community to provide greater resources for protein-rich foods.

In Example A, the nutritionists were able to revise their approach to try to increase the effectiveness of the education. In Example B, the nutritionists have used the results of evaluation both to adjust their educational approach and, in cooperation with other agencies, to effect nutritional changes within the community.

The examples above demonstrate the interpretation of evaluative information about group behavior, and adjustment of the program to meet the needs of the group. Review of the individual data forms will sometimes permit you to identify a person who is critically ill and in need of medical care. Review of the family resources data may reveal that a family is not eating because they have extremely limited resources for food. Or, there may be other family problems which prevent desired nutrition but which cannot be solved by education alone. When such individual cases are identified in the evaluation data, the evaluator or the educator can serve as a communication link between the individual family and other services within the community--advising the family about a service which can help, or advising the service about the family's condition and needs.

Interpretation and Use of Results Which Demonstrate that Nutrition Education is Effecting Fundamental Changes in Food Behavior

Nutrition education is not a commercial or profit-making endeavor. It is a service to the peoples of a community or a nation--dependent on governments, foundations, and philanthropic-minded groups for its resources. When one considers the magnitude of the task of nutrition education--in light of ignorance, taboos, food shortages, and the need to educate each new generation--resources are pitifully small.

One of the most powerful ways to increase the resources for nutrition education is the presentation of results of objective evaluation which demonstrate that positive changes in food behavior are being achieved. Whenever your evaluation provides such a demonstration, use those results in your own work, but do not stop there. Publicize the results. Share them with the program participants. Share them with other nutrition educators. It may help them to change their approaches and to achieve greater effects on food behaviors. Use the results also in your search for added resources--in recruiting volunteers, in proposals to potential sponsors and funding agencies. Finally, coordinate your findings with those of other sectors concerned with the nutritional well-being of the target population.

SUGGESTED RESOURCE MATERIAL

1. Caro, F. G. (Ed.) *Readings in evaluation research.* Russell Sage Foundation, 230 Park Avenue, New York, New York 10017, 1971. $12.50

2. Hays, W. L. *Basic statistics.* Brooks-Cole Publishing Company, Division of Wadsworth Publishing, 540 Abrego Street, Monterey, California 93940, 1967. $3.50

3. Latham, M. C. *Planning and evaluation of applied nutrition programmes.* UNIPUB, Inc., Post Office Box 433, New York, New York 10016, 1972. Free

4. McNemar, Q. *Psychological statistics.* John Wiley, 605 3rd Avenue, New York, New York 10016, 1969. $13.95

5. Suchman, E. A. *Evaluative research: Principals and practice in public service and social action programs.* Russell Sage Foundation, 230 Park Avenue, New York, New York 10017, 1967. $6.50

6. Whitehead, F. B. *Nutrition education research project. Report of feasibility study.* Agency for International Development (A.I.D.), Technical Assistance Bureau, Office of Nutrition, Washington, D. C. 20523, 1970. Free

APPENDIX

Formats, Worksheets, Reference Tables, and Related Instructions for Use

Individual Data Format A-2

Computerized Format for Individual Data A-4

Infant Data Format A-6

Family Profile Format A-8

Family Resources Data Format A-10

Worksheet Number 1, Summary Sheet for Recording Sequential Measures and Changes in Diets for Individuals in a Group A-12

Worksheet Number 2, Analysis for Two Groups with One Measure A-14

Worksheet Number 3, Analysis for Two Groups with Two Measures A-16

Worksheet Number 3a, Alternate Analysis for Two Groups with Two Measures A-18

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Worksheet Number 5, Cost-Effectiveness Analysis A-22

Table A, Table of Random Numbers A-24

Table B, Significance Levels of Chi Square Values for Different Degrees of Freedom A-28

INSTRUCTIONS
Individual Data

PURPOSE: To present a sample format for collecting field data about an individual who is more than five years of age.

INSTRUCTIONS:

1. Enter the name of the group to which the individual belongs. This should indicate whether control or experimental; it may include the location if this differs by group.
2. Enter the name of the person whose food behavior is being reported; enter the code number assigned to this individual.
3. Enter sufficient descriptive information so you can find the person again for a subsequent interview or for verification of this one.
4. Enter age in years on last birthday. If exact age cannot be known, estimate the age and write "estimated" after the age entered.
5. Check the appropriate box to indicate whether individual is male or female.
6. Ask if the individual is in a normal state of health. If "yes," enter "normal." If "no," ask condition(s) and enter response reported.
7. If individual is a woman, indicate whether pregnant or not.
8. If individual is a woman, indicate whether lactating or not.
9. Indicate whether the individual or some family member has participated in the nutrition education program.
10. If there has been participation, indicate who has been the participant; identify the individual's position in the family.
11. Indicate the number of meetings or sessions the participant has attended.
12. Record all food eaten within the last twenty-four hours. One way of getting this information is to ask: "Can you tell me, please, all of the foods you ate or drank yesterday? Begin with the morning when you got up.....What did you have during the day?.....In the evening? .....Did you eat or drink anything between those times?.....Was there anything else?"
13. Indicate how the food was prepared. This is especially important for mixed dishes which may include a variety of ingredients--ingredients which may vary from location to location, family to family, or because of food availability.
14. Indicate the number of times the food was eaten during the day. Some foods may be eaten several times during a day.
15. Indicate whether the person who is providing the information is the person whose food consumption is being reported.
16. If the report is not on the person providing the report, indicate the relationship to the person whose diet is reported.
17. Ask if the reported diet is typical. If "no," ask what makes the report atypical and enter the response reported.
18. Record your name and the date you collected the interview information.

INDIVIDUAL DATA

A. IDENTIFICATION:

1. Group _____
2. Name _____ Code Number _____
3. Address/Location _____

B. INDIVIDUAL CHARACTERISTICS:

4. Age _____ 5. Sex ☐ Male ☐ Female
6. Observable health status _____
7. Is respondent pregnant? _____ 8. Is respondent lactating? _____

C. PARTICIPATION DATA:

9. Has this person or a family member participated in the Nutrition Education Program? Yes _____ No _____
10. Who is the participant? _____ Position in family _____
11. How many meetings has the participant attended to date? _____

D. FOODS CONSUMED YESTERDAY:

12. FOOD	13. HOW PREPARED	14. NUMBER OF TIMES EATEN

(Space for Scoring the Adequacy of this Diet for this Individual when the Data are Reviewed)

E. REPORTING CONDITIONS:

15. Is the person who is the source of information for this report the person whose diet is being reported?

    Yes _____ No _____

16. If no, what is the relationship to the person whose diet is reported? _____

    _____

17. Are there any reasons to think the diet reported is not typical? Yes _____ No _____

    If yes, give reason. _____

    _____

Name of Interviewer _____ *Date of Interview* _____

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INSTRUCTIONS

Computerized Format for Individual Data

PURPOSE: To demonstrate a sample format for handling field data on a computerized basis.

INSTRUCTIONS: Follow the instructions for collecting data presented for the regular Individual Data Format. The following instructions will guide you in setting up codes for computer data handling. Instructions are presented by keypunch card column numbers, or sets of these, as appropriate.

