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PROJECT ON ANALYSIS OF COMMUNITY
LEVEL NUTRITION PROGRAMS

# Volume VII:
# The Rapid Information Feedback System: A Mechanism for Promoting Community Learning

Roy L. Miller, Ph.D.
William D. Drake, Ph.D.

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U.S. Agency for International Development
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This volume is one of a series of eight produced by the Project on Analysis of Community-Level Nutrition Programs. The four year research project utilized an interdisciplinary team from many parts of the world.

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# CHAPTER I
# THE RIFS CONCEPT

One of the most challenging problems confronting management is the establishment of procedures to bring data to bear on timely decisions concerning policy and practice. This is true for governments, for big business, and, in fact, in almost all facets of modern life. Throughout three and one-half years of a project to analyze community-level nutrition programs, a research team from Community Systems Foundation developed a concept for utilizing data in managing and evaluating nutrition interventions--a concept based on Rapid Information Feedback Systems, or RIFS. Although a technical capability for processing nutrition data is very much a part of RIFS, it is a broader concept, inextricably interwoven with a philosophy of intervention and a style of data analysis. This document explains the relationship between that concept and the technical aspects of data handling.

The RIFS notion emerged in response to an immediate and troublesome discovery at the outset of the project to analyze community-level nutrition programs. Except for a very few highly expensive research projects, there were no community-level programs gathering and using data according to the minimal standards required to enable an effective analysis. Yet, there were community-level programs engaged in data collection. The roots for the RIFS concept extend to the circumstances leading to this disturbing discovery.

By and large, the types of individuals engaging in community-level nutrition programs are three--medical people (doctors, nurses), public health people, and people with a religious or moral commitment to improve the social welfare of the poor (church people, social workers, and Peace Corps graduates). With the possible exception of a few public health professionals, this set of individuals is unfamiliar with data handling and

analysis and, for the most part, untrained in the "systems analysis" of complex problems. Furthermore, each type of individual enters into an intervention with a "solution" in hand, one usually reflecting prior training and/or current folklore.

Rarely, then, are the data collected for management. The data are gathered to help diagnose individuals (particularly in medically oriented programs), to lend legitimacy to a particular project, or, most often, to meet the requirements of funding agents for retrospective evaluation of their investments. In none of these cases is the emphasis on ongoing review of the totality of the data for improving program effectiveness.

Surprisingly, however, as this research team reviewed the elements leading to success in community-level interventions, such periodic review was identified as a crucial component for any nutrition intervention. Recognizing that the political, social, economic, and physical environments of any intervention are in a constant state of flux, as are the resources (human and monetary) available to any given intervention, this research team came to advocate a management philosophy embracing the utilization of data to guide the revision of program activities.

Furthermore, the research team recognized the limitations of numerical data analysis alone in generating the type of information from which one can guide a nutrition program. The subjective knowledge of program activities and environmental conditions is an equally important component of data analysis--a component to be explicitly incorporated in any evaluation effort.

The combined need for numeric and subjective data to guide program decision-making is best met by a Rapid Information Feedback System. Such a system utilizes data collected periodically (or even continuously) over time to learn about the internal dynamics of a program. The data are reviewed by management to identify weaknesses in program design and/or areas which must be considered in future work. This system must include several components: an error-detection phase to guarantee the integrity of numeric data; a data-manipulation process to facilitate analysis: an accepted and understood analytic procedure; and the

involvement of the field people and management in the review of analytic results.

The balance of this document explains the technical capabilities and philosophic outlook needed to make such a system viable. We will discuss each component of the system in a chapter of its own—covering the origins of the need for the component, the technical solutions for creating it, and normative propositions for future RIFS systems.

# CHAPTER II
# ERROR DETECTION

This chapter is best introduced with a humorous but true story. The PRIMOPS data set used in the project to analyze nutrition programs was collected in the La Union barrio of Cali, Colombia, by promotoras who periodically visited the homes of participating families. During each visit, several "forms" were filled out. Copies of the data were made and sent to a keypunch operator for "data entry." The computer cards were stored in boxes in an office of the Universidad del Valle in Cali. The first attempt to read the cards came after one and one-half rounds of data had been keypunched. (The promotoras were already in their fourth round of home visits.)

