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**SOLVING
OPERATIONAL PROBLEMS
IN PRIMARY HEALTH CARE
1981-87**

Final Report of the PRICOR Project

PRICOR

Primary Health Care Operations Research

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LIST OF ACRONYMS

AMREF	African Medical Research Foundation
APHA	American Public Health Association
CRS	Catholic Relief Services
CEDPA	Centre for Development and Population Activities
CEDH	Center for Education Development in Health
CHS	Center for Human Services
CMC	Christian Medical Commission
CBD	Community-Based Distribution
CF	Community Financing
CHW	Community Health Worker
CO	Community Organization
CEA	Cost-Effectiveness Analysis
CSSR	Country Study Status Report
EMRO	Eastern Mediterranean Regional Office of WHO
ICORT	International Conference on Oral Rehydration Therapy
KAP	Knowledge, Attitude and Practice
LDC	Less Developed Country
MCH/FP	Maternal Child Health/Family Planning
MOH	Ministry of Health
MCUA	Multiple Criteria Utility Assessment
NCIH	National Council for International Health
NIS	National Institute for Statistics
OR	Operations Research

ORS	Oral Rehydration Salts
ORT	Oral Rehydration Therapy
PAHO	Pan American Health Organization
PHC	Primary Health Care
PRICOR	Primary Health Care Operations Research
PVO	Private Voluntary Organization
PROFAM	Profamilia
PPC	Program and Policy Coordination
RHM	Rural Health Motivator
TBA	Traditional Birth Attendant
UNFPA	United Nations Fund for Population Activities
AID/USAID	U.S. Agency for International Development
VHW	Village Health Worker
WHO	World Health Organization

EXECUTIVE SUMMARY

Primary Health Care Operations Research (PRICOR) is a project of the Center for Human Services (CHS), funded by the Office of Health of the U.S. Agency for International Development (AID). Its first phase began in 1981 and continued through March 1987; a second PRICOR project began in 1985 and will continue through September 1990. This report covers activities undertaken during the first phase only.

As stated in the Cooperative Agreement between CHS and AID, the objective of this first phase was:

...to assist developing country decisionmakers and health program managers to find better ways to deliver primary health care (PHC) programs. This is to be accomplished through a series of country-specific operations research (OR) studies designed to address the specific PHC policy and program issues identified by host country health officials and health program managers.

PRICOR studies addressed problems at the community, rather than the clinic or hospital level. Research proposals were solicited and studies funded in four major areas: 1) Community Health Workers, 2) Community Financing of PHC, 3) Community Organization for PHC, and 4) Commodity Distribution for PHC (later with a focus on ORS distribution).

PRICOR's two major activities were the development of an effective problem-solving methodology and assistance to local investigators for completing 45 operations research (OR) studies in 29 countries.

Working with local investigators, PRICOR found ways to involve community members and decisionmakers in problem-solving research, facilitating the development of an increased capacity for conducting such research, and employing innovative ways to disseminate information about study findings and methods, first to program managers and second to a variety of other concerned audiences.

PRICOR also provided technical assistance in OR, published monographs on OR methods and issues, delivered workshops and seminars in OR, prepared comparative analyses of research results, and disseminated information about study results and methodology.

PRICOR's quantitative achievements are impressive:

- More than 400 concept papers reviewed, 49 studies funded, 45 substantially completed;
- Five monographs on OR methods and issues prepared and distributed in three languages (English, Spanish, French);
- Twenty Interim Reports distributed to more than 200 researchers, policymakers, etc.;

- Abstracts of the 45 completed studies, most translated into Spanish and French, distributed to more than 650 researchers, policymakers, etc.;
- Detailed summaries (10-15 pages) of 34 completed studies for distribution to selected audiences;
- Monographs comparing issues and results from PRICOR studies in three priority areas: Community Health Workers (CHWs), Community Financing (CF), and Oral Rehydration Therapy (ORT);
- More than 40 articles for publication in professional journals, including one full and one partial PRICOR issue of the international journal, Socio-Economic Planning Sciences;
- Numerous presentations at briefings, seminars and conferences;
- Eight workshops in six countries;
- An international OR conference in Washington, D.C.

Chapter 1 of the final report provides a brief overview of the PRICOR project. This is followed by a chapter describing the country studies (Chapter 2); the comparative analyses of study findings in three areas--Community Health Workers, Community Financing, and Oral Rehydration Therapy (Chapter 3); PRICOR's approach to operations research (Chapter 4); five monographs on OR methods and issues (Chapter 5); and the variety of ways employed to disseminate information about study findings and methods (Chapter 6). The report contains two Appendices: 1) a description of the process of study solicitation, review, and monitoring that helped to ensure the scientific quality of the studies; and 2) a bibliography of written materials and publications produced by PRICOR staff, investigators, and consultants during the course of the project.

1.0 THE PRICOR PROJECT — AN OVERVIEW OF THE FIRST PHASE

1.1 PRICOR — WHAT IT IS, WHAT IT HAS ACCOMPLISHED

It is best to do things systematically, since we are only human and disorder is our worst enemy.

Hesoid, Greek poet

Maria, age 6 months, died in her mother's arms of dehydration. She died, not because her illness was untreatable, but because no one in Pacatuba knew how to treat diarrhea, and her mother could not afford to take her to the doctor in the town of Fortaleza, some 32 kilometers away.

In northeast Brazil, Maria's story is not unusual. Diarrhea is a major cause of mortality and morbidity among infants and small children. But these deaths are preventable because a highly effective, cheap and simple technology is available for rehydrating children. This technology is a sugar-salt solution called Oral Rehydration Therapy (ORT). The challenge in Pacatuba, as in many other parts of the developing world, was to figure out a way to bring that technology to the children in need of it.

PRICOR researchers did just that. An interdisciplinary team of medical and social scientists from the Federal University of Ceara and the University of Virginia identified, developed, and tested a culturally-acceptable way to manage diarrhea and deliver ORT in Pacatuba.

The researchers began with a baseline survey, in-depth interviews and observations to examine the problem: how many children suffered from diarrhea, what did mothers do about it, did they know about and use ORT? They found that diarrhea was common, that mothers sometimes spent large sums of money to travel to town for ineffective treatment, and that a number of folk beliefs affected people's views on what caused diarrhea and how to treat it.

The researchers also identified and examined different ways to introduce ORT and concluded that traditional healers would be the best providers. Meetings between the healers and researchers led to the identification of both cultural and technical problems that had to be solved before ORT could be provided. Technical problems, such as how to teach healers to prepare and administer Oral Rehydration Salts (ORS) correctly, and cultural problems such as, where ORS should be prepared and administered were researched. Alternative solutions to each problem were developed, tested, and implemented. This pragmatic approach to problem-solving continued over one and a half years, as the new delivery system was developed, tested, and refined.

Seventeen traditional healers in Pacatuba were trained in preparing the oral rehydration solution and are now managing diarrhea with it. Electrolyte testing has shown that the solutions they prepare are extremely accurate, and mothers are receiving ORT from these healers as the first line of care in the village. In 12 months they delivered 7,400 liters of ORS at a total program cost of US \$4,027. Operating costs averaged approximately US \$0.48 per healer per month; average volume was 36 liters per healer per month.

A follow-up survey showed that the traditional healers increased mothers knowledge and use of ORT. Familiarity with homemade ORT among mothers went from 3 percent before the study to 72 percent; familiarity with free government packets went from 56 to 75 percent. There was a significant increase from 39 percent to 79 percent in those reporting that they always used some form of ORT. The percentage who went to traditional healers for ORT went from 0 to 54 percent. The project is now being replicated in a large-scale child survival project in 23 counties in the State of Caera funded by Project Hope and AID.

This study, one of 49 supported by PRICOR, demonstrated that practical solutions to real operational problems can be found through operations research.

1.1.1 What Is PRICOR

Primary Health Care Operations Research (PRICOR) is a project of the Center for Human Services (CHS), funded by the Office of Health of the U.S. Agency for International Development (AID).¹ Its first phase began in 1981 and continued through March of 1987; a second PRICOR project began in 1985 and will continue through September 1990.² This report covers activities undertaken during the first phase only.

The agreement between CHS and AID focused on helping local program managers find solutions to their operational problems. The objective was stated in the Cooperative Agreement:

The purpose of this 5-year project is to assist developing country decisionmakers and health program managers to find better ways to deliver primary health care (PHC) programs. This is to be accomplished through a series of country-specific operations research (OR) studies designed to address the specific PHC policy and program issues identified by host country health officials and health program managers.

¹ Cooperative Agreement AID/DSPE-5920-A-00-1048-00. The Center for Human Services (CHS) is a private, nonprofit, development services organization specializing in the design and management of programs that address the basic needs of people in developing countries and the United States.

² PRICOR was given a 6-month, no-cost extension, bringing the total project period to 5 1/2 years. The second 5-year phase of PRICOR (called PRICOR II) began in October, 1985. Thus, there was 1 1/2 year overlap in the two phases.

Clearly one of the strengths of PRICOR is its focus on helping local health providers find ways to solve their own problems.

1.1.2 PRICOR Priorities and Activities

PRICOR's research priorities concentrated on finding and testing solutions to problems at the community level rather than the clinic or hospital level. Research proposals were solicited and studies funded in four major areas:

- Community Health Workers
- Community Financing of PHC
- Community Organization for PHC
- Commodity Distribution for PHC (later focusing on ORS distribution).

PRICOR's major activity was the development and funding of country studies, but several other services were provided by the project:

- Technical assistance in operations research (OR)
- Publication of monographs on OR methods and issues
- Workshops and seminars in OR
- Comparative analyses of research results
- Dissemination of findings.

PRICOR staff and consultants developed a practical OR approach that incorporates the essential features of traditional operations research, yet remains flexible enough to be applied to a variety of operational problems in primary health care. This approach is discussed in Section 4.1, PRICOR's Approach to Operations Research.

1.2 PRICOR ACCOMPLISHMENTS

The project's accomplishments have been significant.

- Country Studies. The agreement called for "up to 28 country studies" to be funded over five years. During six solicitation cycles, PRICOR received more than 400 concept papers and proposals, and funded 49 studies in 32 countries, with no increase in the original budget.
- Monographs. Five monographs on OR methods and issues in PHC were prepared. Over 11,000 copies of these monographs have been distributed around the world in English, Spanish, and French.
- Workshops. Although no workshops were called for in the Cooperative Agreement, PRICOR and AID staff both realized

that applicants would need training in proposal development and OR methods. Eight workshops were held in six different countries.

- International Conference. A highly successful international conference of PRICOR researchers was held in Bethesda, Maryland in June, 1986. Participants came from 31 countries to share experiences and compare results of their studies.
- Seminar and Conference Presentations. PRICOR investigators, consultants and staff made many presentations of study findings and methodological approaches at meetings of such organizations as the National Council for International Health (NCIH), the American Public Health Association (APHA), and the World Federation of Public Health Associations (WFPHA).
- Interim Reports. Twenty reports of preliminary study findings were prepared. These two-page reports were designed to present results quickly and simply to program decisionmakers. Each report was distributed to a select mailing list of over 200 researchers, policymakers and others interested in PRICOR studies.
- PRICOR Abstracts. Forty-five of the forty-nine studies were summarized in two-page abstracts for rapid distribution and review of project results. Most of these summaries were translated into Spanish and French. Over 650 sets of these summaries were distributed.
- Study Summaries. Longer reports were prepared for 34 of the most significant studies and distributed to selected readers.
- Comparative Studies. PRICOR staff analyzed the results of the individual studies and prepared comparative monographs on Community Health Workers (CHW), Community Financing (CF), and Oral Rehydration Therapy (ORT).
- Computerized ORT Planning Model. A prototype computer model was developed to aid health planners in designing ORT programs.
- OR Literature Repository. A computerized data base of operations research literature in health was designed and developed with over 500 entries to date.
- Journal Publications. PRICOR researchers, consultants and staff prepared over 40 articles for professional journals. A complete issue and part of a second issue of the international journal, Socio-Economic Planning Sciences was devoted to PRICOR studies.

- Training Materials and Curricula. As byproducts of workshops and technical assistance activities, staff and consultants prepared a variety of training materials in English, French and Spanish. The materials are focused on proposal development and OR techniques.
- Briefings, and Presentations. PRICOR staff made numerous presentations about the project and the studies to professional groups, university classes and AID officials.

These are just the bare statistics on PRICOR's achievements. There also have been important qualitative contributions, as highlighted below and discussed in subsequent chapters.