COLUMN NUMBER	ITEM	CODE STRUCTURE AND DEFINITION
1	Report Form	Predesignated as "1." When a series of formats is computerized, each format has a unique number.
2	Report Number	Use a sequential number for each successive use with an individual.
3-4	Group Number	Assign a unique number for each group used: 01 = Control, 02 = First Experimental Group, 03 = Second Experimental Group, etc.
5-6	Family Number	Assign a unique number for each family included. This code will be useful in associating Individual Data with the Family Profile and Family Resources Data.
7-8	Individual Number	Assign a unique number for each family member included. Columns 3-8 provide a unique and consistent identification of an individual through a series of measurements.
9-10	Location Number	Assign a unique number for each separate location included in the study.
11-12	Age	Use actual age in years.
13-14	Sex	Enter "X" in Column 13 if male; enter "X" in Column 14 if female.
15-16 17-18 19-20	Health Status	Establish unique codes for health conditions found in your area. Up to three conditions can be coded for each individual.
21-22	Pregnant	Enter "X" in Column 21 if "yes," "X" in Column 22 if "no." If question does not apply, make no entry.
23-24	Lactating	Enter "X" in Column 23 if "yes," "X" in Column 24 if "no." If question does not apply, make no entry.
25-26	Program Participation	Enter "X" in Column 25 if this individual or some family member has participated in the Nutrition Education Program. Enter "X" in Column 26 if there has not been participation.
27	Participant's Position in Family	Establish codes similar to the following: 1 = mother, 2 = grandmother, 3 = daughter, etc.
28-29-30	Number Meetings Attended	Enter actual number.
31-32 33-34 35-36 37-38 39-40 41-42 43-44 45-46	Meets Criteria	Enter "X" in Column 31 if first criteria is met, "X" in Column 32 if not met. Follow this "yes/no" pattern for as many criteria as have been established. Up to 8 criteria can be handled within this structure.
47-48	Person Reporting	Enter "X" in Column 47 if person reporting is the same person whose diet is reported; enter "X" in Column 48 if these are two different persons.
49	Relationship	Establish codes similar to the following: 1 = mother, 2 = grandmother.
50-51	Typical Diet	Enter "X" in Column 50 if the diet reported is typical for the individual; enter "X" in Column 51 if the diet is not typical for the individual.
52-53 54-55 56-57	Reasons for Non-typical Diet	Establish unique codes for reasons the diet is not typical. Up to three reasons can be coded for each individual.
58-59	Interviewer Code	Assign a unique code for each interviewer.
60-61 62-63 64-65	Date of Interview	Enter numerical code for the month in Columns 60-61: 01 = January, 02 = February,.....12 = December. Enter day of the month on which interview conducted in Columns 62-63. Enter last two digits of the year in Columns 64-65: 1975 = 75, 1976 = 76, etc.

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COMPUTERIZED FORMAT FOR INDIVIDUAL DATA

INDIVIDUAL DATA

A. IDENTIFICATION:

Report Form [1] (1) Report No. [ ] (2) Group No. [ ] (3 4)

1. Group _____

Code Number: Family [ ] (5 6) Individual [ ] (7 8)

2. Name _____

Location [ ] (9 10)

3. Address/Location _____

B. INDIVIDUAL CHARACTERISTICS:

4. Age [ ] (11 12)

5. Sex: Male [ ] (13) Female [ ] (14)

6. Observable health status _____ Health Status [ ] (15 16) [ ] (17 18) [ ] (19 20)

7. Is respondent pregnant? Yes [ ] (21) No [ ] (22)

8. Is respondent lactating? Yes [ ] (23) No [ ] (24)

C. PARTICIPATION DATA:

9. Has this person or a family member participated in the Nutrition Education Program? Yes [ ] (25) No [ ] (26)

10. Who is the participant? _____ Position in family _____ [ ] (27)

11. How many meetings has the participant attended to date? [ ] (28 29 30)

D. FOODS CONSUMED YESTERDAY:

12. FOOD	13. HOW PREPARED	14. NUMBER OF TIMES EATEN

MEETS CRITERIA	Yes	No
#1	[ ] (31)	[ ] (32)
#2	[ ] (33)	[ ] (34)
#3	[ ] (35)	[ ] (36)
#4	[ ] (37)	[ ] (38)
#5	[ ] (39)	[ ] (40)
#6	[ ] (41)	[ ] (42)
#7	[ ] (43)	[ ] (44)
#8	[ ] (45)	[ ] (46)

E. REPORTING CONDITIONS:

15. Is the person who is the source of information for this report the person whose diet is being reported? Yes [ ] (47) No [ ] (48)

16. If no, what is the relationship to the person whose diet is reported? _____ [ ] (49)

17. Are there any reasons to think the diet reported is not typical? Yes [ ] (50) No [ ] (51)
If yes, give reason.

_____ Reasons [ ] (52 53) [ ] (54 55) [ ] (56 57)

Name of Interviewer _____ No. [ ] (58 59) Date of Interview Mo. [ ] (60 61) Day [ ] (62 63) Year [ ] (64 65)

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INSTRUCTIONS
Infant Data

PURPOSE: To present a sample format for collecting field data about an individual who is five years of age or less.

INSTRUCTIONS:

1. Enter the name of the group to which the infant belongs. This should indicate whether control or experimental; it may include the location if this differs by group.
2. Enter the name of the infant whose food behavior is being reported; enter the code number assigned to this infant.
3. Enter sufficient descriptive information so you can find the household again for a subsequent interview or for verification of this one.
4. Enter the infant's age in months since birth. If exact age cannot be known, estimate the age and write "estimated" after the age entered.
5. Check the appropriate box to indicate whether infant is male or female.
6. Measure and record the infant's weight.
7. Ask if the infant is in a normal state of health. If "yes," enter "normal." If "no," ask condition(s) and enter response reported.
8. Indicate whether the person providing the information or some other family members have participated in the nutrition education program.
9. If there has been participation, indicate who has been the participant; identify this person's relationship to the infant.
10. Indicate the number of meetings or sessions the participant has attended.
11. Indicate whether the infant was fully, partially, or not breast fed yesterday; if breast fed, indicate the number of times of such feeding.
12. Indicate whether the infant was fully, partially, or not bottle fed yesterday; if bottle fed, indicate the number of times of such feeding. Also, indicate the bottle formula content.
13. Indicate whether the infant consumed any foods yesterday.
14. If "yes," indicate what foods were eaten.
15. Indicate how the food was prepared.
16. Indicate the number of times the food was eaten.
17. Identify the person providing the information for this report.
18. Indicate the relationship of this person to the infant.
19. Ask if the reported diet is typical. If "no," ask what makes the report atypical and enter the response reported.
20. Record your name and the date you collected the interview information.

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INDIVIDUAL DATA
Infant or Child One-to-Five Years of Age

A. IDENTIFICATION:

1. Group _____
2. Name of Infant or Child _____ Code Number _____
3. Address/Location _____

B. INFANT'S CHARACTERISTICS:

4. Age (months) _____ 5. Sex ☐ Male ☐ Female 6. Weight _____
7. Observable or reported health status _____

C. PARTICIPATION DATA:

8. Has this person or a family member participated in the Nutrition Education Program? Yes _____ No _____
9. Who is the participant? _____ Position in family _____
10. How many meetings has the participant attended to date? _____

D. FOODS CONSUMED YESTERDAY:

11. The infant or child was breast fed? Fully _____ Partially _____ Not at all _____ Number of breast feedings yesterday _____
12. Is the infant or child bottle fed? Fully _____ Partially _____ Not at all _____ Number of bottle feedings yesterday _____
    Bottle formula used _____
13. Did the infant or child consume any foods other than that from breast or bottle? Yes _____ No _____
    If yes, list below:

14. FOOD	15. HOW PREPARED	16. NUMBER OF TIMES EATEN

(Space for Scoring the Adequacy of this Diet for this Individual when the Data are Reviewed)

E. REPORTING CONDITIONS:

17. Who is the source of information for this report? _____
18. What is the relationship to the infant or child whose diet is described? _____
19. Are there any reasons to think the diet reported is not typical? Yes _____ No _____
    If yes, give reason. _____

Name of Interviewer _____ *Date of Interview* _____

INSTRUCTIONS
Family Profile

PURPOSE: To present a sample format for collecting field data about a family:

INSTRUCTIONS:

1. Enter the name of the group to which the family belongs. This should indicate whether control or experimental; it may include the location if this differs by group.