Because of the large number of participants in the PRIMOPS program, some 36,000 cards were needed to capture the round and one-half in machine-readable form. While passing the cards through the card reader to create a magnetic tape with all the data, it was discovered that bugs had eaten round, machine-readable holes in several hundred cards.

The bugs were apparently smart or lazy. The round holes appeared in precisely the proper position on the card to be read by the card reader. (Apparently the bugs had the habit of entering a stack of cards through an existing hole made by a keypunch and eating through all subsequent cards without that hole.) In combination with the correctly punched square holes already on the cards, the new readable hole created an illegal input code and, therefore, the bug-eaten cards were rejected by the card reader. It is not known--and never will be--how many of the new readable holes created legal combinations that were not so conveniently rejected.

The point of this story, of course, is that the mere act of recording data does not guarantee that it is correct. The bug anecdote is an extreme example of how errors "creep" into data. In reviewing eight data

sets, we have encountered coding errors, mistakes in transferring data from source documents to coding forms, keypunch errors, key verification errors, and, finally, we have made errors ourselves in manipulating the data within the computer during analysis. On top of all this, errors are made by program participants in responding to questions or by field staff in recording the responses--sometimes deliberately. (Deliberate misrepresentation of age in programs with an age prerequisite for participation is common.)

One reason to institute RIFS in interventions is the reduction of data processing errors in the data. To understand how RIFS reduces errors, we must first describe the error-detection process in the absence of RIFS.

Let us consider a typical nutrition data set as received for analysis in the project to analyze community-level nutrition programs. Even though this example is hypothetical, it is illustrative of most of the data reviewed throughout the project. The data set contains longitudinal anthropometric data on children where each observation was recorded independent from the others. This means that the January 1977 observation and the June 1977 observation were recorded and keypunched separately—that is, at two distinct points in time. The linkage between the two might be the child's name or, more frequently, an identification number. (The only exception to this independence of observations, in our experience, was a retrospective recording of weights recorded on a growth chart during a single cross-sectional survey.)

Generally in such a data set there are a fair number of erroneous codes. For example, a given observation might include the sex of a child coded "1" for male, "2" for female. An entry of "3" is erroneous. For convenience, we call this a "range" violation; that is, it is a code that is out of the prescribed range for a given variable.

Similarly, one typically encounters a fair number of erroneous combinations of codes—for example, a three-month-old child who weighs 14 kilograms (30 pounds). Fourteen kilograms is within the range of weights encountered in the data set, as is three months within the age range. Taken together, you have one large baby. For convenience, we call these

errors "relation" violations; that is, combinations of codes whose relationship is invalid.

The third and most troublesome error occurs when each of two observations on a single child is correct (no range or relational errors) but, taken together, the two are inconsistent. For example, a child may go from male to female or "grow" inches shorter. For convenience, we call these errors "consistency" violations—that is, multiple observations which lack consistency. The detection of these errors in a data set is a sequential process; however, it is a sequence which on occasion must be repeated.

One must first locate and correct range errors. Because many range errors also result in relational violations, these must be eliminated before searching for unmatched combinations. (A "90" kilogram preschooler will generate a relational violation no matter what the child's age.) Similarly, range and relational errors in a single observation might cause inconsistency errors between observations. (An observation with a weight-for-height relational error due to an error in the height variable might also be inconsistent with other height observations on that child.)

Given a batch of raw (unedited) data and a computer, there are many ways to find and eliminate all of these errors. We chose to design and write distinct FORTRAN programs to find errors. These were corrected manually according to the best judgment of the analyst. In general, we searched for range violations and relational violations in a single pass through the data, and then, made a second pass to check for consistency between observations. Other ways to locate errors include using the error checking facilities of existing statistical programs or other "canned" packages available on many computers.