1.2.1 Problem-Solving at the Community Level

Researchers and decisionmakers in 32 countries found ways to carry out systematic problem-solving research at the community level, in the great majority of cases with the active participation of community members themselves. PRICOR studies concentrated on real-life problems identified by local PHC managers and researchers. What should Community Health Workers (CHWs) do, what can be done to make supervision work, how can we figure out an effective but inexpensive way to train mothers in ORT, what role should the community play in PHC, how will we pay CHWs--these and other operational problems were the subject of PRICOR studies. Substantively, these studies dealt with issues that were not only important to the communities, but to AID: oral rehydration, community financing, cost recovery, and child survival interventions.

1.2.2 Comparative Analyses

The objective in these studies was to produce workable solutions to specific operational issues based on both technical analysis and a thorough understanding of local management factors. To this end, study questions were derived from analysis of local systems and constraints, rather than from theory. Critical factors in research design included the definition of the problem itself, a clear statement of the conditions which proposed solutions had to meet, and an analysis of existing systems and constraints on possible solutions. Unlike much primary health care and family planning research, approaches were multidisciplinary, solution-driven (rather than theory-driven), and hence conceptually broader than most studies. The results were improved operating systems (i.e., actual applications of findings), and much learned about the processes by which problems of this nature can be resolved in developing countries.

PRICOR focused on a limited number of priority themes, making it possible to analyze results comparatively, as summarized below.

1.2.2.1 Community Financing (CF)

PRICOR's 16 community financing studies produced a great deal of new information about the process of designing and maintaining sustainable community-based health activities. Researchers found that projects require parallel work in four areas, namely: cost reduction, demand creation and response, resource generation, and routine management. Cost reduction is often needed because communities are unable to pay for even basic health care services. Demand creation and response is necessary because the lay perception of health priorities usually differs from that of professionals. (The term "response" is appended because accommodations to community interests are generally required.) Good routine management is needed; not only to ensure fiscal solvency, but also to ensure that the program itself is worth financing. Finally, resource generation is often needed to pay for basic drugs and for the health workers' services. Community financing efforts addressed only to, say, resource generation, are less likely to succeed than ones that address other areas as well.

Instances of communities actively supporting professionally designed projects were relatively rare. More commonly, professional/community compromises were needed in order to reflect community demand for curative care, to reduce costs to levels the community could afford, and to give communities a greater sense of control. Traditional desk-bound research would not have addressed these needs, because it would have prevented participation by community leaders and program managers. Unstructured, non-data-based, decisionmaking might have been equally ineffective given the importance of cost and utilization estimates and other research evidence. Appropriate solution development, in many cases, involved structured consensus building techniques such as preference matrices.

PRICOR researchers, in brief, found that making projects sustainable was more than a matter of financing and that, indeed, new revenue generation was sometimes the least of their problems. To be sustainable, projects have to run well and produce high quality care. If dependent on a community financing, they must respond to public demand. Existing disinterest in preventive care, rather than being an irremovable obstacle, may simply be a problem to be overcome through creative solution development. The involvement of program staff and community leaders is also critical to the sustainability of a project.

1.2.2.2 Oral Rehydration Therapy (ORT)

Sixteen PRICOR-funded studies addressed problems in the delivery of ORT services. Five of the studies (Nigeria, Somalia, the Dominican Republic, Mexico, and Egypt-Nagaty) gave primary attention to resolving issues in the supply of oral rehydration salts (ORS) and in ORT services. Egypt, one of these studies, also examined the supply-demand interface. The remaining eleven (Sierra Leone, three in Liberia, Swaziland, Egypt-Galal, Brazil, Grenada, and three in Haiti) focused on ways to increase effective demand, although one of the Haiti studies also attempted to improve ORS availability by increasing the number of community outlets.

Most of the studies began in 1982 to 1983, with a provider-based model of ORT delivery. Community-based distribution (CBD) of ORS packets by paid or volunteer CHWs was beginning to be accepted as a necessary operational extension of the ORT services structure. Results from the problem analysis phase of the demand-oriented studies, however, led to a broad consensus on the critical importance of enabling mothers and other caretakers to prepare and administer ORS to their children before they become seriously dehydrated, and to know where and when to take the child if further treatment is needed. These eleven studies therefore gave major emphasis to developing effective ways of reaching families and communities with ORT promotion and training. Although each of the studies developed its own solution to the operational problem of how best to reach families with the ORT message, most adopted a strategy which called for development of a local community capacity for training the caretakers and other community members.

The PRICOR-funded studies have established that a wide variety of approaches can successfully mobilize communities to participate in ORT promotion and training. An extraordinary variety of citizens in any community can be trained in ORT themselves: CHWs, traditional birth attendants (TBAs), traditional healers, school teachers, principals, religious leaders, market sellers, mothers who are "satisfied users," and school children. These citizens can in turn train the caretakers of young children in these important skills, thereby promoting ORT in the community. The multiplier effect of this training is evident in these studies. However, the studies also demonstrate the importance of training community workers in how to teach mothers as well as in what to teach. Having acquired the knowledge, the caretakers must learn to believe in what has been taught and to develop the self-confidence to put these skills into practice. This is a considerably more difficult task. Because of the short implementation periods, none of the studies was able to demonstrate conclusively what further steps are necessary if the enabled caretakers are to use their newly acquired knowledge and skills in any significant numbers. Study findings, like the established literature, suggest additional time, improved educational methods, reinforcement, and more community support to reduce the personal risk to the caretaker of trying something new and non-traditional.

On the demand side, the PRICOR-funded ORT studies have shown that in most cases, the availability of an adequate supply of ORS, whether packets or home-mix ingredients, is a less significant problem than that of finding ways to increase effective caretaker demand. However, better systems for inventory management are needed to ensure efficient use of scarce resources.

1.2.2.3 Community Health Workers (CHWs)

The use of community health workers was the topic most frequently studied by PRICOR-funded researchers, with thirty studies focused entirely on or including some examination of CHW strategies. The three aspects of CHW strategies that received the most attention in these studies were health workers' tasks (20 studies), community participation in CHW strategies (19 studies), and CHW incentives (17 studies). Training and selection of CHWs were each examined by 11 studies, and 8 studies focused on CHW supervision. These topics reflect the fact that major

problem areas for PHC programs include: defining what CHWs do and making their activities more effective; obtaining community support for and acceptance of CHWs' activities; motivating health workers; and, to a lesser extent, support elements such as training and supervision.

While the settings and institutional contexts for these CHW studies varied widely--from church-run programs serving a few rural communities in a single district, to national government-sponsored programs serving millions--the studies shared an emphasis on identifying "decision variables," (i.e., aspects of CHW strategies that could be controlled or modified by PHC program managers and researchers). The comparative analysis of these studies' findings was based on examining common problem areas and decision variables and comparing the different solutions developed. Studies which addressed the same problem area, such as CHW training, thus contributed to our understanding of the range of possible alternatives for effective CHW trainers, training methods and locale, and how well these worked under different circumstances. Specific study findings are presented in the comparative analyses for determining CHW tasks, CHW selection, training, supervision, incentives, and community participation.

A recurrent theme in the approaches developed by the CHW studies was that for solutions to be sustainable, they must address the interactions between who the health workers are and what they do, the communities where they work, and the health systems to which they are linked. Problems in CHW task specification, supervision and incentives, for example, are affected by the characteristics and aspirations of CHWs themselves, by the expectations and resources of the health system, and by community priorities and concerns. Effective solutions to these problems need to consider the importance of such links.

The major innovation of PRICOR studies in addressing these problems was that they attempted to systematically review all the factors relating to alternative solutions--those related to the CHWs themselves, to the community, and to the health system. This emphasis led to the identification of solutions that sought to balance the needs and priorities of each group. The most successful PRICOR-supported CHW studies were those which recognized the importance of addressing community concerns, of strengthening CHW ties with the higher level health system, and of increasing communication between supervisors, CHWs, and community representatives. The studies found that to improve the performance of CHWs, to make CHW-based strategies more sustainable, and to make CHWs more accepted and utilized by their communities, solutions needed to reinforce these interrelationships.

The CHW studies also support the conclusion that the process used to develop solutions has a great impact on acceptability and therefore, sustainability of these solutions. In some cases (such as in the determination of CHW tasks and the selection of CHW candidates), the appropriate solution depended both on the preferences of the relevant decisionmakers (community leaders as well as PHC program managers), and on objective information (e.g., CHW characteristics statistically associated with stability). Such techniques as nominal group, preference matrices, and Multiple Criteria Utility Assessment (MCUA), which facilitated group decisionmaking and the integration of the priorities of various participants, provided a practical mechanism for identifying locally acceptable

solutions. The PRICOR-funded studies demonstrated that these techniques may be used with a wide variety of participants, ranging from mothers and traditional healers to MOH officials. The group processes were useful not only for bringing into the decision framework relevant points of view, but also for creating consensus about the most feasible solution and building a sense of ownership of the decisions made.

1.2.3 Methodology Development

Although the Cooperative Agreement did not anticipate development of an operations research methodology, this had to be done of necessity, and it may be one of PRICOR's most significant contributions.

When the project began, the staff had to find a practical way to advise research applicants about preparing an OR proposal and actually conducting an OR project. Many PHC problems do not lend themselves to the use of classic OR techniques, perhaps because the problems are complicated and involve large numbers of complex and difficult to measure variables (e.g., community attitudes toward paying CHWs, cultural taboos on using ORT, and obstacles to supervision). Those problems that do lend themselves to traditional OR (inventory, scheduling, logistical problems) are not often the most significant ones.

The staff developed a general approach to operations research that remains true to the process and purpose of classical OR, but which is flexible about the techniques that can be applied. This approach allows investigators to use whatever research methods seem appropriate, from in-depth anthropological observations, sample surveys, and other traditional social science methods, to practical management science methods (including systems models, group decision techniques, and cost-effectiveness analysis).

Although PRICOR studies included statistical and mathematical models (e.g., regression and cost-effectiveness analyses), the staff learned not to promote any particular technique, but rather to choose methodologies best suited to the particular situation and skills of the research team. By being both flexible and eclectic, PRICOR encouraged introduction of new techniques and methodologies to the field of PHC operations research. This has given the field a richer armamentarium from which to draw methods for dealing with its operational problems.

The PRICOR approach to OR and the various techniques used have been documented in easy-to-read monographs for use by local researchers and foreign consultants. That these monographs have been widely used in both practical and classroom settings attests to their utility. PRICOR's general approach has been incorporated into the OR programs of many U.S. and host country organizations working in primary health care and family planning. Brief research reports on studies carried out by PRICOR investigators have also been widely distributed to illustrate the variety of ways that OR studies can be conducted.

The approach and techniques are not without their limitations, however. Not all of the projects followed the process, and it is clear that local researchers will

continue to need technical assistance in learning to apply it. Researchers have a tendency to begin testing a solution without first carefully analyzing the problem. A large body of OR techniques has yet to be tapped, and computerization of OR is a natural field that is ripe for further development. These and other challenges in methodology development will be addressed, hopefully, in the future by PRICOR.

1.2.4 Building Capacity Of Local Institutions

Although "capacity-building" was not an anticipated objective of the PRICOR program, it soon became clear that it should have been. Both staff and AID soon realized that local researchers would need training and technical assistance if they were to design and carry out operations research.

This was particularly evident in Africa--a priority region for PRICOR, but one which has a severe shortage of trained researchers. After rejecting a large number of proposals from Africa because they were technically weak, PRICOR carried out a workshop in Swaziland designed to help a selected number of these applicants develop research proposals that could be accepted for funding. Twenty-eight participants, divided into 14 two-person teams from 11 countries participated, and the results were impressive. Quoting from the mid-term evaluation report:

The whole exercise turned out to be an intensive learning-by-doing effort, all participants showing great interest and dedication. Hence, the highly positive results: out of 12 completed and reviewed proposals, 11 have been approved and funded.

Perhaps more important, but more difficult to measure, the researchers and program administrators who have gone through a workshop or were involved in a study have become better problem-solvers. They apply the problem analysis/solution development/solution testing approach without carrying out a formal research project, which most certainly leads to better management of PHC programs.

Another PRICOR initiative was the establishment of an Intern and Fellows Program, designed to provide recent master's level graduates with an opportunity to gain operations research and technical assistance skills and experience. Through the end of the first phase of PRICOR, eight interns and fellows participated in this program.

These efforts, although wide-reaching, were inadequate to meet the extensive need for both individual and institutional capacity development in OR. PRICOR's resources for training and capacity-building were very limited. Much more will need to be done in this area if OR is to be institutionalized in developing country PHC programs.