2. Enter the name of the person whose food behavior is reported; enter the code number assigned to this individual.

3. Enter the name of the head of the household.

4. Enter sufficient descriptive information so you can find the family again for a subsequent interview or for verification of this one.

5. List the persons who live in the household by identifying their relationship to the head of the household. For example, "wife," "son," "father."

6. Indicate the sex of each household member.

7. Indicate the age of each household member.

8. Check the appropriate educational level for each household member.

9. For women in the household, indicate if they are pregnant.

10. For women in the household, indicate if they are lactating.

11. For employed members of the household, indicate the type of work they perform.

12. Add the number of checks in each appropriate column and enter at the "total" line.

13. Record your name and the date you collected the interview information

FAMILY PROFILE

A. IDENTIFICATION:

1. Group _____
2. Name of person whose food behavior is reported _____ Code Number _____
3. Name of head of household _____
4. Address/Location _____

B. CHARACTERISTICS OF HOUSEHOLD MEMBERS:

5. Relationship to Head of the Household	6. Sex		7. Age	8. Education Level					9. Check if Pregnant	10. Check if Lactating	11. If Individual Employed Indicate Type of Work
				Elementary		Secondary		Higher Education			
	M	F		Complete	Incomplete	Complete	Incomplete				
TOTALS											

Name of Interviewer _____

Date of Interview _____

Updated _____

Updated _____

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INSTRUCTIONS
Family Resources Data

PURPOSE: To present a sample format for collecting field data about a family's resources available for food.

INSTRUCTIONS:

1. Enter the name of the group to which the family belongs. This should indicate whether control or experimental; it may include the location if this differs by group.

2. Enter the family name. This should identify the head of the household.

3. Enter the name of the person whose food behavior is reported; enter the code number assigned to this individual.

4. Identify whether this family lives in a rural farm, rural nonfarm, or urban setting.

5. Identify the amount of money expended monthly for the cost of the residence. If the exact amount cannot be determined, estimate the amount and write "estimate" after the amount entered.

6. Enter the amount of monthly income available from all income sources. This is likely to be an estimate, even if the amount is reported by the respondent.

7. Make a survey of the foods available in the household on the day of report. Separate these by source: grown on the land; gathered from field, forest or waterways; purchased; or other.

8. Identify each food type within the correct source block.

9. Estimate the amount of each food type available.

10. Ask if the report about food availability presents a typical picture with respect to types and amounts of food available on a given day. If "no," ask what makes the report atypical and enter the response reported.

11. Record your name and the date you collected the interview information.

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FAMILY RESOURCES DATA

A. IDENTIFICATION:

1. Group _____ 2. Family Name _____

3. Name of person whose food behavior is reported _____ Code Number _____

B. RESIDENCE:

4. Rural Farm _____ Rural Nonfarm _____ Urban _____

5. Amount of money expended monthly for residence _____

C. INCOME:

6. Estimated monthly income to household, in money from all sources: _____

D. FOODS AVAILABLE IN HOUSEHOLD ON DAY OF REPORT:

7. SOURCE	8. FOOD TYPE	9. ESTIMATED AMOUNT
Grown on the land		
Gathered from field, forest or waterways		
Purchased		
Other		

(Space for Noting Adequacy of Available Food for this Household, for use in Data Review Only)

E. REPORTING CONDITIONS: 10. Are there any reasons to think the types and amounts of food are not typical for this household? Yes _____ No _____. If yes, give reasons. _____

_____

Name of Interviewer _____ Date of Interview _____

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INSTRUCTIONS

Worksheet Number 1

Summary Sheet for Recording Sequential Measures and Changes in Diets for Individuals in a Group

PURPOSE: To present a sample format for summarizing the food consumption data. The format allows summarization of any two comparable data sets for a single group.

INSTRUCTIONS:

1. Review the field data to sort out invalid reports. Reports about food consumption may be invalid for a number of reasons. Some of these include:
   - ✓ More food than is normal--the preceding day was a holiday or feast day.
   - ✓ Less food than is normal--the person whose diet is reported may have been sick or unable to eat in the usual fashion.
   - ✓ The data collector failed to obtain a complete report--the number of times the food was eaten or the amount of the food eaten when the survey is in terms of amounts of food consumed.
   - ✓ The respondent may be an inappropriate person for the group--a member of the control group may be a participant in this or another nutrition education program. An experimental group member may have dropped out of the nutrition education program.
2. Separate the experimental from the control group. Prepare separate summaries on Worksheet No. 1 for each group. Identify each Worksheet by the group.
3. Enter the names and code numbers of each member of the group retained through step 1, above.
4. On the basis of the criteria established for the study, identify each relevant food category. If you have more than four food categories, use additional pages of Worksheet No. 1.
5. On the basis of the criteria established for the study, review each report and determine whether the report represents (+) or (−) behavior on each food category.
6. Check the correct indication for each individual on each food category under "Measure 1."
7. Add the number of checks in each column under Measure 1 and enter the total in row "a."
8. Determine the number of persons included in each food category on measure 1. That is, add the number checked (+) and those checked (−) and enter this total in row "b." Note, that it is possible for these totals to differ from food group to food group if there is "missing data" in a food group.
9. Calculate the percent checked (+) and the percent checked (−) using the instruction on line "c" (line a ÷ line b) and enter the percents in row "c."
10. When data from the second data collection are available, repeat steps 1 through 9 and enter these results on the same worksheet under "Measure 2."
11. To determine the direction of change in diets over time (using the left half of the worksheet), review each individual on each food category and check the appropriate direction of change: (− → +), (+ → −), (+ → +), or (− → −). Note that two reports on an individual are necessary for this step.
12. Repeat steps 7 through 9 to determine the number and percent for each food and change category. Note that there are four behavior categories for each food category rather than two.

SUMMARY SHEET FOR RECORDING SEQUENTIAL MEASURES AND CHANGES IN DIETS FOR INDIVIDUALS IN A GROUP

GROUP: _____

NAMES	Code Numbers	DIETARY MEASURES																DIRECTION OF CHANGE IN DIETS OVER TIME															
		FOOD CATEGORIES																FOOD CATEGORIES															
		1				2				3				4				1				2				3				4			
		Measure 1		Measure 2		Measure 1		Measure 2		Measure 1		Measure 2		Measure 1		Measure 2		− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +	− ↓ −	− ↓ +	+ ↓ −	+ ↓ +	− ↓ −
		+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−																
a. Total Number in each Column																																	
b. Total Number of Individuals in Group *																																	
c. Percent: (a ÷ b) x 100																																	

NOTE: The number of individuals in a group may differ for sequential measures.

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INSTRUCTIONS
Worksheet Number 2
Analysis for Two Groups with One Measure

PURPOSE: To present a sample format for performing a statistical analysis (Chi Square test) to determine if two groups are the same or different. The format permits analysis of any two groups on a single data set.

INSTRUCTIONS:

1. Using the same data (food) categories as defined for Worksheet Number 1, enter the data from rows "a," "b," and "c" on the left half of Worksheet Number 1 in rows "a," "b," and "c" of Worksheet Number 2 for the experimental group.

2. Using Worksheet No. 1 for the control group, enter the data from rows "a," "b," and "c" in rows "d," "e," and "f" of Worksheet No. 2.