Because of the distance (both time and location) between the projects and our computer, we were sorely limited in our ability to correct errors. They could often be eliminated by setting mistaken codes to a value reserved for "missing" data. But only in rare cases could new values be substituted for the wrong ones. Access to source documents and/or the subjects themselves is required for such correction.

Application of the RIFS concept reduces the distance (at least in time if not location) between the field and the analysis site. The review of an interim analysis of the data by field people accomplishes two objectives with respect to error correction: (1) obvious errors might be recognized by the staff who have both the knowledge of and access to program participants to enable corrections; and (2) the origins of consistently made errors might be identified early enough to enable changes in procedures to eliminate the sources of those errors.

The technical solutions to error detection are many and must be selected in accordance with the constraints operating in any given context. The technology of data processing has seen incredible advances in the more developed world in the past few years. The question remains just how much of that technology can and should be brought to the lesser developed nations of the third world

Ideally, range and relational errors could be identified and corrected at the moment of observation. That is, the most advanced solution to error detection is the use of intelligent data entry terminals for recording data on-site—terminals programmed to reject observations which violate range or relational checks. Such an approach is feasible in a data collection procedure where subjects (program participants) come to a central site periodically for observation—if the site has electricity, a terminal, and trained operators. (If the data set is small and/or the terminals are linked to some larger computer, it may be possible to perform consistency checks between observations on-site as well.)

This ideal is not likely to be attained in many Third World settings. Typically, observations will be recorded using pencil and paper which must be transported to a central computer (perhaps in the United States) for data entry and checking. The key to the RIFS concept in this more common case is the rapid processing of the data once it reaches the central computer. Errors should be found quickly and reported back to the field. Even if no immediate analysis is planned, the error checking should be completed. the data should not be "stacked-up," waiting for the moment of analysis.

In summary, data that are not utilized for program management are too often left uncleaned until the "external analyst or evaluator" works with them. The delay makes it difficult for error cleaning; at best, errors can be eliminated. Furthermore, no feedback is provided to the field people collecting the data concerning their accuracy—the mistakes continue to be made over and over again. The concept of a RIFS embraces the rapid processing of data to maximize the opportunity for correcting errors while minimizing problems due to continuing use of a poor field protocol.

## CHAPTER III
## THE DATA BASE MANAGEMENT SYSTEM

The cleaning of raw data is only the first step toward construction of a useful and viable data set. The raw data must be organized in some logical framework and stored in a computer or its peripheral data storage devices. This problem of organizing and storing data in a way to maximize its accessibility is most critical in an ongoing, longitudinal intervention where the data will be used repeatedly, as the data set grows. The method selected for placing the data into a computer can limit the subsequent uses of that data by placing needless restrictions on its retrieval.

Such limitations can be overcome by retaining the services of a skilled programmer to write a "custom-made" computer code to reorganize the data and/or perform the complicated computations necessary to develop needed derived variables from the raw data. As we shall see, alternatives to such reprogramming exist. Before addressing those alternatives, let us dramatize the problem with a realistic illustration of a dynamic data set.

Consider an **ongoing** intervention providing services to a village of about 500 families (with approximately 1,000 preschool children). Assume that the services include the operation of a health post to handle medical consultations, an education program consisting of voluntary monthly classes for mothers, and an outreach program with locally trained women visiting each home every two months to weigh preschool children, provide minimal health care, and reinforce the lessons of the education program.

Data are collected from every mother upon entry to the program. This "registration" data would include such items as number of children, their ages, sex and birth order, the family structure (husband alive and at home, families per household, etc.), and other data that would remain "fixed" throughout the program. Imagine that once a year, the trained village

workers administer a short survey questionnaire to help monitor the socioeconomic status of all participants. Let us also suppose that the weights of all preschool children and disease history between visits are recorded for each home visit. Note that this information is specific to each child, while the registration and survey data pertain to families. Finally, imagine that every service contact between family and intervention is recorded by taking attendance at classes and by recording actions taken during visits to the health posts.