1.2.5 Dissemination Innovations

The most important users of PRICOR study results were local program managers and the international primary health care community. PRICOR worked closely

with both to ensure the maximum benefit from researcher efforts. While much was done through printed media and conference presentations, possibly the most effective PRICOR innovation was to involve program managers, health staff, and community residents right from the start in study design, data analysis, and decisionmaking. The feedback loop from research to application was greatly shortened as a result.

Ways in which managers became involved in studies included the following:

- A requirement that every grant applicant demonstrate close linkage with decisionmakers; this included the requirement that each researcher attending a proposal development workshop in Swaziland be accompanied by a decisionmaker;
- The selection of district health officers, MOH personnel, and other program staff, as principal investigators;
- The use of participatory decisionmaking techniques, particularly at the solution development phase;
- The conduct of operations research seminars in Liberia, Thailand, India, Bolivia, Nigeria, Haiti, and elsewhere.

In brief, program managers were involved from the start in many locations and were not only informed but participated directly, a factor which seemed to contribute to direct replication of both study results and the research process. In Thailand, the Permanent Secretary of Health was continually briefed on progress in the community financing study. He, in turn, relayed this information to the Cabinet, which used it to institute a national policy promoting establishment of diversified revolving funds to support PHC. Similar events occurred elsewhere.

Innovative methods were also used to reach the international health community, especially busy personnel with limited time for reading. These dissemination vehicles included:

- Interim Reports. Two-page summaries of studies in progress, prepared on 20 studies.
- PRICOR Abstracts. Two-page summaries of study reports, prepared on all completed studies and, with a few exceptions, translated into French and Spanish.
- Study Summaries. 15 to 25-page summaries of 34 studies, for those interested in greater detail.
- Comparative Analyses. Longer cross project analyses of study results, on community health workers, community financing, and oral rehydration therapy.
- Special issues of the international journal, Socioeconomic Planning Sciences, devoted to PRICOR studies.

- Innumerable conference and other presentations.

1.2.6 Lessons Learned and Future Directions

There is no doubt that PRICOR has been a successful program, both quantitatively and qualitatively. The program produced more studies, conducted more workshops, and disseminated more research products than initially expected--and it did this at no increase in budget. The program also had an impact on individual PHC programs, some of which were highly significant.

It is possible to conclude from this experience that there is a need for this kind of operations research, that operational problems can be addressed in a systematic way, that local researchers can learn to carry out this kind of problem-solving research, and that PHC program managers will use the results.

2.0 COUNTRY STUDIES

PRICOR has been extremely helpful in design and initiation of the research project ...Mission pleased that nationals are taking the leading role in design and implementation of the OR and feels that the PRICOR project will contribute significantly to increasing institutional capability of UNIKIN, NIS, and MOH in conducting OR as well as provide useful information for decision makers in design of PHC programs.

Cable from USAID Mission

Country studies were the primary focus of the PRICOR Project. To evaluate them, this section will be divided into two parts: (1) an overview of the studies, and (2) quality controls (the funding and monitoring process).

2.1 OVERVIEW OF STUDIES

Forty-five studies in 29 countries were substantially completed in the PRICOR project--more than 1.5 times the number that was recommended in the Cooperative Agreement, with budgets that totaled \$4,200,671 and averaged \$85,728 per study. Ninety percent of the funded studies were successfully completed, a remarkable number considering the experiences of other applied research projects.

The studies were carried out by host country and U.S. researchers worldwide (see Figure 1 for map). Sixteen studies were funded in Africa, 11 in Asia, 20 in Latin America and the Caribbean, and 2 in the Near East. The studies are listed by country, investigator, budget, topic, and duration in Table 1.

2.1.1 Problems Addressed in PRICOR Studies

Though numerous operational issues affect primary health care, PRICOR staff determined early on that a focused research effort would have greater impact and that clear guidelines about preferred topic areas would help researchers design their proposals. To assist in topic selection, PRICOR staff convened a technical advisory group of outside PHC specialists. This group strongly recommended concentration on community-level activities as the most difficult and most critical to PHC success. With staff and AID colleagues, the group recommended specific focus on community financing, community organization, community health workers, and commodity distribution. These topics were later broadened to encourage research on oral rehydration therapy and immunization but otherwise remained the same for all of PRICOR's funding cycles. (Proposals

**FIGURE 1
COMPLETED STUDIES FUNDED BY PRICOR**

<u>Country</u>	<u>Topic</u>	<u>Study Title</u>
1. Bangladesh	CHW	Health Care Utilization in Bangladesh
2. Benin	CF	Community Financing of PHC Services
3. Bolivia	CHW/CF	Community Financing to Reduce Attrition of CHWs
4. Bolivia	CF	Determining Alternative Community Financing Mechanisms
5. Brazil	CHW/CF	Use of Visitadoras and Financing of Water Supply
6. Brazil	CF	Community Financing of PHC
7. Brazil	ORT/CHW	Using Traditional Healers to Deliver ORT
8. Dominica	CF	Revolving Drug Funds
9. Dominican Republic	ORT/CF	Improving Distribution of ORS
10. Ecuador	CHW	PHC Delivery Utilizing Rural Health Promoters
11. Egypt	ORT	Adding Nutrition Repletion to ORT Programs
12. Egypt	ORT	Improving ORS Inventory Management
13. Grenada	CO/ORT	Community Participation in Reduction of Child Mortality
14. Haiti	CHW/CF	Alternative Methods of Motivating CHWs
15. Haiti	CHW	Resource Allocation in PHC Planning
16. Haiti	CHW	Role of TBAs in Maternal Health
17. Haiti	ORT	Community Organization in Promoting ORT Use
18. Honduras	CF	Community Financing of PHC
19. India	CF	Financing and Organizational Problems of Cooperatives
20. India	CCD	Identification of an Optimum Distribution System for Vaccines
21. Jamaica	CF/CHW	Productivity of PHC Teams
22. Korea	CO/CHW	Model PHC Programs in Rural Communities
23. Liberia	CF	Planning and Evaluating Community Financing
24. Liberia	ORT	Diarrheal Disease Intervention
25. Liberia	ORT	Training Mothers to Use ORT
26. Liberia	CHW	Training Adolescents to Promote Health
27. Mali	CF	Community Financing of PHC
28. Mexico	ORT	Marketing and Distribution of ORS
29. Mexico	CHW	Health Service Planning and Community Needs
30. Nigeria	CHW	Community Participation in Stabilization of VHWs
31. Nigeria	CHW	Increasing Productivity of CHWs Through Supervision
32. Papua New Guinea	CHW/CO	Training Health Workers
33. Peru	CHW	An Improved System for the Delivery of PHC
34. Philippines	CHW	Alternative Training Strategies for CHWs
35. Philippines	CHW	Role of CHWs in Provision of Nutrition Services
36. Philippines	CF	Alternative PHC Financing Schemes
37. Senegal	CF	Community Financing of PHC
38. Sierra Leone	ORT	Training Mothers to Use ORT
39. Somalia	CCD	Improving the Availability of PHC Drugs
40. Swaziland	CF	Appropriate Methods for Sustaining CHWs
41. Tanzania	CHW	Community Participation in Supervision of VHWs
42. Thailand	CF	Community Financing of Nutrition, Water and Sanitation
43. Thailand	CHW	Alternative Approaches to Supervision of CHWs
44. Uruguay	CO	Community Participation in Resolving Health Problems
45. Zaire	CF	Testing Alternative Payment Schemes for Health Centers

Key: CF = Community Financing
 CHW = Community Health Workers
 CO = Community Organization
 CCD = Community-Based Commodity Distribution
 ORT = Oral Rehydration Therapy

OPERATIONS RESEARCH IN PRIMARY HEALTH CARE

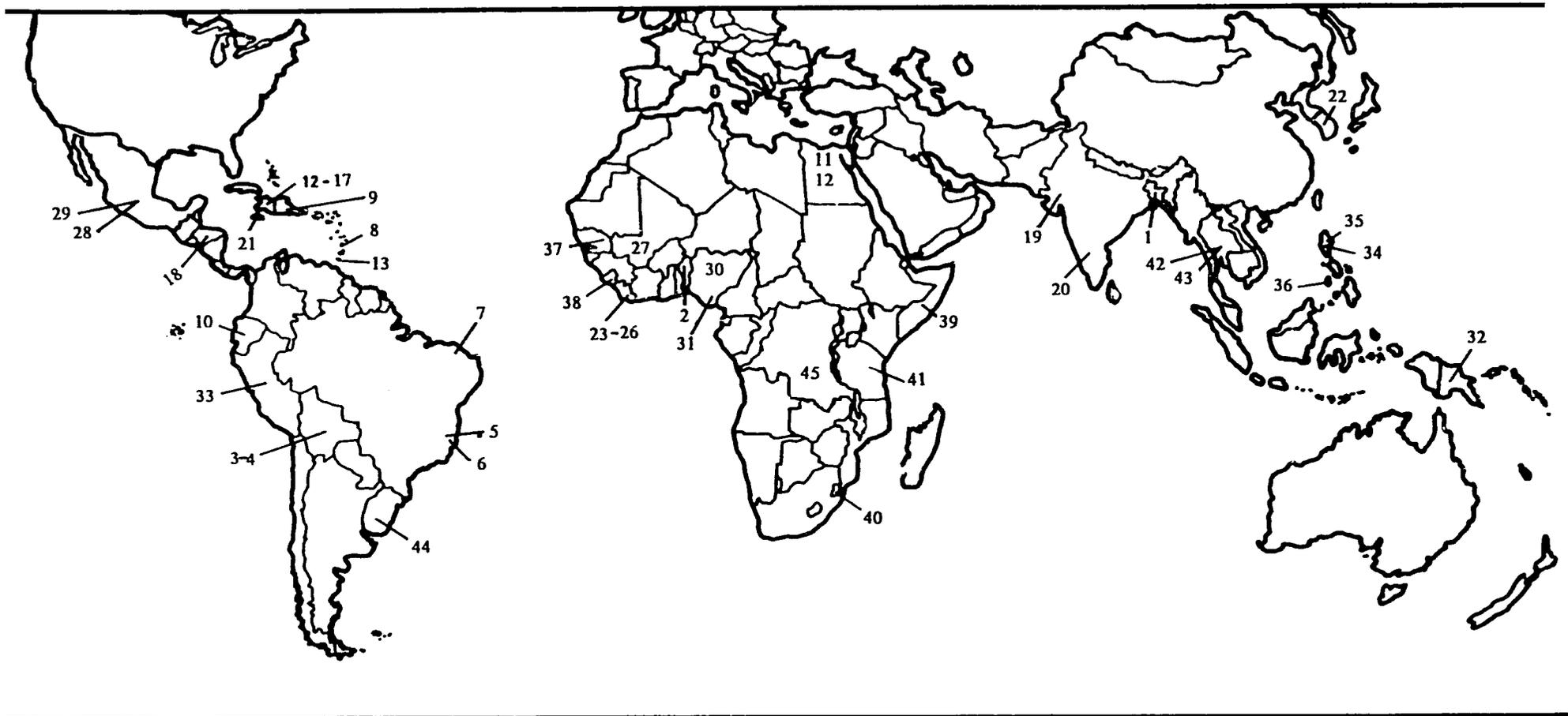


FIGURE 1. GEOGRAPHIC DISTRIBUTION OF COMPLETED PRICOR STUDIES

**TABLE 1
PRICOR COUNTRY STUDIES**

COUNTRY OF STUDY	PRINCIPAL INVESTIGATORS	TOTAL COST	TOPIC	DUR- ATION (MO.)
<u>AFRICA</u>				
BENIN	COIT, ELIZABETH,/ALIHONOU, E.	80,429	CF	32
IVORY COAST*	SANOH LAYES	28,597	CD/IMM	15
LIBERIA	COLE, ANDREW	32,450	CF	22
LIBERIA	COLE, ANDREW K.	9,676	CO/ORT	11
LIBERIA	GALAKPAI, MOSES	92,772	CO/ORT	22
LIBERIA	MOORE, JANET/WALL, PAUL	146,912	CHW	24
MALAWI*	CHIZIMBI, F.S.	27,405	CO	24
MALI	TRAORE, MAMADOU N.	21,447	CF	20
NIGERIA	GRAY, HERMAN	18,088	CHW	27
NIGERIA	OJOFEITIMI, E.O.	32,206	CHW	22
SENEGAL	GRAY, CLIVE	27,433	CF	5
SIERRA LEONE	JALLOH, M.B.	21,720	CHW/ORT	25
SOMALIA	LANE, NORMAN	73,328	CD	9
SWAZILAND	DLAMINI, B./CONNOLLY, C.	34,534	CHW	24
TANZANIA	MTANGO, FARIJI D.	102,600	CHW	30
ZAIRE	LUSAMBA, N.B./BAER, R.	114,998	CF	33
Total		864,595		
Average		54,037		21.6
<u>ASIA</u>				
BANGLADESH	CHOWDHURY, SHAFIQ	40,611	CHW/CO	13
INDIA	ELKINS, HENRY	128,267	CO/CF	15
INDIA	SUBRAMANYAM, K.	34,307	CD/IMM	16
KOREA	HONG, YEO-SHIN	119,351	CO	36
PAPUA NEW GUINEA	SPEAR/VOR DER BRUEGGE	75,124	CHW	19
PHILIPPINES	LANTICAN, LETICIA S.M.	48,441	CHW	27
PHILIPPINES	OSTERIA, TRINIDAD	72,049	CF	28
PHILIPPINES	SALVOSA-LOYOLA, CARMENCITA	52,861	CHW	23
SRI LANKA*	SAMARAWICKRAMA, G.P.	3,031	CHW	13
THAILAND	TANSKUL, ORATHIP	186,888	CF	37
THAILAND	VALYASEVI, AREE	58,426	CHW	16
Total		819,356		
Average		74,487		19.4