3. Using the N's in rows "a" through "f" obtain the totals required in rows "g" through "i."

4. Rows "a," "b," "d," and "e" are the observed N's. That is, they represent the number of respondents falling into a given data category on the basis of the interview data. The calculations required in rows "j" through "m" give you the comparable expected N's--the N's which would be found by chance alone. These two sets of N's are compared (by performing the remaining steps on the Worksheet) to determine if there is a difference between the two groups large enough to be considered a non-chance difference.

5. There is a simple check you can make on the accuracy of your calculations to this point: rows "j" + "k" should equal row "c;" rows "l" + "m" should equal row "f."

6. When entries in this block of calculations (rows "j" through "m") are less than 10, use caution in interpreting the results. An expected N of less than 10 is considered by some statisticians to be so low as to make use of the Chi Square test questionable. Other statisticians place this level at 5 rather than 10. If you find a value or two here at about 5, the Chi Square test can be used since a correction is made for small expected N's in the next set of steps (rows "n" through "q"). However, if expected N's in a given data category are uniformly or frequently small, that data category should be eliminated and the Chi Square test performed using only the remaining data categories.

7. Perform the step-by-step calculations called out for rows "n" through "y." The calculations in steps "n" through "q" provide the absolute difference between the observed and the expected N's. Thus, within the | | area, the plus or minus sign of the difference is ignored. Entries in rows "n" through "q" cannot be less than "0." If the calculated value is less than "0" (that is, a negative value), enter "0" instead of the calculated value. In each data category, rows "n," "o," "p," and "q" should be the same and rows "r," "s," "t," and "u" should be the same.

8. Determine the Chi Square for each individual data category following the instruction in row "A" (the sum of rows "v" through "y").

9. Using the "1" degree of freedom shown in row "z" and the Chi Square value in row "A," refer to Table B and determine the significance level for the Chi Square. (Use the instructions provided for Table B to determine the significance level.) Enter these results in row "B."

10. Determine the number of degrees of freedom for the combined set of data categories following the instruction in row "C."

11. Determine the Chi Square for the combined set of data categories following the instruction in row "D."

12. Using the degrees of freedom shown in row "C" and the combined Chi Square shown in row "D," determine the significance level for the Chi Square from Table B. Enter this result in row "E."

ANALYSIS FOR TWO GROUPS WITH ONE MEASURE

WORK SHEET NUMBER 2

GROUP 1_____ GROUP 2 _____

	STEPS PROCEDURES	DATA CATEGORIES							
		1		2		3		4	
		N	%	N	%	N	%	N	%
Enter the totals from the bottom of Worksheet 1 for Experimental Group	a: (+) Behavior								
	b: (−) Behavior								
	c: TOTAL (a + b)								
Enter the totals from the bottom of Worksheet 1 for the Control Group	d: (+) Behavior								
	e: (−) Behavior								
	f: TOTAL (d + e)								
Use the N's in rows a through f and calculate the Chi Squares	g: a + d								
	h: b + e								
	i: g + h								
NOTE: If any entry in this block is less than 10, see instructions	j: c x g ÷ i								
	k: c x h ÷ i								
	l: f x g ÷ i								
	m: f x h ÷ i								
NOTE: Disregard plus or minus signs of subtraction within | |	n: |a − j| − .5								
	o: |b − k| − .5								
	p: |d − l| − .5								
	q: |e − m| − .5								
	r: n^2								
	s: o^2								
	t: p^2								
	u: q^2								
	v: r ÷ j								
	w: s ÷ k								
	x: t ÷ l								
	y: u ÷ m								
Chi Square for Individual Data Categories	z: Degrees of freedom	1		1		1		1	
	A: Chi Square (v +w+x+y)								
	B: Significance of difference								
Chi Square for Combined Data Categories	C: Degrees of freedom (Sum of row "z" for Categories used) _____								
	D: Chi Square (Sum of row "A" entries) _____								
	E: Significance of difference _____								

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INSTRUCTIONS

Worksheet Number 3

Analysis for Two Groups with Two Measures

PURPOSE: To present a sample format for performing a statistical analysis (Chi Square test) to determine if two groups are the same or different when they are compared on changes from one measurement period to another. The format permits analysis of any two groups on any two sets of comparable data.

INSTRUCTIONS:

1. Using the same data (food) categories as defined for Worksheet Number 1, enter the data from rows "a," "b," and "c" on the right half of Worksheet Number 1 for the experimental group in rows "a" through "e" of Worksheet Number 3.

2. Using Worksheet Number 1 for the control group, enter the data from rows "a," "b," and "c" in rows "f" through "j" of Worksheet Number 3.

3. Using the N's in rows "a" through "j" obtain the totals required in rows "k" through "n."

4. Rows "a" through "d" and rows "f" through "i" are the observed N's. That is, they represent the number of respondents falling into a given data category on the basis of the interview data. The calculations required in rows "o" through "v" give you the comparable expected N's--the N's which would be found by chance alone. These two sets of N's are compared (by performing the remaining steps on Worksheet Number 2) to determine if there is a difference between the two groups large enough to be considered a non-chance difference.

5. There is a simple check you can make on the accuracy of your calculations to this point: the sum of rows "o" through "r" should equal row "e;" the sum of rows "s" through "v" should equal row "j."

6. When entries in this block of calculations (rows "o" through "v") are less than 10, you may want to make some changes in your analysis. An expected N of less than 10 is considered by some statisticians to be so low as to make use of the Chi Square test questionable. Other statisticians place this level at 5 rather than 10. If you find a value at about 5, or even several values at about 5, the Chi Square test can be used--but should be interpreted cautiously. If expected N's in a given data category are uniformly or frequently small, that data category should be eliminated and the Chi Square test performed using only the remaining data categories. If the small expected values are uniformly associated with one type of behavior pattern, a recombining of behavior patterns can be accomplished and the small expected N's eliminated. Worksheet Number 3a presents such a recombining on the basis of the following three categories: (− → +), (+ → +), and (+ → − and − → −).

7. Perform the step-by-step calculations called out for rows "w" through "D." The calculations in these steps make use of the absolute difference between the observed and the expected N's: for example, $|a - o|$, $|b - p|$. Thus, within the $|\quad|$ area, the plus or minus sign of the difference is ignored.

8. Determine the Chi Square for each individual data category following the instructions in row "F" (the sum of rows "w" through "D").

9. Using the "3" degrees of freedom shown in row "E" and the Chi Square value in row "F," refer to Table B and determine the significance level for the Chi Square. (Use the instructions provided for Table B to determine the significance level.) Enter these results in row "G."

10. Determine the number of degrees of freedom for the combined set of data categories following the instruction in row "H."

11. Determine the Chi Square for the combined set of data categories following the instruction in row "I."

12. Using the degrees of freedom shown in row "H" and the combined Chi Square shown in row "I," determine the significance level for the Chi Square from Table B. Enter this result in row "J."