The problem is one of organizing these different types of data for their potential different uses. (The problem becomes considerably more complex if the intervention covers multiple villages with different service components, or tries to gather additional data such as consumption data.) Assuming the equivalent of three computer cards per registration and two cards per survey (one per child observation and one per service contact) we will have over 20,000 cards for this small village in three years.

Each use of the data might require its own organizational structure. For example, suppose the data are to be used to identify children who are most at risk at a single point in time. The data would have to be arranged child by child but with various family characteristics appended to each child record. Perhaps only one or two of the historical observations on weight would be needed to define current "at riskness."

As a second example, suppose the data are to be used for resource planning by analyzing the relative contribution of various program components to the progress of children in improving their nutritional status. The data would again be arranged child by child but with summaries of the mother's intensity of participation appended to each record as well as a summary of the child's participation. Perhaps only two observations on weight would be needed for each child, say one year apart. Finally, the data could be used to generate partial answers to research questions such as the quantification of the relationship between changes in the socioeconomic status of a family and the overall nutritional status of its children. Here the data would be arrayed family by family, but with summaries of the changes in nutritional status for all children in the

family.

The potential uses for the data are far more varied than those described above, as is the implied restructuring of the data for each use. Furthermore, if the RIFS concept is applied, the need to accomplish such restructuring promptly will be accentuated as intermediate reviews of the data suggest additional avenues of inquiry. (Note that the converse is also true—the ability to restructure data promptly will facilitate more detailed and better conceived reviews of the data and enhance the ability to carry out the RIFS concept.)

We already acknowledged that a skilled programmer can restructure the data by writing an original code to perform each task. This can be slow and will, no doubt, be expensive. As computer technology has improved, so has the art of writing generalized programs to perform often-repeated operations. First, there appeared an array of "statistical packages" capable of performing statistical analysis on data passed to the package according to some predefined format. More recently, data base management systems (DBMS) have arisen to facilitate the restructuring of data by combining subsets of the data in diverse ways. In our own work, we used both—a data base management system with a built-in, direct linkage to a statistical package. The DBMS was used to organize the data into the nice rectangular subsets needed by the statistical package. Packages exist now with the capabilities of both a data base management system and a statistical package. Our own choice of two separate and distinct but linked systems was governed by convenience and the relative simplicity of operation of each of the two systems selected.

The DBMS, called MICRO, is a relational data base designed to utilize Boolean algebraic expressions to manipulate small "data-sets."

> The MICRO Information Management System is a collection of computer programs which permits non-programmers to define, enter, interrogate, manipulate, and update user-defined collections of data in a relatively unstructured and unconstrained environment. (Kahn, 1977; 13)

The commands in MICRO parallel English as much as possible; therefore,

the syntax is easy to learn and easy to use. Furthermore, MICRO has a fine self-documentation system and a flexible output facility for certain types of report generation.

The statistical package, MIDAS, is a very efficient, interactive program that facilitates the rapid response to some very complex questions that can be asked of a data set. The syntax of the MIDAS commands is more specialized than that of MICRO but, once learned, is fairly easy to apply.

Although this particular combination of generalized programs—MICRO and MIDAS—is available on relatively few computers, it serves as a good illustration of the ideal way to process data. At this point, it would be most convenient to offer a demonstration of the two systems at work; however, it is impossible in a written document to demonstrate how easy it is to respond to a spontaneous question for a real data set. We are left considering our hypothetical longitudinal data set with its four types of data, where each type is stored at a different level of aggregation.

Such a data set would be stored in MICRO, using at least five distinct types of "MICRO data set." (In MICRO, a "data set" is the term applied to some collection of data and its associated dictionary which defines the variables in that collection. Such a "data set" has many records or lines where each line contains all the variables in the dictionary in the order given by that dictionary. Usually, each line corresponds to a single observational unit—for example, a child or family. The "data set" then holds parallel observations for all the children or families.) One data set, say REGIST, might hold the registration data. Another, say SURVEY, might hold the survey. Still another, say OBSERV, might contain the child observations. Finally, data sets named ATTEND and MEAL.POST might contain the attendance records and health post activity records. The "key" to reassembling the data sets for analysis would be some identification number. (For example, each family might have a number shared by all its members, while each member is assigned a unique number within the family, or even the individual name.) (MICRO can work with names; however, misspellings could cause problems.)