NEAR EAST

EGYPT	GALAL, OSMAN	56,340	CD/ORT	15
EGYPT	NAGATY, AMHAD	81,560	CD/ORT	26
Total		137,900		
Average		68,950		20.5

LATIN AMERICA

BOLIVIA	GONZALEZ, RENE	29,235	CHW	15
BOLIVIA	MILLER, MARTIN	97,576	CF	17
BRAZIL	BAKER, TIMOTHY	83,227	CF/CHW	15
BRAZIL	LASSNER, KAREN	146,865	CF	33
BRAZIL	NATIONS, MARILYN K.	123,248	CHW/ORT	25
DOMINICA	CROSS, PETER	214,324	CF	35
DOMINICAN REPUBLIC*	CROSS-BERAS, JULIO	22,041	CHW	24
DOMINICAN REPUBLIC*	UDALL, ALAN	109,952	CD/ORT	25
ECUADOR	LUNA, JORGE	229,084	CHW	31
GRENADA	WHITE, NORMAN F.	94,909	CO/ORT	18
HAITI	AUGUSTIN, ANTOINE	67,512	CF	16
HAITI	AUGUSTIN, ANTOINE	94,692	CHW	17
HAITI	BOULOS, CARLO	92,795	CHW	28
HAITI	WARD, WM./CAYEMITTES, MICHEL	148,841	CO/ORT	24
HONDURAS	HARTMAN, FRED	100,165	CF	29
JAMAICA	DESAI, PATRICIA/ZACHARIAH, B.	157,357	CHW	24
MEXICO	MACORRA, LUIS DE LA	5,005	CD/ORT	4
MEXICO	RAMOS, ANA	81,248	CHW	23
PERU	SPIRA, WILLIAM M.	98,347	CHW	10
URUGUAY	EBOLE, OBDULIA	78,503	CO	27
Total		2,074,926		
Average		103,746		22

GRAND TOTAL		3,896,777		
AVERAGE		79,526		21

* Not completed

Key: CD = Community Distribution
 CF = Community Financing
 CHW = Community Health Worker
 CO = Community Organization
 IMM = Immunization
 ORT = Oral Rehydration Therapy

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**TABLE 2
OVERVIEW OF PRICOR COMMUNITY FINANCING STUDIES**

	Scope		Scheme					Service, Commodity Financed					Scheme implemented	Comm. cost sharing	Full cost recovery	COMMENTS	
	Community	Regional/National	Fees	Drug fund	Comm. labor/in-kind	Loan fund	Other	New	Existing	CHW	Drugs	PHC services					Other
<u>Problem-Solving Studies</u>																	
BENIN	●		●					●				●		●	●	●	Fee/episode recovered over 1/3 of total costs in most recent period
BOLIVIA	●				●			●		●	●			●	●		Households to give share of June potato harvest to committee who sells and pays CHW
BRAZIL-Lassner	●		●				●	●			●			●	●		Multiple schemes for cost sharing in place about one year
DOMINICA		●	●					●		●						●	Nat drug system improved; RDF supported by district budgets; user fees planned
HAITI	●					●		●	●					●	●		PHC credit associations established, annual fee used for CHW salary
HONDURAS		●	●					●			●				●		Health behavior and expenditures documented, some hosp. cost recovery mechs. implemented
LIBERIA	●			●	●			●		●	●			●	●	●	Drug funds successful, CHWs not satisfied with community labor as compensation
MALI		●	●	●	●				●	●	●				●		Defined essential PHC services, proposed appropriate cost sharing
PHILIPPINES	●			●				●			●			●		●	Drug funds have remained capitalized 9 months after field test
SWAZILAND	●				●				●	●				●	●		CHWs to be compensated after September harvest
THAILAND		●				●		●				●	●	●		●	Multi-purpose revolving fund more effective financing mech. than single-purpose fund
ZAIRE		●	●					●			●			●	●		Fee/episode compared with fee/consultation, communities/supervisors prefer fee/episode
<u>Studies that Analyzed Existing Projects</u>																	
BRAZIL-Baker		●	●					●						●	●	●	User fees support recurrent costs of water systems, managed with revolving fund
INDIA		●	●		●	●	●	●	●	●		●	●	●	●	●	8 case studies of community health projects, variety of successful financing schemes
SENEGAL		●	●					●			●				●		Recurrent costs of supervision, CHWs, and drug resupply most difficult to finance

**TABLE 3
PRICOR ORT STUDIES BY COUNTRY,
STUDY OBJECTIVE AND
PROBLEM ADDRESSED**

			SUPPLY						DEMAND					
			Modality of delivery	Source of supply	Product: Commercial	Product: Home mix	Pricing policy and financing	Management information system	Distribution system	What/how to train promoters, trainers	Provider KAP, including pharmacists	Use of non MD/RN providers	What/how to train caretakers	Caretaker KAP
AFRICA	1. LIBERIA (A. Cole)	To develop, field test teaching strategies to reinforce mothers' proper treatment of diarrhea.			•					•	•	•	•	•
	2. LIBERIA (Galakpai)	To identify acceptable home-based ORT solution and best teaching strategy for mothers/caretakers.			•					•	•	•	•	•
	3. LIBERIA (J. Moore, P. Wall)	To design, test health education curriculum for adolescents as promoters of health, based on tasks currently performed.			•					•	•			•
	4. NIGERIA (Ojofeitimi)	To identify effective ways to improve VHW supervision.	•											
	5. SIERRA LEONE (M. Jalloh)	To identify best strategy and person to train caretakers in home-based ORT.			•					•	•	•	•	•
	6. SOMALIA (N. Lane)	To develop strategies to overcome existing constraints on supply of essential PHC drugs.					•	•						
	7. SWAZILAND (B. Dlamini, L. Dunn)	To identify ways communities can finance and supervise CHWs and to increase CHWs' value by additional PHC training including ORT.			•					•	•	•	•	•
LATIN AMERICA/CARIBBEAN	8. BRAZIL (M. Nations)	To determine how best to mobilize and integrate traditional healers to deliver ORT and manage diarrheal illness.	•		•					•	•	•	•	•
	9. DOMINICAN REPUBLIC (A. Udall)	To analyze current ORT demand, distribution, and current pricing policies to design a government subsidized pricing structure.		•		•	•	•				•		
	10. GRENADA (N. White)	To develop ways to involve community organizations in health related activities, including ORT.			•					•	•	•	•	•
	11. HAITI (A. Augustin)	To determine optimal use of CHW time in promoting 4 key PHC services, including ORT.			•					•	•	•	•	•
	12. HAITI (A. Augustin)	To determine best ways to motivate CHWs and provide incentives for mothers to learn and use PHC interventions, including ORT.			•		•				•			•
	13. HAITI (M. Cayemittes W. Ward)	To find effective ways of mobilizing community participation in promotion of ORT.			•	•	•			•	•	•	•	•
	14. MEXICO (L. De la Macorra)	To determine feasibility of marketing and distributing ORT tablets.		•	•		•		•		•			
NEAR EAST	15. EGYPT (O. Galal)	To find effective ways to modify existing ORT programs to teach mothers about rehydration and nutritional repletion.	•	•	•					•	•	•	•	•
	16. EGYPT (A. Nagaty)	To improve ORT inventory management system.		•	•	•	•	•		•		•		

**TABLE 4
OVERVIEW OF PRICOR COMMUNITY HEALTH WORKERS/
COMMUNITY ORGANIZATION STUDIES**

COUNTRY	SCOPE		OUTPUT OBJECTIVES				CHW PROGRAM INPUTS						SOLUTIONS DEVELOPED		
	Community	Regional/National	Utilization/Acceptance of CHW	Increased Coverage	CHW Stabilization	Effectiveness/Efficiency of CHW	Role/Task Specification	Community Organization	Selection	Training	Supervision	Incentives		Logistics	Linkages with other resources
Bangladesh		●	●				●								Proposed increasing CHW/patient ratio, extending service hours and home visits
Benin	●			●	●		●	●		●	●	●			Stable CHW program supported by community financing scheme
Bolivia	●			●	●		●	●	●	●	●	●	●		New cadre of CHWs placed at village level; cost sharing by community
Brazil/Baker		●				●	●		●	●	●	●	●		Analysis of successful national PHC program, not problem-solving focus
Brazil/Nations	●		●	●			●	●	●				●	●	ORT services delivered by traditional healers in rural areas
Ecuador		●				●			●	●			●		Supervision guidelines, logistic system, and training curriculum revised and adopted
Haiti/AEDC	●				●	●	●					●		●	Annual fee from mothers' credit clubs used as incentive for CHWs
Haiti/Eye Care	●					●	●		●						CHW time allocated by task, caretaker risk status; CHW's trained in training caretaker
Haiti/Cayemittes	●			●			●		●				●	●	Training modules prepared, used to promote ORT in community, improve supply
Haiti/Boulos	●					●	●		●						Cost-effective shorter training adopted
India/Elkins		●	●	●	●	●	●	●	●	●		●		●	8 case studies of community PHC programs. Effective solutions identified.
Jamaica		●				●	●		●	●					Model developed and being implemented for manpower reallocation
Korea		●		●				●							CHWs and community leaders trained in preventive services
Liberia/Cole II	●		●	●			●	●		●				●	CHWs trained in how to train mothers in CRT
Liberia/Moore	●			●			●	●	●	●				●	School children trained in health practices using 8 modules

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TABLE 4 (continued)
**OVERVIEW OF PRICOR COMMUNITY HEALTH WORKERS/
 COMMUNITY ORGANIZATION STUDIES**

COUNTRY	SCOPE		OUTPUT OBJECTIVES				CHW PROGRAM INPUTS							SOLUTIONS DEVELOPED	
	Community	Regional/National	Utilization/Acceptance of CHW	Increased Coverage	CHW Stabilization	Effectiveness/Efficiency of CHW	Role/Task Specification	Community Organization	Selection	Training	Supervision	Incentives	Logistics		Linkages with other resources
Malawi		●						●							Solution not yet developed
Mexico/Ramos		●				●	●	●		●	●				Trained CHW and supervisors in community diagnosis and micro planning techniques
Nigeria/Gray	●				●		●		●	●	●	●		●	CHW roles and tasks changed; reduced attrition by providing incentives
Nigeria/Ojofeitimi		●		●		●	●			●	●		●		Trained supervisors; developed guidelines and protocols for supervision
Papua New Guinea		●		●				●		●					Trained health staff in involving villagers and CHWs in decisionmaking
Peru	●					●				●	●			●	CHWs used microcomputers for carrying out routine visits and recordkeeping
Philippines/Lantican		●	●			●	●		●	●					Established CHW & trainer selection criteria; modified training programs
Philippines/Loyola		●				●			●						Improved nutrition training modules and community awareness of nutrition
Sierra Leone	●					●		●	●				●		Trained village leaders to train mothers in ORT
Sri Lanka		●				●				●				●	Trained trad. practitioners in PHC: health ed. & referrals to govt. services
Swaziland	●		●		●		●	●		●	●	●			CHW attended refresher courses; community supports CHW with volunteer labor
Tanzania		●	●	●		●	●	●			●		●		Reorganized CHW supervisory system
Thailand/Kraisid		●									●				Developed four province-specific supervision models
Uruguay	●							●		●					Formed health committees and trained volunteer promoters

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were more broadly solicited under the small grants program, described in Appendix A, but accepted proposals were all in the focus areas.) Tables 2 through 4 list studies by major topics.