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ANALYSIS FOR TWO GROUPS WITH TWO MEASURES

GROUP 1 _____ GROUP 2 _____ WORKSHEET NUMBER 3

	STEPS PROCEDURES	DATA CATEGORIES 1 N	1 %	2 N	2 %	3 N	3 %	4 N	4 %
Enter the totals from the bottom of Worksheet 1 for Experimental Group	a: (−) → (+)								
	b: (+) → (−)								
	c: (+) → (+)								
	d: (−) → (−)								
	e: Total (a + b + c + d)								
Enter the totals from the bottom of Worksheet 1 for the Control Group	f: (−) → (+)								
	g: (+) → (−)								
	h: (+) → (+)								
	i: (−) → (−)								
	j: Total (f + g + h + i)								
Use the N's in rows a through j and calculate the Chi Squares	k: a + f								
	l: b + g								
	m: c + h								
	n: d + i								
NOTE: If any entry in this block is less than 10, see instructions	o: (e x k) ÷ (e + j)								
	p: (e x l) ÷ (e + j)								
	q: (e x m) ÷ (e + j)								
	r: (e x n) ÷ (e + j)								
	s: (j x k) ÷ (e + j)								
	t: (j x l) ÷ (e + j)								
	u: (j x m) ÷ (e + j)								
	v: (j x n) ÷ (e + j)								
NOTE: Disregard plus or minus signs of subtraction within | |	w: $\lvert a - o \rvert^2 \div o$								
	x: $\lvert b - p \rvert^2 \div p$								
	y: $\lvert c - q \rvert^2 \div q$								
	z: $\lvert d - r \rvert^2 \div r$								
	A: $\lvert f - s \rvert^2 \div s$								
	B: $\lvert g - t \rvert^2 \div t$								
	C: $\lvert h - u \rvert^2 \div u$								
	D: $\lvert i - v \rvert^2 \div v$								
Chi Square for Individual Data Categories	E: Degrees of freedom	3		3		3		3	
	F: Chi Square (w+x+y+z+A+B+C+D)								
	G: Significance of difference								

Chi Square for Combined Data Categories

H: Degrees of freedom (Sum of row "E" for Categories used) _____

I: Chi Square (Sum of row "F" entries) _____

J: Significance of difference _____

INSTRUCTIONS

Worksheet Number 3a

Alternate Analysis for Two Groups with Two Measures

PURPOSE: To present a sample format for performing a statistical analysis (Chi Square test) to determine if two groups are the same or different when they are compared on changes from one measurement period to another. The format permits analysis when the Worksheet Number 3 analysis yields small expected N's in the (+ → −) or (− → −) category.

The format permits analysis of any two groups on any two sets of comparable data.

INSTRUCTIONS:

1. Using the same data (food) categories as defined for Worksheet Number 1, enter the data from rows "a," "b," and "c" on the right half of Worksheet Number 1 for the experimental group in rows "a" through "d" of Worksheet Number 3a. Data for columns (+ → −) and (− → −) must be combined.

2. Using Worksheet Number 1 for the control group, enter the data from rows "a," "b," and "c" in rows "e" through "h" of Worksheet Number 3a. Data for columns (+ → −) and (− → −) must be combined.

3. Using the N's in rows "a" through "h" obtain the totals required in rows "i" through "l."

4. Rows "a" through "c" and rows "e" through "g" are the **observed N's.** That is, they represent the number of respondents falling into a given data category on the basis of the interview data. The calculations required in rows "m" through "r" give you the comparable **expected N's** -- the N's which would be found by chance alone. These two sets of N's are compared (by performing the remaining steps on Worksheet Number 3a) to determine if there is a difference between the two groups large enough to be considered a nonchance difference.

5. There is a simple check you can make on the accuracy of your calculations to this point: the sum of rows "m" through "o" should equal row "d;" the sum of rows "p" through "r" should equal row "h."

6. When entries in this block of calculations (rows "m" through "r") are less than 10, use caution in interpreting your results. An expected N of less than 10 is considered by some statisticians to be so low as to make use of the Chi Square test questionable. Other statisticians place this level at 5 rather than 10. If you find a value or two here at about 5, the Chi Square test can be used. However, if expected N's in a given data category are uniformly or frequently small, that data category should be eliminated and the Chi Square test performed using only the remaining data categories.

7. Perform the step-by-step calculations called out for rows "s" through "x." The calculations in these steps make use of the **absolute difference** between the observed and the expected N's: for example, $|a - m|$, $|b - n|$. Thus, within the $|\quad|$ area, the plus or minus sign of the difference is ignored.

8. Determine the Chi Square for each individual data category following the instruction in row "z" (the sum of rows "s" through "x").

9. Using the "2" degrees of freedom shown in row "y" and the Chi Square value in row "z," refer to Table B and determine the significance level for the Chi Square. (Use the instructions provided for Table B to determine the significance level.) Enter these results in row "A."

10. Determine the number of degrees of freedom for the combined set of data categories following the instruction in row "B."

11. Determine the Chi Square for the combined set of data categories following the instruction in row "C."

12. Using the degrees of freedom shown in row "B" and the combined Chi Square shown in row "C," determine the significance level for the Chi Square from Table B. Enter this result in row "D."

ALTERNATE ANALYSIS FOR TWO GROUPS WITH TWO MEASURES

WORKSHEET NUMBER 3a

GROUP 1 _____ GROUP 2 _____

	STEPS PROCEDURES	DATA CATEGORIES 1 N	1 %	2 N	2 %	3 N	3 %	4 N	4 %
Enter the totals from the bottom of Worksheet 1 for Experimental Group	a: (−) → (+)								
	b: (+) → (−) and (−)→(−)								
	c: (+) → (+)								
	d: TOTAL (a+b+c)								
Enter the totals from the bottom of Worksheet 1 for the Control Group	e: (−) → (+)								
	f: (+) → (−) and (−)→(−)								
	g: (+) → (+)								
	h: TOTAL (e+f+g)								
Use the N's in rows a through h and calculate the Chi Squares	i: a + e								
	j: b + f								
	k: c + g								
	l: TOTAL (i+j+k)								
NOTE: If any entry in this block is less than 10, see instructions.	m: (d x i) ÷ l								
	n: (d x j) ÷ l								
	o: (d x k) ÷ l								
	p: (h x i) ÷ l								
	q: (h x j) ÷ l								
	r: (h x k) ÷ l								
NOTE: Disregard plus or minus signs of subtraction within | |	s: $\lvert a - m \rvert^2 \div m$								
	t: $\lvert b - n \rvert^2 \div n$								
	u: $\lvert c - o \rvert^2 \div o$								
	v: $\lvert e - p \rvert^2 \div p$								
	w: $\lvert f - q \rvert^2 \div q$								
	x: $\lvert g - r \rvert^2 \div r$								
Chi Square for Individual Data Categories	y: Degrees of freedom	2		2		2		2	
	z: Chi Square (s+t+u+v+w+x)								
	A: Significance of difference								
Chi Square for Combined Data Categories	B: Degrees of freedom (Sum of row "y" for Categories used)								
	C: Chi Square (Sum of row "z" entries)								
	D: Significance of difference								

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INSTRUCTIONS

Worksheet Number 4

Analysis for One Group with Two Measures (Case Study)

PURPOSE: To present a sample format for a statistical analysis (Chi Square Test) to determine if there is significant difference in the food behaviors of a single group measured at two different points in time. The format is appropriate for case studies, where a control group is not used. It can also be used when the first measurement in an experiment demonstrates that the experimental and control groups are not comparable—in which case the continuing study of the experimental group can be done as a "case study."

INSTRUCTIONS:

1. Use the same data categories you used for Worksheet Number 1. Write the title of the data category or categories in the appropriate spaces numbered 1, 2, etc., under the heading "DATA CATEGORIES." If more than four categories are needed, add columns to the worksheet.

2. Enter the data from the "Dietary Change" side of Worksheet Number 1 in rows "a" through "e."

3. Use the N's for rows "a" and "b" to calculate the Chi Squares by following the remaining steps "f" through "i" on Worksheet Number 4.

4. When an entry in row "f" is less than 10 you may want to eliminate the data category from the Chi Square test. If entries in row "f" are consistently much less than 10, eliminate the Chi Square test and use only the N's and percentages in rows "a" through "e."