Consider the problem of identifying children at risk. Suppose we have

just entered the anthropometric measurements made in December and define risk in a child as weight loss between October and December. Suppose also that the family income was less than $300/mo. during the last survey. We then:

FIND IN OBSERV WHERE MONTH-OBSERV IS DECEMBER

to pull out December's observations. Note, MONTH-OBSERV is our name for month of observation. We

NAME RESULT DEC.OBS.

(In MICRO, each operation produces a temporary new "MICRO data-set" named RESULT. To preserve this RESULT set, it must be renamed.) Then, to get October's observations we

FIND IN OBSERV WHERE MONTH-OBSERV IS OCTOBER

and name this new set with

NAME RESULT OCT.OBS.

For the example, suppose 800 children were weighed in December and 750 in October. Of these, only 600 were weighed in both months. According to our definition of "risk," only those children weighed in both months can be classified as being at risk. To create a data set with just those children weighed in both months, we use a MICRO command to join the data sets while restricting the entries to those children weighed in both months. Remember, there are 800 records in DEC.OBS. and 750 in OCT.OBS. We then

RESTRICTANDJOIN DEC.OBS BY FID AND CID WITH
OCT.OBS BY FID AND CID

Assuming each child is identified uniquely by his family identification number, FID, and child number within the family CID, this command produces the data set with the 600 records corresponding to children weighed twice. Had we used the similar command, JOIN, in place of RESTRICTANDJOIN, we would have produced a data set with 950 records. Each child weighed in either month would be included with the weight for the missing month set automatically to a value preset during the original data set creation.

We could then compute the weight difference for the 600 children using MICRO.

COMPUTE IN RESULT SO THAT WEIGHT-DIFF =
WEIGHT-DEC-WEIGHT-OCT

We are naming the new variable WEIGHT-DIFF and are assuming that the weight variables in the December and October data sets had already been renamed WEIGHT-DEC and WEIGHT-OCT. (Each rename is one command; for example, NAME IN DEC.OBS WEIGHT TO WEIGHT-DEC.) To get the family income in the data set we again use the RESTRICTANDJOIN.

RESTRICTANDJOIN RESULT BY FID WITH SURVEY BY FID

Again, we have produced a new RESULT set with 600 records, only this time all the variables for the family in the SURVEY data set are appended to the end. If we have two children in the same family, each has the **same** collection of variables appended to his/her record. Thus, even though the 600 children may come from only 250 families, each child record has the correct family income added to it. If we let FAM-INC be the name of the family income variable, we can then find the children who are at risk with one more command.

FIND IN RESULT WHERE WEIGHT-DIFF IS LESS THAN Ø
AND FAM-INC IS LESS THAN 300

This command extracts the cases meeting the conditions specified from the larger data set. Suppose 50 children met those conditions. We could then use MICRO to print a list of those children. This list could even be done by name if the REGIST file pairs names and identification numbers. We would only have to RESTRICTANDJOIN the data set containing only those children who are at-risk with the REGIST file.

The amazing feature of the DBMS approach is that the list of at-risk children could be generated from the data sets in a matter of seconds—far less time than it takes to read about how such a list could be generated. Thus, if we chose to change our definition to include such a variable as "bouts of diarrhea," we could generate the new list **in a matter of seconds.**

The other problems requiring data reorganization described earlier might need statistical analysis. The feature of the DMBS which facilitates such analysis is its ability to take linked data sets with different numbers of records and at different levels of a hierarchy (household-family-individual) and create rectangular data sets suitable to statistical analysis. Each RESULT set in our analysis was such a rectangular data set, even though they were made up from data sets which were not stored originally at the same level of the hierarchy.