PRICOR studies concentrated on real-life problems identified by local PHC managers. They addressed such questions as what should CHWs do, how should they allocate their time, what can be done to make supervision work, how to figure out an effective but inexpensive way to train mothers in ORT, what role should the community play in PHC, and how to pay CHWs.

In the community financing studies, for example, the circumstances leading to community financing as a possible solution were complex:

- In Zaire, program managers sought community financing in order to implement a new Ministry of Health decentralization policy. Central government resources were not adequate to permit service extension or new programs.
- In Rio de Janeiro, researchers from a local Private Voluntary Organization, CPAIMC, feared their dependence on foreign funding sources, while in Senegal, health planners sought alternatives to using USAID funds for supervision and other recurrent costs.
- Economic setbacks in Honduras, and government inability to buy sufficient drugs in Dominica, motivated community financing studies in those two countries. The Dominica study was also an effort to improve drug procurement, inventory control, and distribution.
- Poor CHW morale and high attrition rates in Bolivia and Swaziland led researchers to identify financing shortfalls as key problems requiring solutions.

Most PRICOR studies had multi-dimensional goals, as suggested by the above examples. In Bolivia, researchers sought to reduce high CHW attrition rates and ensure coverage of vital PHC services in rural areas. In Brazil, CPAIMC sought to increase service accessibility and use in the urban slums of Rio in addition to reducing dependence on external funding. In Haiti, the study team wanted to give mothers incentives for learning child survival interventions while at the same time motivating health workers to teach these skills. Dominican health care managers were just as concerned with improving drug procurement and distribution as they were with strengthening financing.

2.1.2 Selected Findings and Solutions

The PRICOR studies helped decisionmakers find viable solutions to difficult and complex problems. For example, in one priority area, community financing of PHC studies, in Honduras, Brazil and elsewhere found that community people were willing and able to pay for health care, contrary to the conventional wisdom. A

study in the Philippines showed that village drug depots (boticas) were effective mechanisms for raising funds for PHC. A study in Thailand identified thousands of successful community-managed revolving funds, many of which were supporting nutrition and sanitation activities as well as drug supply. In Swaziland, a study came up with a novel way to support rural health motivators (RHMs). From a variety of options, the community chose to donate communal land and agricultural labor toward the production of a crop that would be given to the RHM, who could then sell the crop for cash.

This last example illustrates how many of the OR projects came up with solutions that were novel but culturally acceptable because they involved communities in the analysis of the problem and the development of solutions. The involvement of villagers, CHWs, and especially PHC program managers in the research is a characteristic feature of PRICOR studies. The studies were designed from the beginning with the end user in mind.

2.1.3 Impact of PRICOR Studies

In addition to advances in the adoption of OR techniques to approach PHC problems (see Section 4.0, Methodology Development), PRICOR staff currently estimate that about two-thirds of the studies have had a significant impact on the delivery of PHC services. This is a very high "success rate" for applied research. We attribute this to the many strengths of the methodology and the high caliber of researchers who carried them out. Examples of study impact on service delivery include:

- As a result of a financing study in Thailand, the Ministry of Public Health is encouraging communities throughout the country to set up diversified revolving funds to help finance PHC.
- In the Philippines, OR techniques were used to test alternative financing schemes for maintaining or expanding basic PHC coverage in the community. Five villages in Iloilo (the study province) chose to establish and fund "boticas" (small community-run drugstores). The success of this study has attracted the interest of the national government, which has had little success with its own attempts to stimulate community financing.
- The supervision goals developed through the PRICOR study in Tanzania have been adopted by the MOH as the official goals for the Village Health Worker (VHW) program. Villagers and village health committees are significantly involved in the supervision of their VHW. Another OR study has begun based on the results of their first OR study.
- The productivity model developed in the Jamaica study is being tested by the MOH in two health districts.

- The nutrition syllabus developed by PRICOR researchers in the Philippines and the health education syllabus developed in Liberia have been adopted as the standard curricula for their respective countries.
- In Egypt, a national mass media campaign for ORT is using the nutritional message developed by PRICOR researchers.
- Perhaps the most dramatic example is in Honduras where a cost-reduction study conducted by PRICOR researchers has saved the Ministry of Health \$1.5 million.

The studies were also designed with replication in mind. In the Philippines, when the research communities asked for "seed money" to bankroll the establishment of their boticas, PRICOR declined on the grounds that this was not a replicable approach, as PRICOR could not provide seed money to other communities throughout the Philippines. The research team and local leaders then came up with a variety of schemes for raising the needed capital, ranging from assigning a "contribution" from each household to imposing taxes on sales of produce and livestock, and raffling pigs.

Replication of the results of several PRICOR studies has already taken place.

- A project in northeast Brazil has developed a highly effective way to improve the use of ORT by using traditional healers as providers of ORT. This strategy is now being extended to the entire state of Ceara in collaboration with Project Hope.
- In Benin, a PRICOR-developed community financing and management scheme was developed that resulted in the recovery of 100 percent of health center and community-level costs. This system is being replicated in another commune in Benin and is being studied by the Ministry of Health in Guinea as an option that they may implement.
- A drug procurement system was developed in the Ministry of Health in Dominica that resulted in drugs being purchased at a lower cost and managed more efficiently. Stockouts decreased by 65 percent, supply increased by 20 to 30 percent, and there was up to a 6-fold unit cost decrease in certain drugs. This system is being used as a model for other countries in the Caribbean.
- In Liberia, a series of community-based revolving drug funds were capitalized and managed by communities. Adjacent communities have become interested in participating in the scheme and are in the process of extending services into previously unserved areas.

PRICOR studies dealt not only with national and regional level problems, but also reached into previously untouched areas dealing with some of the hardest to reach

populations. A study in a remote area of Gongola State, Nigeria, helped staff from the Christian Reformed Church of Nigeria Rural Health Program find testable solutions to a chronic problem of attrition of village health workers. Though inadequate financing was the apparent problem, researchers identified non-financial means of boosting CHW morale and expanding career opportunities. Another study in Papua New Guinea developed and tested ways to reorient the health services from a curative to a preventive philosophy by increasing community participation in program planning. In rural Bolivia, a research team found a way to extend PHC into areas where no formal services had been previously provided by training and deploying low-level health workers who are paid a reduced community-financed salary. Funds to pay the salaries are raised, by the way, by assigning quotas of wheat or potatoes that are collected after the May harvest.

Beyond solving immediate operational problems, the feedback from the investigators confirms that the impact of the studies will have widespread spin-offs. This they attribute to their enhanced capacity to solve problems, the recognition of the importance of involving key decisionmakers early in the research process, and the utility of the OR process for dealing with a variety of problems. As most of the studies have only recently ended, the full impact of their results cannot yet be measured.

2.1.4 Accomplishments

Each study brings its own individual accomplishments to the PRICOR Project. In examining all the studies for trends in contributions to the development of primary health care in the developing world, outstanding accomplishments include:

- Local researchers systematically solved important PHC service delivery problems and most of these solutions were implemented, an important measurement of the success of the researchers and of the PRICOR Project. The high rate of implementation is attributed to three characteristics of the problem-solving methodology: the solution was identified using an analytical process, incorporated important variables and constraints, and included the participation of key decisionmakers.
- As a result of the country studies, new and/or enhanced primary health care services are being provided in hard to serve areas and for high risk populations.
- Despite the small number and low quality of research concept papers from Sub-Saharan Africa in the initial screenings, 16 studies were eventually funded in that region, the result of a proposal development workshop and extensive technical assistance from PRICOR. This represents an important step forward for AID-funded work in a priority region.

- The results of the studies contribute significantly to the state-of-the-art in specific child survival interventions, and to an understanding of how primary health care services at the community level can be delivered and sustained.
- A cadre of researchers and managers have been trained in OR who will continue to use the approach in solving problems. This capacity-building has included the principal investigators, other study staff, and workshop participants in participating countries as well as many researchers and managers who have used the PRICOR monographs to guide them in solving operational problems.
- Local institutions that have worked with the PRICOR researchers have an enhanced capability to manage grants. They have developed skills in preparing budgets, following AID regulations, monitoring financial commitments, and institutionalizing administrative processes.
- The results of the country studies demonstrate the utility of the PRICOR approach to OR. It is a practical, feasible approach to solving complex service delivery problems in developing countries using the classic OR logic and appropriate OR techniques.

2.2 PROJECT MANAGEMENT

2.2.1 Study Selection

PRICOR solicited studies worldwide using a 12-page brochure printed in French, English and Spanish. Two funding tracks were developed: one limited to USAID Mission-initiated studies, and another open to researchers interested in conducting studies in eligible countries worldwide. Special efforts were made to assist applicants from Africa and from USAID missions.

Each applicant was instructed to submit a six-page concept paper prior to preparation of a full proposal. Numerous inquiries, and over 400 written proposals were received. PRICOR staff and outside reviewers carefully scrutinized each concept paper, and applicants passing preliminary review were then invited to submit full proposals.

PRICOR staff worked closely with potential researchers to develop acceptable proposals once a concept paper had been approved. Detailed comments and questions were mailed along with the proposal invitation. Technical assistance was sometimes provided, especially for USAID mission proposals. A workshop was conducted in Swaziland to assist African applicants; 11 of the 12 participants eventually developed acceptable proposals. Only fully acceptable proposals, most reviewed by outside specialists, were funded.

Six review cycles were completed by the project. A total of 438 concept papers were received of which 49 studies were eventually funded and 45 eventually completed. The first two cycles of the review process differed from the last four in that the staff played a major role in determining which projects should be rejected before the external panel review. In the first two cycles, the staff rejected about 60 percent of the initial concept papers. In the others, the staff rejected only approximately 30 percent of the initial projects. In these latter cycles, consultants were added to the review process, so that staff only screened papers obviously not suited to PRICOR (such as requests for a scholarship, a descriptive family planning survey, or a project on disaster relief). The new second stage included review by both staff and consultants. The reason given by the PRICOR staff for this change in routine was a concern that reliance primarily on PRICOR staff would bias the types of studies funded.

In reviewing twenty of the rejected projects in each topic area, the mid-term evaluation generally agreed with the review process. Reasons for rejection of projects included: lack of a clear research design or problem, poor methodology, absence of the three-phased OR model, a focus on only one aspect (such as a pilot test), inadequate links to decisionmakers, and topics for study which were not priority concerns.

2.2.2 Country Study Monitoring Plan

The PRICOR Country Study Monitoring Plan had three goals: 1) to assist in the technical guidance of each study; 2) to assure that at the conclusion of each study an appropriate technical record existed to permit an evaluation and subsequent dissemination of conclusions drawn and recommendations promulgated by the investigators; and 3) to ensure and verify fiscal compliance by recipients of funds.

The approach to obtaining these outcomes was a combination of requiring regular reporting by organizations which received PRICOR funds to carry out studies, systematic tracking by PRICOR of compliance with reporting requirements, and review of report documents by PRICOR staff, with written and on-site feedback as necessary to clarify and rectify problems.

Once the local USAID mission and the AID contracts office approved a proposal, the PRICOR budget/subagreement officer negotiated a subordinate agreement with the institution sponsoring the research. The subagreement was "incrementally-funded and cost-reimbursable." Funds to cover anticipated initial expenses were advanced, but subsequent payments followed a prearranged schedule and were subject to receipt of acceptable technical and financial reports. Recipients were also required to adhere to U.S. Government Standard Provisions and the Center for Human Services' General Provisions. The majority of subagreement recipients were audited after the completion of their studies.

2.2.2.1 Promotion of Technical Quality

To assure the technical quality of studies, measures were taken before and after funding. The pre-funding procedures are described in detail in Appendix A. Numerous levels of review and approvals were important check points for each study.

After a study was funded, principal investigators were required to submit bi-monthly or quarterly progress reports, outlining activities during the period and relating these specifically to progress on scheduled events. The subagreement required the following to be included in the reports:

1. Progress to date;
2. Work in progress;
3. Problems and difficulties encountered;
4. Previous problems and difficulties solved;
5. Assistance or guidance required of CHS; and
6. Next work scheduled to be undertaken.