5. Determine the Chi Square for each individual data category following the instruction in row "k."

6. Using the "1" degree of freedom shown in row "j" and the Chi Square value in row "k," refer to Table B and determine the significance level for the Chi Square. (Use the instructions provided for Table B to determine the significance level.) Enter these results in row "l."

7. Determine the number of degrees of freedom for the combined set of data categories following the instruction in row "m."

8. Determine the Chi Square for the combined set of data categories following the instruction in row "n."

9. Using the degrees of freedom shown in row "m" and the combined Chi Square shown in row "n," determine the significance level for the Chi Square from Table B. Enter this result in row "o."

10. If a Chi Square is significant, determine if it is in the right direction, that is, demonstrating a positive effect rather than a negative effect. If row "a" is greater than row "b," the effect is positive; if row "b" is greater than row "a," the effect is negative. If row "a" is equal to, or nearly equal to row "b," there has been no overall effect.

ANALYSIS FOR ONE GROUP WITH TWO MEASURES (CASE STUDY)

GROUP_____ WORKSHEET NUMBER 4

	STEPS PROCEDURES	DATA CATEGORIES							
		1		2		3		4	
		N	%	N	%	N	%	N	%
Enter the totals for dietary change data from the bottom of Worksheet 1	a: (−) → (+)								
	b: (+) → (−)								
	c: (+) → (+)								
	d: (−) → (−)								
	e: TOTAL (a + b + c + d)								
Use the N's in rows a and b and calculate the Chi Squares									
NOTE: If any entry in this block is less than 10, see instructions	f: a + b								
NOTE: Disregard plus or minus signs of subtraction within | |	g: |a − b|								
	h: g − 1								
	i: h^2								
Chi Square for Individual Data Categories	j: Degrees of freedom	1		1		1		1	
	k: Chi Square = i ÷ f								
	l: Significance of difference								
Chi Square for Combined Data Categories	m: Degrees of freedom (Sum of row j for Categories used) _____								
	n: Chi Square (Sum of row k entries) _____								
	o: Significance of difference _____								

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INSTRUCTIONS

Worksheet Number 5
Cost-Effectiveness Analysis

PURPOSE: To present a sample format for collecting and using cost and performance data to demonstrate the cost-effectiveness of the program. The basis for this analysis is the cost of one unit of behavioral change—the cost associated with the nutrition education required to bring about positive change in the food behavior of one individual. This format will work equally well if performance data are available from the whole group or from only a sample of the group.

INSTRUCTIONS:

1. Identify the group for which the data are collected. If data are prepared for more than one group representing, for example, different approaches to nutrition education, prepare separate worksheets for each group.

2. Block I, SEQUENTIAL TIME PERIOD, handles data for sequential periods of program operation. Identify the time period the data represent. It is better—but not essential—that successive time periods be equal. When comparisons are made between groups, it is essential that time periods are comparable for each group.

3. Enter the number of new program participants each period in row "a" and the number of dropouts in row "b." Dropouts are those who enrolled in the program but did not remain with it for any reason or set of reasons. Determine the net number of new participants (row "a" minus row "b") and enter in row "c."

4. Define the criteria for determining whether (− → +) or (+ → −) behavior has been exhibited. For example the criteria may reflect this type of change across any food category, or the criteria may require this type of change within one specific food category. Note that the procedure does not deal with (+ → +) and (− → −) behaviors since these do not reflect a <u>change</u> in behavior.

5. On the basis of the criteria defined in step 4 above, identify the percent of new participants showing (− → +) behavior and enter in row "d." Identify the percent showing (+ → −) behavior and enter in row "e." Determine the net percent positively affected by subtracting row "e" from row "d" and enter in row "f."

6. Derive the net number of persons positively affected (row "c" x row "f" ÷ 100) and enter in row "g." Round this to the nearest whole number.

7. Enter the cost of program operation this period in row "h."

8. In block II, CUMULATIVE TIME PERIOD, data are accumulated over the successive time periods. In each cumulative time period space, enter the total time included. For the first block, this will be the same as the first sequential time period. For the second block, the cumulative time period will start with the beginning of the first sequential time period and end with the end of the second sequential time period. For the third block, the cumulative time period will be the beginning of the first sequential time period and the end of the third sequential time period.

9. Determine the net number of participants to date by adding all of the row "c" entries and enter in row "i." Determine the cumulative number of persons positively affected by adding all row "g" entries and enter in row "j."

10. Calculate the percent of participants positively affected to date and enter in row "k."

11. Determine the cumulative cost of program operation by adding all row "h" entries and enter in row "l."

12. Determine the unit measure of cost effectiveness (row "l" ÷ row "j") and enter in block III. Note that if the net percent cumulatively affected (row "k") is a negative value, the cost per person positively affected cannot be calculated for this time period.

13. Block IV. Present a narrative description of all resources used in the education program which do not require monetary expenditures. Examples of such resources are services of volunteer workers, free media time, donated food or fuel, et cetera. If donated services, materials, and equipment differ from time period to time period, identify the time period to which the description applies. Calculate or estimate the monetary value of the donated goods and services and enter this amount in row "m." Add the row "h" entry to the row "m" entry and enter this amount in row "n." Add all the row "n" entries to determine the cumulative program and donated costs and enter in row "o."

14. Determine the unit measure of cost-effectiveness, including program and donated costs (row "o" ÷ row "j") and enter in block V.

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COST-EFFECTIVENESS ANALYSIS

WORKSHEET NUMBER 5

GROUP _____

I. SEQUENTIAL TIME PERIOD					
a: Number of new participants					
b: Number of dropouts					
c: Net number of new participants (a - b)					
d: Percent of new participants showing (−) → (+) behavior	%	%	%	%	%
e: Percent of new participants showing (+) → (−) behavior	%	%	%	%	%
f: Net percent positively affected (d - e)	%	%	%	%	%
g: Net number positively affected [(c x f) ÷ 100]					
h: Cost of program operation					

II. CUMULATIVE TIME PERIOD					
i: Net number of participants to date (add all "c" entries)					
j: Cumulative number positively affected (add all "g" entries)					
k: Net percent positively affected to date [(j ÷ i) x 100]	%	%	%	%	%
l: Cumulative cost of program operation (add all "h" entries)					

III. UNIT MEASURE OF COST-EFFECTIVENESS, PROGRAM COSTS ONLY (l ÷ j)					

IV. DESCRIPTION OF DONATED SERVICES, MATERIALS, EQUIPMENT:					
m: Equivalent monetary value of donated goods and services					
n: Program and donated costs (h + m)					
o: Cumulative program and donated costs (add all "n" entries)					

V. UNIT MEASURE OF COST-EFFECTIVENESS, INCLUDING PROGRAM AND DONATED COSTS (o ÷ j)					

NOTE: Calculations in rows j, l, and o are made across row entries. All other calculations are made within the column.

INSTRUCTIONS
Table A
Table of Random Numbers

PURPOSE: To make selection of a sample of people on a strictly chance basis.

INSTRUCTIONS:

1. Number the total set of people from whom selection is to be made. For example, if there are 90 people included, number them from 01 through 90; if there are 400 people included, number them from 001 through 400.

2. Determine the number of people to be randomly selected.

3. Select the set of digits to be used for making random selection. If two digits are required (as in the 01 through 90 example), the first two, second two, or third two digits of the four-digit set could be chosen. Selection can be made by blindly pulling one of three slips of paper, each of which identifies a two-digit set.

4. Determine the point at which selection is to start. Select the column and row of digits within the column by the above described "slip of paper" technique.

5. Determine the direction of random number selection by the same "slip of paper" technique. Directions can be "up," "down," "right," or "left."