General familiarity with statistical computer programs is sufficiently greater than with DBMS; therefore, we will not belabor this point with an extended example of such a system. It is more important to address the availability of DBMS and the problem of "doing" without one.

Data base management systems are becoming available on smaller and smaller computers. Still, it is difficult to imagine a small organization supporting such a computer in running an intervention in just a few remote villages in a developing country. However, it is certainly within the scope of imagination to envision a central facility supporting a DBMS run by a country government or by the home base of a large private voluntary organization. Such a central facility could provide similar services to a variety of interventions simultaneously, bringing DBMS capability within reach of small users while creating a central repository for locally generated data. Finally, individual interventions could contract with private "consulting" companies--even back in the United States--to process their data. This creates something of a problem with regard to responsiveness but brings the latest in technology to fairly remote areas.

In the absence of such capability, we recommend that simpler, less ambitious data collection schemes be employed. Processing of the data could be manual and still produce useful results. Much can be learned by weighing children, determining nutritional status graphically, and observing changes in the status of individuals or groups. Field people with intimate knowledge of a program can, quite often, interpret such observed changes better than a more complex statistical analysis relating nutritional status to other variables.

The context of an intervention will, of course, determine the appropriate level of technical sophistication for that intervention. Complex data-gathering schemes, however, should not be undertaken unless the data-handling capability is available to facilitate data manipulation and analysis.

# CHAPTER IV
# ANALYSIS

A clean data base stored in a data base management system offering flexibility and ease in data manipulation with a straightforward linkage to a statistical analysis package is the basic tool of a Rapid Information Feedback System. Like all tools, it is useful only when appropriately applied to the task for which it was designed.

The Rapid Information Feedback System concept calls for an iterative, interactive analytic process characterized by the critical review of statistical "proofs" by the people with intimate knowledge of the program dynamics. The process begins with the application of simple (not simplistic) analytic methodologies. More complicated techniques are applied after the analyst and the program staff have exhausted the simpler approach.

This philosophy of analysis is best understood when contrasted to the opposing view, in which one establishes an experimental design that controls for confounding factors and accepts the results of statistical analysis as truth. The contrast is not altogether unlike the contrast between Bayesian and classical statistics. Classical statisticians conceptualize experiments assuming little knowledge of the phenomenon under study, while Bayesians utilize the prior knowledge of the analyst in designing their approach.

Like the Bayesian-Classical distinction, the RIFS-Experimental design contrast is one of degree and emphasis. A strong advocacy statement for good experimental design is made by Habicht and Butz. They identify three strategies to control for confounding factors (alternative explanations of observed outcomes): controlled experimental design, use of complementary indicators, and statistical analysis. Habicht and Butz advocate that use of all three strategies, but they place clear priority on

the first.

> Good experimental design is the single most important factor necessary for successful evaluation (Habicht and Butz, 1979; 151)

After discussing the three strategies in the order presented above, they go on to state:

> They have been presented in their order of importance. There can be no possible useful conclusion without adequate experimental design. Interpretation of positive effects in an outcome indicator must be reinforced by analysis of other indicators for congruity to be persuasive. Analysis of possible confounding factors reinforces the assertion that a change in an indicator of nutritional status was, indeed, due to the intervention and not to some confounding factors. (Habicht and Butz, 1979; 154)

The RIFS concept reverses the priorities. Controlled experimental design in the realm of social intervention is virtually impossible to carry out. The reasons for this are many.

1. Even the best "matching" procedures for pairing villages or groups of participants within villages cannot overcome the simple fact that villages or groups of individuals are generally different.

2. Whatever differences between villages exist at the outset of a social intervention, the changing environment throughout the experiment (social interventions usually span years) will almost guarantee that the villages are different by the end of the intervention.

3. If paired villages are physically close, there are often spillover effects from treatment village to control. If they are physically apart, the divergence of setting is accentuated.