Each report was reviewed by the PRICOR staff monitor, and evaluated for its implications with regard to achievement of study objectives, costs, and timetable. Problems, in particular, were noted and a response to these requested if necessary. Comments were prepared and sent to the principal investigator. The PRICOR monitor visited the study site or arranged for a consultant visit if a problem threatened the successful outcome of the study.

All relevant study documents were maintained in a physical file. To monitor the scheduled and actual flow of events, an electronic record called the Country Study Status Report (CSSR) was maintained on a microcomputer. This record was updated by the study monitors and sent bi-monthly to all PRICOR technical staff, the AID Office of Health, and to the appropriate AID Regional Bureau.

The CSSR is a management tool to help the PRICOR monitor track the progress of the study at a glance. The format shows completed and outstanding milestones, technical assistance, and technical and financial reports. Each monitor established the level of detail which provided adequate control without over-elaboration. The "Action" section was intended to serve as a reminder to the study monitor of action to be taken by the staff. The "Status" section was a very brief narrative describing the current status of the study, not an historical narrative. A copy of each bi-monthly CSSR was maintained in the physical file also.

PRICOR staff conducted regular briefings for the AID Regional Bureaus on the studies being conducted in the countries in that region. At that time, AID staff had the opportunity to comment on the progress and course of the studies. Also, on site visits, the staff member or consultant briefed the USAID Mission to update their staff and exchange views. These interactions provided valuable feedback to PRICOR about local conditions and contributed to the overall monitoring task.

2.2.2.2 Administrative Reports

PRICOR prepared and submitted the following reports to AID, describing tasks, activities, and accomplishments:

- Monthly Work Plan
- Monthly Progress Reports
- Bi-monthly Country Study Status Reports
- Quarterly Liaison/Coordination Reports
- Quarterly Financial Reports
- Semi-Annual Project Reports
- Annual Reports

PRICOR prepared Project Status Summaries throughout study implementation and distributed them to AID. Copies of the final reports for each study, prepared by the study investigators, were provided to AID as they were received.

2.2.2.3 Assurance of Appropriate Final Report

The Country Study Final Report served several purposes.

1. It provided a complete record of the study's purpose, methodology, and outcome.
2. It was an instrument for the investigator to offer and support their conclusions and provide recommendations for the resolution of their specific operational problem(s).
3. It assisted PRICOR staff in evaluating the validity of the methodological design and implementation, and of the conclusions and recommendations of the country study team.
4. It became a source of data for the comparative analyses.

The principal investigators received guidance on the format of the Final Report in writing and had an opportunity discuss it at the regional workshops in Liberia and Mexico. Each report was to include: executive summary, background, study purpose, methodology employed, results, conclusions and recommendations, and administrative sections. Final Reports were reviewed by PRICOR staff for thoroughness and clarity of reporting.

2.2.2.4 Assurance of Fiscal Compliance

The Cooperative Agreement establishing the PRICOR Project stipulates that recipients of funds for country studies must adhere to the same fiscal policies as PRICOR itself. Assurance of such compliance began with the subordinate agreement between the Center for Human Services and each country study host organization. In addition, a pre-award audit by a chartered accounting firm was

required for many of the studies to verify such things as proposed daily rates for staff, reasonableness of rental charges for space and equipment, and adequacy of accounting system.

Proposed budgets were reviewed by PRICOR's Budget/Subagreement Officer and some items were negotiated prior to signature of the subagreement. Each subagreement contained a provision for the holdback of 5-10 percent of the budget until PRICOR determined that all work was completed satisfactorily and that no disallowances of requested reimbursements would be necessary. A post-completion audit was completed in studies which met criteria established by PRICOR.

Recognizing that many organizations do not have sufficient liquidity to "float" the costs of a research study, PRICOR provided an advance payment equivalent to about four months operating expenses. Thereafter, the Recipient submitted requests for reimbursement of paid (not incurred) expenses on a regular basis. These requests were examined by the PRICOR Monitor and Budget Officer for compliance with limits on budgetary line items and regulations regarding allowable expenses. Payment was forwarded as soon as allowability of expenses was verified.

A summary of payments and a running balance were entered on the CSSR for ready access by the staff monitor. A detailed budget and expenditure record was maintained also by the Budget Officer.

2.3 LESSONS LEARNED

2.3.1 Selection of Study Problems

One of the major strengths of the PRICOR project was its emphasis on local problem-solving and integration with management. Proposals were solicited worldwide within certain broad problem categories; while there was a requirement that problems be "significant," no effort was made to ensure that study problems were indeed the most critical within a given context. Problem analysis was seen as the first stage of the research itself; often systematic analysis of symptoms and underlying causes led to significant redirection of the research.

Local variability in problem identification and systems analysis complicated subsequent comparative studies. PRICOR has now developed a systematic analytical tool for more careful problem identification and prioritization as a first step in operational studies.

2.3.2 Incremental Funding Of OR Studies

Operations Research studies focus on priority problems. When those priorities change, the studies need to reflect this. Unlike basic research, researchers must be responsive and sometimes alter the approach. A second related complication in funding OR studies is the difficulty of predicting how the three phases will be carried out before the research has begun. For example, often what is learned in

the problem analysis influences how the solution development phase will be carried out. One way of addressing both changing priorities and evolving knowledge about the health problem is to fund OR studies in stages, with discrete outputs defined at the end of each phase before the succeeding one is funded.

2.3.3 Development of More Rapid OR Approaches

PRICOR studies took an average of 20 months to complete. PHC managers often require results in much shorter periods of time. Strategies need to be elaborated for conducting OR much more rapidly.

2.3.4 Development of Generalizable Findings

Since the PRICOR project was designed to concentrate on "country-specific" problems, comparative analysis and generalization were not priorities. As the project developed, however, it became clear that there was a growing interest in generalization. In the future, where it is possible, methodologies should be standardized so that generalization will be possible.

2.3.5 Use of Heuristic Techniques

Given the complexity of PHC problems in developing countries, traditional social science methods of research and classic OR techniques are appropriate in only limited situations. When the data, computational, and cost factors preclude these techniques, heuristic techniques have proved to be easily adapted to complex problems, require less data, are more understandable, and generate feasible and acceptable solutions at a reasonable cost and in an acceptable time frame.

2.3.6 Technical Assistance in OR

Researchers benefited from extensive contact with the PRICOR staff. Technical assistance, in writing, over the telephone and in site visits, was critical at key points in the studies particularly at the outset and in the development of alternative solutions. In addition to the PRICOR monographs, the use of the summaries as case studies, have been invaluable in providing technical assistance to researchers in how to carry out OR.

2.3.7 Institutionalization of OR in PHC Programs

PHC program managers must have the human and financial resources available to them to design and conduct problem-solving studies. These resources could be located in an OR Unit within a PHC program, at a local university, or among private sector research organizations. Wherever feasible, assistance should be provided to help institutionalize an OR capability within host countries.

2.3.8 Short- and Long-Term Training

One of the most significant problems that has faced PRICOR is finding ways to transfer OR technology to host country researchers, most of whom have had very little social science training and no exposure to OR. The workshops and manuals that PRICOR developed have helped to address that problem, but there remains a significant need for both short- and long-term training in OR for host country researchers.

That these studies dealt with significant operational problems in the delivery of primary health care is clear. But it would be misleading to give the impression that they were all successes. A few studies were not completed, some developed extensive problem analyses but no solutions, some developed solutions but ran out of time or funds before they could be tested. Nevertheless, the direction of the research proved to be correct. Primary health care is a community-based concept that relies on community involvement if it is to succeed. By concentrating on locally-identified problems and providing relatively modest resources to study those problems, and by developing locally-acceptable solutions and testing those solutions in the communities, the PRICOR program demonstrated that operations research can play a significant role in improving the delivery of primary health care.

2.4 CONCLUSIONS ABOUT COUNTRY STUDIES

PRICOR's funding and substantial completion of 45 studies in 29 countries, including studies in 10 African countries, was a major project achievement. The fact that these studies were tightly managed financially and strongly supported technically adds to the accomplishment. Few other international research projects have been as successful in their scope or quality.

PRICOR's competitive award procedure and encouragement of developing country investigators brought forward a new group of primary health care personnel, many not previously involved in international collaboration. Many of these researchers are likely to have continuing influence over national health activities, unlike typical expatriate researchers who may produce useful results but then usually withdraw from the scene. PRICOR carefully selected and then nurtured these researchers through workshops, site visits, and regular technical correspondence. Their identification and development were major project achievements.

PRICOR's administrative and management process gained wide respect, including that of the AID contracts office. Staff provided clear guidance to subagreement recipients and carefully observed processing details themselves. The contracts office granted CHS additional approval authority as a result. Post-completion audits show that financial monitoring was very effective.

While overall results were positive, PRICOR staff eventually concluded that a series of smaller studies within a few countries would probably have greater impact than major one-time efforts. Staff should probably be on hand more frequently, perhaps residing in or near the study country. Close technical guidance

is especially needed during start-up of studies, and at the point of solution development. Greater staff access to raw data is needed to ensure quality control. All of these improvements have been instituted in the follow-on project now underway.

3.0 COMPARATIVE ANALYSES

PRICOR studies illuminated peripheral-level primary health care processes and significantly increased international knowledge about community financing, health workers, and oral rehydration therapy. Forty-five studies were substantially completed, mostly in relatively isolated rural areas. Sixteen studies produced significant information on community financing, sixteen on oral rehydration therapy, and thirty on community health workers. (Most produced information on multiple topics.) PRICOR staff analyzed these studies within comparative frameworks and prepared reports on the three topics listed above; the study files and the summaries that PRICOR staff prepared will be a rich source of data for further analyses over the next several years.

In reviewing these comparative analyses, it should be understood that PRICOR studies were explicitly designed to resolve local problems within existing organizational contexts, and that generalizability of results was not a project objective. Through workshops, extensive technical assistance, and wide distribution of methods manuals, PRICOR staff encouraged a common approach to problem analysis, solution development, and validation. Common variable definitions and analysis plans were not imposed, however, because of the enormous variation in local contexts and study problems. This was clearly necessary in the first phase of any major PHC operations research project; too little was known about how to resolve specific problems to attempt to impose a rigid comparative framework. As the comparative analyses show, PRICOR researchers and the world at large learned a great deal about problem solution processes and specific applications, but findings have yet to be validated for new settings.

3.1 THE PROCESS FOR DEVELOPING COMPARATIVE ANALYSES

As final study reports began to arrive in late 1985, PRICOR staff developed comparative analysis protocols for use in abstracting study detail for analysis. Protocols were developed for community financing, ORT, CHWs, community organization, and methods. Most were circulated and discussed widely within the PRICOR staff, and at least one was reviewed by outside specialists, to ensure that information would be abstracted wherever available on critical PHC issues. A team of study monitors, research assistants, and writers was assembled to abstract the study reports.

Abstracting activities were intense during the period leading up to the June 1986 PRICOR international conference because of our need to identify discussion issues for the meeting, and to plan for comparative presentations at that meeting and at the National Council for International Health (NCIH). Each completed protocol was reviewed by technical staff, and in many cases, internal critiquing sessions were held to clarify what we had learned and not learned and how such research might be done in the future. These sessions also considered commonalities and differences among studies in the same subject area. By March 1987, over 150 country study protocols had been drafted, reviewed and entered into comparative analyses. (Most studies contributed to multiple comparative analyses.) Final report

information and interpretations were verified and amplified at the June PRICOR international conference.

Rough drafts of comparative analyses were prepared and critiqued in internal PRICOR review sessions prior to the June conferences and subsequently presented both to the assembled principal investigators and to NCIH participants. Pressure of PRICOR II work, however, as well as delays in receipt of critical country study reports, led to work being temporarily set aside through much of the summer and early fall. Work resumed in October and has now been completed.

The results of these efforts are comparative analyses on community financing, oral rehydration therapy, and community health workers. (All three deal with community organization and with methods. These had been identified for separate analysis but were addressed in the three main papers.) The three comparative analyses are available in manuscript form for distribution to interested parties, and results will continue to be presented at international meetings and other gatherings. A great deal has been learned about the process of developing sustainable community-based health activities, and PRICOR will continue to disseminate this information as appropriate. Summaries of each of the three comparative analyses follow.

3.2 COMMUNITY FINANCING OF PRIMARY HEALTH CARE

Recognizing financing's urgency, PRICOR selected community financing as one of four subject areas in which it would work between 1981 and 1986. Sixteen studies were funded either to document or to develop community/user financing activities. Six of these studies were in Africa, three in Asia, and seven in the Latin American/Caribbean region. Six additional studies produced significant data on health care expenditures, costs, and productivity. In all cases, PRICOR supported American or Less Developed Country (LDC) researchers through funding and technical guidance but did not do the research itself.