6. Once the start point and direction of selection have been determined by the above steps, go through the table writing down each "within bounds" number encountered until the desired sample has been achieved.

7. Obey the following rules in making random selections:

   a. Once a number has been selected it cannot be reselected.
   For example, if 30 cases within the 001 through 400 range is determined by steps 1 and 2 above, the number "135" can be selected only once. If "135" appears again in the selection process, it must be replaced by another "within range" (001 through 400) number.

   b. Repeat steps 3 through 6 each time a new random selection is to be made. Otherwise, there will be a non-random selection factor introduced. That is, there will tend to be a similar use of the same portion of the table over and over again.

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TABLE OF RANDOM NUMBERS

ROW NUMBER	COLUMN NUMBER 1	2	3	4	5	6	7	8
1	0544	7692	3808	9193	5054	4670	7839	4274
2	3202	7587	5662	4800	3286	8919	2530	8374
3	2701	2459	1086	0314	0972	2203	3821	9650
4	5998	3427	3134	4503	8721	1670	2272	5196
5	8706	4743	7902	4797	5303	1683	2683	2061
6	2377	4946	5986	7315	0902	2934	0196	7415
7	1670	9433	0027	1317	0633	8605	5873	3784
8	8265	1504	1991	1921	6872	3482	2196	2785
9	3075	1130	6509	2994	8723	4293	9278	7042
10	9554	5886	8642	4238	5935	0364	1414	1205
11	8786	7150	9118	1276	9730	9518	3275	7290
12	4930	7098	3265	2901	8477	1626	3757	5122
13	9183	4553	0627	6545	5315	4053	2079	6772
14	0296	7825	4353	1073	6057	5764	0647	4589
15	5713	0368	2083	0223	8063	5944	6041	5543
16	1547	7654	7231	4664	3507	8102	5238	7030
17	4275	9455	5258	5456	7379	1963	3854	3650
18	1811	3445	2394	2327	3442	2857	3433	2621
19	0762	6629	5198	8147	5676	3882	1400	8668
20	2550	7828	4167	7204	7519	8631	1122	1386
21	8338	1493	6400	6951	2414	4747	4609	5398
22	6883	7991	0767	7979	8244	3642	6996	5424
23	5642	8462	4910	5038	2524	7054	2129	1264
24	0728	0864	3519	0530	2730	0215	6951	5013
25	1377	2639	5778	1059	0693	8405	7101	4118
26	2741	3662	7194	3551	0436	1121	4112	7875
27	8656	3339	4773	0918	6380	8016	5439	8608
28	6071	3417	5841	7418	1493	9407	7171	3688
29	3390	5421	0944	0517	4344	8936	5800	0010
30	9381	2887	9953	3543	7617	7569	2026	4998
31	1480	3615	7786	5753	1872	5213	4112	0723
32	8586	1132	9578	5071	1411	3654	1791	9358
33	4383	5110	3346	5326	3467	5618	3486	0749
34	6806	3239	1766	0697	9861	4433	0712	6868
35	2440	4736	0395	2357	4244	3922	5379	0086
36	5499	6265	7286	6299	2554	7954	6352	9852
37	4353	4207	4259	2731	3461	9173	2911	8659
38	7786	4843	9910	5018	1822	5266	0183	5810
39	5998	3628	0155	5155	8251	7142	1999	6421
40	9574	6288	3686	5522	4851	6586	5311	7441
41	3290	2512	3685	2734	1000	[illegible]78	8541	3518
42	9541	7602	3385	6509	8773	4516	0439	2022
43	2142	3391	7066	6923	9194	6875	1219	7626
44	0828	3772	9778	8310	8374	5550	1440	9878
45	1216	7825	1346	0862	9538	1181	5918	3347
46	2082	1686	7914	2390	3014	0735	4248	3083
47	3644	0727	1850	7678	9417	6120	5790	8280
48	9230	8575	0564	1871	5451	0567	4740	1686
49	8117	4673	5795	8812	3419	9910	9504	0248
50	8183	9124	6775	5442	2444	4370	1605	1015

Random number values presented in these tables were generated by Synectics Corporation through use of a computer program developed by T. Vind, Honeywell Incorporated, Aerospace Division, St. Petersburg, Florida. The copyrighted program generates 8,192 Gaussian and uniform random numbers between 0 and 32,768 before recycling.

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Table A (Continued)

ROW NUMBER	COLUMN NUMBER 9	10	11	12	13	14	15	16
51	0511	9064	4507	0170	8976	2600	2954	1405
52	2052	0666	8042	8990	1353	4916	5208	5942
53	3985	0829	6480	2122	2873	3237	4834	1897
54	2292	7888	4690	5672	9164	6975	6984	6218
55	9960	2657	5038	8879	7742	6592	5482	1601
56	4804	7820	7214	6901	0709	4596	0078	9769
57	8832	3921	3954	0798	3070	7714	6365	0617
58	2728	5478	2937	3062	3274	5273	5918	6270
59	2011	9480	2720	6555	5816	8096	3370	9045
60	1959	0192	1354	5597	1491	3330	4874	8244
61	2653	8620	8662	2062	0967	5064	9642	5640
62	1176	6621	5238	7623	2374	2263	5627	1367
63	9424	1774	6275	5988	3126	6112	3851	9103
64	6279	2053	2911	5068	3226	8119	4072	4960
65	8225	0300	5883	8681	9608	3565	1906	0973
66	0409	8918	5146	6582	8863	6946	6111	6746
67	2199	7013	0981	1610	7444	2640	6926	1630
68	4990	9004	1438	8084	6215	9516	0431	2590
69	9993	1343	4339	0672	3820	8939	0367	2510
70	3195	4741	4833	2711	2642	8322	0160	5670
71	7555	7823	1283	8997	3469	6680	5351	0779
72	3651	3344	7380	1896	0503	3967	1209	2338
73	0758	1566	4584	2473	3405	0187	0574	2145
74	9528	9417	9127	6001	1511	8668	2232	8001
75	8275	1804	8013	2570	8630	6232	9150	2948
76	6713	2675	1292	6489	8271	9473	1916	1333
77	0470	1025	0064	2410	3833	1309	9759	7945
78	3874	7720	3199	6479	7870	5430	0612	9349
79	1587	8858	3339	7904	0799	4019	5539	6624
80	6933	9495	3897	1861	4966	5310	7011	1481
81	1958	9891	4333	4945	1933	0581	5151	4696
82	1788	4876	3879	1339	9019	0161	7014	8756
83	0251	1383	4816	9434	2276	0318	7272	8411
84	4323	3405	2194	0795	5014	7478	9288	2351
85	9634	7993	3837	0066	0904	5003	2282	2483
86	0474	5485	9614	3366	0057	2308	6961	4593
87	1517	6952	5166	2711	2960	5130	1617	6683
88	6114	2604	9185	0504	6488	7700	5953	7806
89	9057	5375	4853	0547	5347	7022	8398	8059
90	9945	7321	4679	2263	6012	9425	7703	5761
91	8144	7921	0667	2202	5280	5453	1314	5833
92	7843	9094	3868	0998	9088	7254	2560	0407
93	4687	1993	0381	6389	5162	6192	3480	0068
94	2962	0382	8799	8932	7030	7234	9220	5496
95	7355	2105	8042	3433	4508	3288	3591	2222
96	3972	2973	5244	5045	5042	3862	3573	5512
97	2066	5518	4144	4814	8121	5235	7553	8220
98	6770	6997	9250	2470	5438	2460	1520	1891
99	1938	9489	9290	3641	3044	0358	1244	3365
100	4279	1842	5313	9870	0049	5801	1751	7789