4. Ethical and moral considerations make it difficult to withhold services from control groups.

In acknowledging that controls are likely to break down, RIFS advocates shift their priorities to those techniques that are most likely to identify the causes for break down as they occur in hopes of setting up procedures to monitor those causes to facilitate the statistical analysis needed to account for them. As noted, this is achieved by reviewing intermediate

analyses with program staff periodically throughout the life of an intervention.

This does not mean that RIFS advocates ignore experimental design. When conditions are such that an experiment can be set up to try to sort out program impact from other changes, it is better to do so. However, this is not a necessary action for sorting out program impact--nor is it sufficient. One must review the complex circumstances and events of an intervention as it unfolds to derive competing explanations for observed outcomes and to understand why the experimental design is weak. Only then can analysis lead to learning.

To help understand the implications of the two different approaches to analysis, it is instructive to review two of the interventions considered in the project to analyze community-level nutrition programs. The first, the Thailand rice fortification program, was constructed around a carefully conceived and well-executed experimental design. At the conclusion of the intervention, it was discovered that the control populations improved as much with respect to height and weight as the populations receiving the various fortifications. The conclusion was that fortification had no substantial effect on nutritional status but that the Thai children experienced a secular change during the study. After describing this result, the researchers write:

> These data point up the need to have adequate controls in a study such as this.
>
> It is impossible to determine the causes of the secular changes observed. (Gershoff et al., 1977; 1188)

The second, the KOTTAR interventions, was more service-oriented. Anthropometric data were gathered and recorded as part of the intervention for diagnostic purposes and to help awaken the consciousness of participating mothers to nutritional issues. The analysis indicated that the population had improved over the course of the intervention. There were not controls, but a RIFS-type exploration of conditions revealed that rice prices were dropping during the program period as the region

recovered from a famine. The conclusion, therefore, was that there was a change in the weights of participating children (height measures were not taken) due to the famine recovery, the program, or both.

This RIFS-type exploration came retrospectively—after all of the data were collected. Therefore, it was impossible to return to the region to gather more data to help separate program impact from rice price impact. In the true RIFS, such action would have been taken.

The conclusions of both studies are remarkably similar. However, the RIFS analysis was geared more at explaining observed phenomena in the total context of environmental change in the region. Therefore, some inroads were made in explaining the observed changes in the data. Our strong conviction is that a similar RIFS-type analysis while the program was in progress might have helped explain more about the secular change in Thailand. Of course, the maximum benefit of RIFS in either circumstance would have been enhanced if the analyses had been viewed as interim analyses—guides to the next steps and not, merely, end products.

A logical question then is how does one go about setting up a RIFS analysis. The first step in defining a RIFS system is the identification of the indicators needed to measure progress. At first, this sounds like a simple and straightforward task. In practice, it is not. To measure progress, one must have a clearly articulated goal and a scheme for moving from the existing state to the state defined by that goal.

In the nutrition intervention, the most common goal is the "improvement of the nutritional status of the community." Defining precise measures of such a goal and establishing a yardstick with which to gauge progress towards it are the problems. One can look at "average" nutritional status or one can monitor only the worst off. One can concentrate first on the elimination of acute malnutrition as determined by a deficiency in weight-for-height in preschool children. Or, one can concentrate on the recovery from chronic malnutrition as determined by a deficiency in height-for-age in preschool children. Similarly, one might stress the reduction of anemia as measured by hematocrit count in the blood or the prevention of diarrhea as measured by either the frequency of

occurrence of the disease or the severity of each bout. The choices are many[ To be useful, the RIFS must monitor indicators which accurately reflect the operational goals of the intervention.

The second step in the RIFS is the design of the appropriate analytic device for measuring change in the key indicators. With many indicators, it is not sufficient to monitor absolute change independent of all other factors. For example, suppose a key indicator is the "percent of weight-for-age standard." (This is the most common measure utilized in nutrition programs and is computed by taking the ratio of the observed weight for a child to some standard weight for all children of the same age as the subject.) In Volume I of this report, we offer empirical evidence of the dependency of this measure on age. Because the age distribution of most populations participating in interventions changes, it is necessary to view changes in the "percent of standard" indicator by age group. Again in Volume I, we suggest the use of the characteristic curve (plot of "percent of standard" against age) to account for this dependency.