Study locations ranged from the sometimes violent urban slums of Rio de Janeiro, to the relatively traditional rural communities of Zaire, Liberia, and Bolivia. Some researchers tried to guide the design of specific community financing schemes, while others sought to influence the policy environment. Some studies were prospective, that is, intended to study and influence future conditions, while others, like traditional evaluation, were mainly intended to analyze current conditions and their causes. Some studies were national in scope, others encompassed only a few communities. Some studied government ministries, others private groups. Despite their diversity, these studies produced a rich collection of comparable findings, particularly relating to the need for a systematic analysis of sustainability problems and to the process by which solutions were developed.

Perhaps the single most important conclusion to be drawn from the PRICOR-supported studies is that sustainability is a complex problem requiring complex solutions, not just increased resource generation. To reduce sustainability concerns, PRICOR-supported researchers worked in four areas, namely:

- Program Design. To respond more effectively to community demand (but also to help shape demand),
- Cost Reduction. To make even simple services more affordable,
- Resource Generation. To pay for basic drugs, health worker salaries, and key support elements, and,
- Management. To improve program quality, to help improve worker stability and performance, and to strengthen fiscal accountability.

The studies make it apparent that community financing efforts addressed only to, say, resource generation, are less likely to succeed than ones that address other areas as well. To a certain extent, moreover, researchers found that problems due to apparent resource scarcity could be resolved through cost reduction or improved management without the need to generate new funds.

Program Design - Demand Creation and Response. In designing community financing schemes it is essential to remember that what health professionals want may not be what intended beneficiaries want, and that in any case, even simple programs may be unaffordable. People by and large are primarily interested in curative care because it responds to immediately perceived needs and has readily observable outcomes. Preventive care is usually less popular, at least until its benefits have been demonstrated, and there has been doubt about the feasibility of community financing to support it.

PRICOR-supported studies found considerable grounds for optimism about preventive care, however, especially when efforts were made to build on--rather than simply accept--existing demand. In Thailand, communities were found to actively support water, sanitation and nutrition activities, either by participating in revolving funds specific to these activities, or by financing them from drug sale profits. In Rio de Janeiro, the two biggest sources of new revenue were charges for Pap smears and contraceptives. Surpluses from curative care were used to cross-subsidize preventive care in Zaire and Benin; while demand for low cost loans helped generate incentives for child survival activities in Haiti. Investigators learned that they had to look closely at what communities were willing and able to pay for, but that disinterest in preventive care could be bypassed using creative financing.

A number of researchers found that community demand was affected as much by the perceived quality and convenience of services, and by the public's knowledge of them, as it was by cost. These concerns were best dealt with through improved management rather than by financing changes alone.

Cost Reduction. Researchers in Dominica and Bolivia concentrated on cost reduction as a means to make services more affordable and as a necessary prelude to community financing. Up to six-fold cost savings on individual items were achieved in Dominica through bulk procurement and competitive bidding; while in Bolivia, the functions and selection criteria of local health workers were simplified

to reduce salary levels by 50 percent. The danger of reducing costs too far was suggested by Zairian results showing that some health centers made ends meet by drastically curtailing expenditures per capita and per clinic visit.

Resource Generation. Researchers generated new resources through drug sales, service fees, credit schemes that produced surpluses, and ad hoc fund raising. Payments in cash, in labor, and in kind were reported. Researchers in Zaire and Benin reported nearly full cost coverage at the community level, while most of the revolving drug funds developed or documented in PRICOR-supported studies generated sufficient income to maintain or expand capital.

Management. Many researchers found that management concerns were more critical than resource generation in making programs sustainable. Research on management systems was conducted to:

- maintain or improve program quality,
- improve health worker stability and performance,
- ensure fiscal solvency.

Studies on community health workers found that supervision, community respect, and opportunity for career advancement were sometimes just as critical as cash income for stability and performance. Even though Nigerian health workers with the lowest salaries had the highest attrition rates, the principal investigator, found that many could be motivated to stay on the job through non-financial means. Some researchers reported that regularity of payment was just as critical as the amount. The sustainability of revolving drug funds also depended on good inventory control, supply systems, and procurement--all management concerns. Systematic analyses of support systems and local management factors may be essential for community financing.

A second major area of comparative findings concerns the processes by which solutions to sustainability problems were developed. Instances of communities actively supporting professionally designed projects were rare. More commonly, professional/community compromises were needed to reflect community demand for curative care, to reduce costs to levels the community could afford, and to give communities a greater sense of control. Traditional desk-bound research would not have addressed these needs, because it would have prevented participation by community leaders and program managers. Unstructured, non-data based, decisionmaking might have been equally ineffective given the importance of cost and utilization data and other research evidence. Appropriate solution development, in many cases, involved structured consensus-building, through preference matrices and other techniques.

Most studies involved three very different groups of people, namely, community residents and leaders, program managers and workers, and technical analysts/researchers. Community residents were needed to clarify their interests and resources and to "buy-in" to resulting financing schemes. Health workers were needed not only to develop improved management systems, but also, in some cases, because their own livelihood depended on results. Analysts were needed to study

program costs and community demand, to conduct systematic reviews of management and service delivery processes, and to coordinate the involvement of other groups. In many cases, their most important contribution was the introduction of heuristic problem-solving tools. Though several researchers collected extensive data sets, these were often less useful than discussions with community leaders and simple community-level analyses.

PRICOR researchers, in brief, found that making projects sustainable was more than a matter of financing and that, indeed, new revenue generation was sometimes the least of their problems. To be sustainable, projects have to run well and produce high quality care. If dependent on a community financing, they must respond to public demand. Existing disinterest in preventive care, rather than being an irremovable obstacle, may simply be a problem to be overcome through creative solution development. The involvement of program staff and community leaders is also critical to the sustainability of a project.

3.3 REACHING MOTHERS WITH ORT

Sixteen PRICOR-funded studies addressed problems in the delivery of ORT services. Of these, five studies concentrated on issues of ORS (oral rehydration salts) supply and services. The remaining eleven focused primarily on how best to develop a local training capacity and/or to train mothers. One of these, while addressing demand issues, also gave serious consideration to improving ORS availability by increasing the number of community outlets. Each study was designed to guide operational decisions; the expected result was an improvement in ORT system functioning, under prevailing or anticipated conditions in that system. Study locations varied from the urban areas of Egypt to the relatively traditional rural communities of Sierra Leone, Liberia, and Haiti. Some studies were intended only for the design of specific ORT programs, while others were also meant to influence national policy.

Results from the problem analysis phase of these studies showed that the availability of adequate ORT supplies was usually a less significant problem than the need to find ways to increase effective demand. Emerging from this phase, too, was a recognition of the critical importance of enabling caretakers to administer ORS to their sick children before they became seriously dehydrated, and to know when and where to take the child if further treatment were needed. Accordingly, many researchers shifted emphasis away from service delivery problems toward finding effective ways to influence the family decision process.

Virtually all the caretaker-focused studies began with efforts to create a favorable social climate. Support from health professionals, the educational establishment, formal and informal leaders was sought in order to secure social and religious sanction for ORT and for the study activities. By design, all of the studies were undertaken in active cooperation with the local PHC establishment, governmental or private. Six of the studies experimented with ways of involving the education sector at the local and national levels. In Liberia, ORT was integrated into a national health education curriculum. Other Liberian investigators followed this lead and involved teachers and school children in establishing a community-based

training capacity. One of the Haiti studies used a similar approach, while Sierra Leone and Brazil involved the teachers alone as ORT promoters or trainers. These studies discovered an acceptable and complementary role for the schools in creating a climate of awareness, support, and sanction for the new ORT practices.

Many of the studies stressed the importance of finding the right opinion leaders, key groups or individuals as community entry points. In Liberia, all the studies worked with village leaders and village councils. In Swaziland, it was the Paramount Chief and the Council of Elders who opened the door for the researchers. In Brazil, obtaining the support of the traditional healers was central. In one of the Haiti studies, investigators worked with a wide variety of local leaders, formal and informal.

Interestingly, as the researchers focused so intently on identifying the best people to serve as community entry points, they inadvertently discovered an entry process. The intensive research process--the baseline anthropological studies and household surveys, the process of identifying caretakers, identifying trainers, training trainers, initiating community and group meetings, and stimulating home visiting--all generated considerable interaction within the community around the subject of diarrhea and ORT. All investigators consulted with formal and informal leaders on numerous activities and questions, and most employed local people as field assistants. In short, the positive role of the research activities themselves in generating support must not be overlooked.

A wide variety of promotional activities were undertaken. Home visits, particularly by CHWs, TBAs, and school children were the most important of these, but other mechanisms played a role. Public assemblies, established social and religious groups, and affinity groups all provided opportunities for ORT promotion. Research teams in Haiti, Sierra Leone, and Liberia used local media, drama skits, music, and other entertainment to spread the message. All studies produced flyers and other print materials for local distribution. These usually illustrated the signs of acute dehydration and the recipe for homemade ORS. None of the researchers had access to national mass media, although national programs were underway in some of the countries.

All the studies were successful in generating considerable awareness of an interest in ORT; some were remarkably effective in enlisting a significant portion of the community in this promotional effort.

As caretaker training became the central intervention of these studies, the training process itself turned out to be of greater importance than had initially been foreseen. Ten of the sixteen PRICOR-funded ORT studies established community-based training capabilities for ORT. In six of the ten, the research teams themselves conducted the training of trainers (TOT)--participating in or even directly selecting the trainers, and designing the training content and methods. In Grenada and two of the Haiti studies, the TOT was left largely to Health Center nurses or PHC service delivery teams. One Haiti study was unique in assembling a training team that included PHC specialists, social and behavioral scientists, and training and adult education specialists.

To reach the largest possible number of mothers with available training resources, the investigators followed two basic training strategies. Researchers in Sierra Leone, Swaziland, Brazil, and Grenada used a one-tier approach in which the researchers and/or community nurses trained one group of community trainers who in turn were charged with reaching all the mothers in the community, (i.e., a simple multiplier approach). Investigators in the six Liberia and Haiti studies opted for more complex designs; they tried to increase the multiplier effect by training two tiers of ORT trainers. For example, in Haiti, the District Health Officer and specialist team trained CHWs, church leaders, school teachers, and Rural Development trainers. These in turn trained community leaders, market sellers, school children and other volunteers, who then finally trained the mothers.

Diarrhea, dehydration and ORT formed the core learning content for the trainers. Most also included messages about child feeding and nutrition. Researchers in Sierra Leone, Liberia, and Grenada also discussed such diarrhea-related topics as sanitation, transmission of infection, hand-washing, etc. Because of resource constraints, trainers in nearly all of the African programs were trained to teach mothers to prepare home-mixed sugar-salt solution, while in the other regions training focused on pre-packaged ORS.

Module development was found useful and efficient in those projects where educational objectives and content varied for different target groups. Curricula from virtually all of the studies included lessons on methods for reaching and training the caretakers. Researchers stressed the importance of training trainers in how to teach as well as what to teach the mothers. The basic approach used lecture, demonstration, and discussion, but some trained workers in more engaging methods of communication: in a Haiti study, trainers were taught promotional techniques, while researchers in Sierra Leone introduced storytelling, drama, role play and singing. In several studies "learning by doing" was stressed, using children with diarrhea and/or dehydration for illustration wherever possible. Somewhat different from the other studies in its duration and intensity, the Brazil project trained healers through repeated demonstrations and regularly held group discussions between the healers and the researchers.

Having established a training capacity in the community, researchers then focused on reaching the mothers and other caretakers through promotional and training activities. Each research team supervised the implementation of caretaker training activities in the field, but in different ways. One research group (Sierra Leone) randomly selected trained caretakers for follow-up evaluation at home. Most investigators employed some means of follow-up immediately after training, except in the case of school children. However, post-tests and evaluations were largely based on verbal recall, often without observation. Comparisons of pre- and post-intervention knowledge, attitude and practice (KAP) studies was the most common way of assessing the results of caretaker training programs.