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ROW NUMBER	17	18	19	20	21	22	23	24
101	4629	7770	3422	0391	5696	3205	1106	4434
102	1510	4317	9850	7709	0119	8185	7736	9822
103	3967	8011	2928	0035	9901	6917	9694	3801
104	9910	1052	4887	4346	1662	0452	1284	8617
105	7633	2674	9285	6279	1852	5890	4416	3942
106	6856	4643	5895	4586	8883	6100	7957	6723
107	5983	8592	7818	9484	3680	3448	1163	1833
108	6550	0277	7646	4328	8843	6623	6425	4142
109	0460	0623	5021	1116	4916	5086	3082	0698
110	9361	2386	5910	2242	6401	1346	5356	0772
111	6976	8254	3219	4303	2703	1130	8849	4736
112	3975	0628	9458	1470	3415	0764	5111	4314
113	1427	4043	9907	4947	9616	0072	4356	4325
114	6274	7419	3617	0690	7544	4647	7147	9592
115	6946	7351	4133	1718	2698	8685	5502	7087
116	4955	2233	7602	5793	3076	1321	7352	1782
117	4975	2935	9667	7749	1323	4016	0976	2923
118	0359	7414	2017	2691	2241	4279	8876	3160
119	5883	5684	0558	1711	0335	9114	3902	1810
120	6710	5092	1078	7284	9927	0847	7608	6274
121	1119	2699	5578	2287	2238	6749	0196	6270
122	1600	7226	5110	5479	5764	3242	4995	6222
123	3807	3296	8496	9839	8845	9693	8511	6180
124	9250	9076	4607	3175	4239	9790	1410	5460
125	2621	0034	9085	3032	2589	3994	4767	9087
126	0025	9700	9895	9043	0440	7260	8295	4010
127	0700	7845	1669	7799	2727	7146	4864	5122
128	2583	6514	3468	8997	3670	3702	6003	1894
129	9488	8214	3019	2761	4347	9474	1931	6653
130	6071	1892	7374	6168	8643	1609	5993	6691
131	9348	3901	3630	1101	9881	1749	7428	6118
132	9464	2978	2383	9228	0390	5306	1528	3927
133	8947	1965	3550	1470	3114	3742	4469	7242
134	5599	9074	3545	1302	5899	1289	3621	7498
135	4192	9493	0827	9775	2206	3226	1728	5830
136	7127	2867	9630	3847	4400	4604	0319	1046
137	0998	8788	0232	1918	8988	5246	2350	0554
138	2741	3645	7409	2756	6481	1023	5650	7719
139	8017	1864	8536	1031	7875	4576	2232	4549
140	8345	3911	3207	8408	3500	1594	0028	8957
141	8391	1082	4787	8571	6298	3262	2831	7038
142	7064	3206	8242	2239	8216	6089	4857	6807
143	0818	3472	2757	7668	8916	2077	4496	1040
144	7576	6208	3839	7368	0089	5278	3280	3801
145	1166	6320	8216	6971	2915	9790	5903	6596
146	8556	0230	0492	2483	3605	7209	1226	2710
147	2593	6715	1490	9649	3028	7174	5727	8193
148	0356	9831	1526	3496	3868	7654	4569	0621
149	6522	7158	6795	1580	6541	3554	4338	5363
150	4436	4570	7711	6294	7820	7660	1991	2266

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INSTRUCTIONS

Table B

Significance Levels of Chi Square Values for Different Degrees of Freedom

PURPOSE: To determine whether the results of a Chi Square analysis (using Worksheet No. 2, 3, 3a, or Worksheet No. 4) demonstrate a statistically significant difference either between groups or between subsequent measures for the groups.

INSTRUCTIONS:

1. Determine the number of degrees of freedom which apply to the data distribution. For individual data categories, the degrees of freedom are pre-entered on the worksheets. (Line "z" of Worksheet No. 2; line "E" of Worksheet No. 3.) For combined data categories, the number of degrees of freedom is calculated by the instruction provided on the worksheet. (Line "C" of Worksheet No. 2; line "H" of Worksheet No. 3.)

2. Enter the table at the row indicating the appropriate number of degrees of freedom.

3. Keeping in mind the Chi Square value which is being examined, proceed from left to right across the table until the largest value that is smaller than, **but not greater than**, the Chi Square is found. For example, with 1 degree of freedom and a Chi Square of 6.25, the relevant value is 3.84146; with 9 degrees of freedom and a Chi Square of 17.24, the relevant value is 16.9190.

4. Determine the Probability (P) level at the top of the column in which the relevant value is found. In both of the above examples, this value is "P = 0.05," indicating that this difference would be found by chance alone once in 20 times, or 5 in 100 times. This is the first level at which a difference, represented by the Chi Square value, can be said to be significant.

5. Enter the level of Probability on the Worksheet. (Line "B" or "E" on Worksheet No. 2; line "G" or "J" on Worksheet No. 3.) Make these entries using the following symbols about the Probability level:

   the > symbol means "greater than'
   the < symbol means "less than"

   The Probability levels for the two examples above would be written as "P< 0.05," indicating a significant result.

6. If the obtained Chi Square value is smaller than the first column entry at the appropriate degrees of freedom, the Probability level is written as: "P> 0.10," indicating a non-significant result.

7. If the obtained Chi Square value is larger than the last column entry at the appropriate degrees of freedom, the Probability level is written as: "P< 0.001," indicating a very significant result.

8. If the obtained Chi Square is equal to a column entry, the "=" sign may be used to indicate the Probability level. For example, with 1 degree of freedom and a Chi Square of 6.64, the Probability level would be written as: "P = 0.01."

Table B

SIGNIFICANCE LEVELS OF CHI SQUARE VALUES FOR DIFFERENT DEGREES OF FREEDOM

DEGREES OF FREEDOM	PROBABILITY (P)			
	P = 0.1 (1 IN 10)	P = 0.05 (1 IN 20)	P = 0.01 (1 IN 100)	P = 0.001 (1 IN 1,000)
1	2.70554	3.84146	6.63490	10.828
2	4.60517	5.99147	9.21034	13.816
3	6.25139	7.81473	11.3449	16.266
4	7.77944	9.48773	13.2767	18.467
5	9.23635	11.0705	15.0863	20.515
6	10.6446	12.5916	16.8119	22.458
7	12.0170	14.0671	18.4753	24.322
8	13.3616	15.5073	20.0902	26.125
9	14.6837	16.9190	21.6660	27.877
10	15.9871	18.3070	23.2093	29.588
11	17.2750	19.6751	24.7250	31.264
12	18.5494	21.0261	26.2170	32.909
13	19.8119	22.3621	27.6883	34.528
14	21.0642	23.6848	29.1413	36.123
15	22.3072	24.9958	30.5779	37.697
16	23.5418	26.2962	31.9999	39.252
17	24.7690	27.5871	33.4087	40.790
18	25.9894	28.8693	34.8053	42.312
19	27.2036	30.1435	36.1908	43.820
20	28.4120	31.4104	37.5662	45.315
21	29.6151	32.6705	38.9321	46.797
22	30.8133	33.9244	40.2894	48.268
23	32.0069	35.1725	41.6384	49.728
24	33.1963	36.4151	42.9798	51.179
25	34.3816	37.6525	44.3141	52.620
26	35.5631	38.8852	45.6417	54.052
27	36.7412	40.1133	46.9630	55.476
28	37.9159	41.3372	48.2782	56.892
29	39.0875	42.5569	49.5879	58.302
30	40.2560	43.7729	50.8922	59.703
40	51.8050	55.7585	63.6907	73.402
50	63.1671	67.5048	76.1539	86.661

Chi Square values are entered in the body of the table.

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