In general, the RIFS analysis includes an analysis of the behavior of the selected indicators in situations similar to that of the target intervention. This facilitates proper presentation of changes in the key indicators minimizing the opportunity for gross misinterpretation of those changes.

The third step in the analysis is a preliminary investigation of alternative explanations of observed changes in the indicators (alternative to program impact) by simple means. Usually, bivariate analyses, relating changes in the indicator to changes in other variables included in the system, are appropriate at this stage. Such analyses serve as an empirical foundation for seeking out more complex relationships accounting for the correlations and interactions between variables.

The fourth step is the articulation of potential explanations to the observed outcomes. Such explanations should not be limited to those suggested by the empirical work—or even to those which are subject to other empirical investigation. This step must involve the local people—residents (if possible) as well as staff.

The fifth step is the use of more complicated analyses to assess the

plausibility of each alternative explanation. The nature of the data and the types of explanation define the analytic methodologies for such an investigation.

Finally, modifications in the system and/or program must be made and the steps repeated. If the indicators are found wanting, the iterative cycle might best begin with step 1. However, in most circumstances, steps 3 through 5 are the most critical.

## CHAPTER V
## COSTS AND BENEFITS

We have spoken of many potentially expensive components to a RIFS—detailed error detection, data base management systems, and a continuous analytic process involving field personnel as well as evaluation and/or research specialists. Two questions remain—how much does it cost, and it is worth it?

We believe that faithful application of the RIFS concept, over the course of a multiyear program, will lead to an absolute reduction in expenditures for data processing for evaluation or research, as well as an increase in the benefit of performing that evaluation or research due to the higher quality of analytic rsults. Let us accentuate this apparent paradox. Adding better error detection, data handling, and intermediate rounds of analysis to an intervention costs less[

The resolution of this paradox lies in the fact that the routinization of data processing tasks as part of an intervention makes performance of those tasks more efficient and enables the regular staff to integrate those tasks with their other responsibilities—perhaps at no extra cost to the project.

For example, in the PRIMOPS intervention, the data processing sequence was viewed as a separate set of activities performed in parallel with the provision of services. The bridge between the activities was the duplicate filing of information by the promotoras who had to record the results of each home visit **twice**, once on the family record kept in the health post and once on a form to go to the keypunchers. Even recognizing that promotoras are not trained in data entry and might even resent the "stigma" associated with performing such a step, they could have keypunched the data in the same amount of time required for the transcription. In Cali, such an approach would have been feasible; it is a

major urban center with electricity and access to data processing machinery.

Because the data were not stored in a workable form, PRIMOPS maintained a separate and parallel manual data collection system for monitoring productivity. This redundant system could have been eliminated if the computerized data were made available in a timely manner. Finally, because the data were not readily available, special studies were done to answer questions that could have been answered with the data from the everyday routine.

Similar examples abound—particularly examples where the entire data collection effort is external to the intervention. Bringing specially trained survey teams to a site just to gather data is a very costly activity. Similarly, contracting anew for data processing and analysis to handle a data set independant of the mainstream of an intervention can add to the overall costs associated with evaluation and/or research.

In summary, a cogent argument for integrating data processing and related activities into the routine operation of an intervention can be made. The marginal cost of including one or two additional tasks for workers already on the payroll can be substantially less than the cost associated with organizing and contracting for those same services with outside consultants.

Although significant, the potential reduction in expenditures is of relatively less magnitude than the potential increase in benefits. Our experience is that few if any interventions have been markedly improved in response to their own data gathering efforts. The benefits derived from the efforts of one set of intervenors tend to accrue to others who review their work or to that same group of people in their subsequent activities (for example, evidence from Candelaria that Colombian children are most at-risk between two and three years of age contributed to the targeting on those children in PRIMOPS).

The RIFS notion is directed toward the maximization of learning during an intervention by the individuals running that intervention.

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