PRICOR-funded researchers demonstrated that villagers can be trained to serve as volunteers in programs to quickly reach a large percentage of the target population with information, education, and training. They established that an amazing variety of citizens can be trained in ORT themselves and can in turn train caretakers of young children. Those trained as caretaker trainers in one or more studies included: Health Center staff, CHWs, traditional practitioners, community

volunteers of many kinds, school teachers, school children, and market sellers. Researchers in Haiti, in a variant of the "satisfied users" model, also trained mothers to train other mothers. The multiplier effect of this training is evident: although study durations were not long enough in most cases to demonstrate sustained increases in ORT use, virtually all studies registered significant gains in caretaker knowledge and skills.

These studies show that a variety of approaches can successfully enable mothers to use ORT, but the adoption of ORT practice comes more slowly. Enabling comes with the mastery of the necessary knowledge and skills, but having acquired the knowledge, the caretaker must learn to believe it and to develop the self-confidence to put it into practice. Study findings, like the established literature, suggest the need for additional time, improved educational methods, reinforcement, and more community support to reduce the personal risk to the mother of trying something new.

The most interesting policy distinction observed among the PRICOR-funded studies was that between those who approached ORT primarily as a medical question, and those who tried to move ORT into the local folk culture. This is reminiscent of the policy difference between those who saw the oral contraceptive as primarily a medical question, and those who advocated community-based lay distribution systems. That issue has been settled with the recognition that both have their place in a broad-based family planning strategy. It may be that a similar trend is underway in the use of ORS, although it is not clear what the impact of WHO's recent rejection of home-mixed sugar-salt solution will be.

3.4 COMMUNITY HEALTH WORKERS

Worldwide interest in the late 1970's and early 1980's in the use of community-level auxiliary personnel and volunteers to extend primary health care services in rural and marginal urban areas led PRICOR to identify operations research on community health workers (CHWs) as one of its four priorities. Reflecting their widespread use and prevalence of operational problems affecting CHWs, some two-thirds of the PRICOR-funded studies involved CHW strategies. Most of these studies were concerned with improving existing PHC programs that relied on CHWs; a fourth of the studies sought to design new CHW strategies. Of the 30 studies involving CHWs, twelve took place in the Latin American/Caribbean region, nine in Africa, and nine in Asia.

Almost all of the studies examined or developed CHW strategies for rural areas; only three studies were of CHWs based in large urban centers. Slightly more than half of the studies looked at private programs (run by churches, non-profit organizations or universities) that benefited a circumscribed population such as that of a cooperative, a single rural community, an entire district, or a province. Twelve of the studies examined programs sponsored by national governments, and one dealt with a state health service that served several million people. Thus, collectively the studies examined the use of CHWs in a wide range of settings and institutional contexts.

The operational problems addressed by the PRICOR-funded CHW studies can be grouped into six major problem areas in the use of community health workers:

- Determining health workers' tasks (20 studies);
- Selection of CHW candidates (11 studies);
- Training (11 studies);
- Supervision (8 studies);
- Health worker incentives and motivation (17 studies); and
- Community participation in CHW strategies (19 studies).

These topics reflect the prevalence among PHC programs of problems with the effectiveness of health workers' activities, with community acceptance and utilization of CHWs, and with health system support of CHWs through training and supervision.

Task Specification. Major problems identified with CHW tasks included gaps between centrally programmed tasks and specific local health problems, lack of priorities among tasks, CHWs being overburdened with too many tasks, (which were often poorly defined), and unbalance between preventive and curative activities.

While no best approach for task selection was identified, studies did indicate that the selection of appropriate and effective tasks for community-level health workers can be improved by integrating the priorities of both communities and the health system in defining CHWs' roles. The studies suggest that addressing the preferences of communities for certain tasks helps to improve the acceptability of CHWs and increases utilization. Also, the fit between tasks and the person assigned to carry them out will be better if consideration is given to what tasks that person can most appropriately perform, given his or her educational level, social role in the community, and time availability.

Selection. Problems with CHW selection were identified as underlying causes of CHW attrition and lack of community acceptance. Most of the studies focused on the criteria for CHW selection and on the participants in the selection process. Study findings indicate that criteria for what makes a "good" CHW are not universal, but rather must be established to address the needs and realities of specific communities and PHC programs. Studies also found that who selects CHWs can affect their acceptability and effectiveness in meeting PHC objectives. Community participation in CHW selection yielded mixed results in terms of the capabilities and acceptability of the CHWs chosen.

Training. CHW training was a key component in solving specific service delivery problems, such as poor performance, and incorporating new priority tasks into the PHC program. PRICOR-funded studies found that improvements were often needed in CHW training content, because it failed to give health workers the skills they needed to carry out assigned tasks. Strategies such as building in opportunities for practice of skills by locating training in or near the communities where CHWs will work and having trainees practice in real settings the kinds of tasks they will perform, were found to be useful. It was also found that frequently, community health workers need to be trained in how to reach and teach mothers as well as what to teach them.

Training content can be strengthened by use of competency-based approaches and by focusing on the specific health problems that CHWs will face in their own communities. Studies showed that dynamic, skill-building training methods were more appropriate and effective for community-level health workers than reliance on formal training approaches such as lectures. To make CHW training more interactive and competency-oriented, trainers need training and experience in the use of more innovative techniques. Involving persons with knowledge of the communities and experience in health service delivery at the community level is also effective in improving the quality of training.

Supervision. The overriding problem addressed by the supervision studies was CHW performance. These studies concentrated in six problem areas which make up a supervision strategy: functions of supervision, frequency, supervision mechanisms, supervisory agents, resources, and preparation of supervisors. Evidence from PRICOR-funded studies supports the view that supervision is one of the most important contributors to program effectiveness. Effective programs have frequent, supportive and problem-oriented supervision that emphasize continued education, problem-solving, guidance and technical assistance. PRICOR-supported studies suggest that effective supervisors have no distinguishable socio-demographic characteristics or professional background. Individual ability and style are more important than any such characteristics. However, supervisors need training, and they can benefit from such supervision tools as checklists, protocols, and routing schedules. Effective supervision can be carried out by communities, lower-level health staff and groups, and it can be complemented with such communications media as cassettes and video tapes. Finally, the studies suggest that effective supervision need not cost more. If well-designed, effective supervision can actually cost less in the short run while leading to increased performance in the long run.

Incentives. Inadequate CHW motivation is a widespread problem affecting CHW performance, stability, and job satisfaction. PRICOR-funded studies examined types and appropriateness of incentives to motivate CHW recruitment, retention, and performance as well as means to generate incentives. Studies found that incentives are needed to motivate CHWs and that a wide range of material and non-material incentives may be useful. While material incentives, especially money, may be needed in some cases to retain CHWs, PRICOR-funded studies demonstrated that a number of non-material incentives can also influence CHW job satisfaction, including better supervision, additional training, and modifications in CHW tasks, as well as intrinsic social and cultural values that facilitate CHW motivation. Identifying appropriate incentives for volunteers, such as generating community support for their PHC activities, skill enhancement opportunities, and interaction with respected, higher level health workers, is especially important because of the high turnover frequently associated with volunteer health workers. PRICOR-funded studies also showed that incentives are useful for more than simply improving CHW stability; incentives are important for both recruiting qualified candidates for CHW positions and for motivating better performance.

Community Participation. The involvement and support of communities in PHC programs was a critical factor in a large proportion of the successful approaches developed by PRICOR-funded studies to improve CHW strategies. Studies focused

on how to increase community participation in program planning, CHW task specification, selection, supervision, and provision of incentives. Researchers generally found that communities were willing to use and support CHWs if they believed that their services have some benefit. However, if community participation is to be meaningful, there must be some channel or vehicle for involvement. Studies experimented with techniques for opening a dialogue between community members or groups and CHWs and other representatives of the official health system. These techniques provided a practical mechanism for communication and resolution of conflict, and facilitated the identification of locally acceptable and appropriate solutions. While generating and sustaining community involvement in CHW activities does require time and effort, the studies which sought community participation found that there was much to be gained from doing so. Studies demonstrated that involving community members or groups in CHW task selection, training, supervision, and monitoring helps to increase community interest in and willingness to support the activities of CHWs, can lead to increased utilization of health workers' services, and may improve the long-term sustainability of community-based PHC activities.

Lessons Learned. An overall lesson learned from the approaches developed by the CHW studies was that for solutions to be sustainable, they must address the interactions between who the health workers are and what they do, the communities where they work, and the health systems to which they are linked. For example, several studies found that an underlying weakness in many PHC programs is lack of support and involvement from the community. Poor community response may be caused by lack of attention on the health system's part to the health problems that are of greatest concern to the community. Community dissatisfaction with PHC programs in turn negatively affects CHW job satisfaction and CHW stability. Effective solutions to these problems need to reflect the importance of these linkages.

The major innovation of PRICOR studies in addressing operational problems with CHWs was that they attempted to systematically review all the factors relating to alternative solutions—those related to the CHWs themselves, to the community, and to the health system. This led to solutions that sought to balance the needs and priorities of each. The most successful PRICOR-supported CHW studies recognized the importance of addressing community concerns, of strengthening CHW ties with the higher level health system, and of increasing communication between supervisors, CHWs, and community representatives. The studies found that solutions needed to reinforce these interrelationships in order to improve the performance of CHWs, to make CHW-based strategies more sustainable, and to make CHWs more accepted and used by their communities.

The collective experience of the CHW studies also supported the conclusion that the process used to develop solutions has a great impact on their acceptability and therefore, sustainability. In some cases (such as in the determination of CHW tasks and the selection of CHW candidates), the appropriate solution depended both on the preferences of the relevant decisionmakers (which frequently included community leaders as well as PHC program managers) as well as on objective information (e.g., CHW characteristics statistically associated with stability). Techniques such as nominal group, preference matrices, and MUA, which facilitated group decisionmaking and the integration of the priorities of various

participants, provided a practical mechanism for identifying locally acceptable solutions. The PRICOR-funded studies demonstrated that these techniques may be used with a wide variety of participants, ranging from mothers and traditional healers to MOH officials. The group processes were useful not only for bringing into the decision framework relevant points of view, but also for creating consensus about the most feasible solution and building a sense of ownership of the decisions made.

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4.0 METHODOLOGY DEVELOPMENT

Few field research programs have any formal procedures for deciding which research issues are most important. Thus, if this step of the PRICOR methodology is even partially successful, it represents an improvement in a state of the art which is little more than intuition.

--PRICOR Mid-term Evaluation Report

4.1 PRICOR'S APPROACH TO OPERATIONS RESEARCH

One of PRICOR's most significant contributions has been the development of an applied, problem-solving research methodology. This section describes the approach, its application in the field, and lessons learned from this experience.

When PRICOR began, the staff faced two immediate problems. The first was to define the range of problems to cover. The second was to decide what methodological approach to adopt. In answer to the first problem, a group of experts recommended that PRICOR concentrate on the delivery of PHC at the community level, rather than at the health center or hospital level, for several reasons:

- PHC is a community-oriented approach;
- Community participation is generally acknowledged to be critical to the success of PHC; and
- Little research had been conducted on operational problems of service delivery at the community level.

The second, a methodological problem was more difficult to solve. Classical OR has been used extensively by business, industry, and defense to solve such operational problems as scheduling, resource allocation, transportation planning, and the like. It relies heavily on highly quantified techniques (linear programming, queuing, and Markov chains, for example). Although classical OR has been highly effective where it has been applied, its successful adaptation to operational problem-solving in complex social systems has been infrequent. In 1978, Parker [1] conducted a review of the literature on the application of OR in the health field and found that the most common applications had been made in hospitals. This is largely because a hospital resembles a typical industrial enterprise. In the hospital, these techniques can be applied very effectively to problems in such areas as: forecasting the demand for service, facility location,

ambulance deployment, size and scheduling of special facilities, staff scheduling, and hospital inventory management.

Many of the classical OR techniques and their applications in the health field are not relevant to community-level problems. Part of the reason for this is that many of these models can only deal with a limited number of variables whose values can be determined; whereas community-level problems involve large numbers of variables, some of which are difficult to identify, much less measure. Also, most models require assumptions (linear relationships in linear programming, for example) that are not appropriate for community-level PHC problems.

AID's Office of Population has supported operational research for over a decade, but their approach has relied heavily on controlled field trials to test hypotheses about how different family planning strategies affect utilization and fertility rates. They have not, until recently (partly as a result of PRICOR's influence) viewed OR as primarily a problem-solving strategy.

Appreciating the operational problem-solving focus of classical OR, but mindful of the limitations of classic OR models, the PRICOR staff has developed a general approach to operations research in primary health care that remains true to the process and purpose of OR, but is flexible about specific models and analytical techniques. Such an approach allows investigators to use whatever research methods seem appropriate, from in-depth anthropological observations, sample surveys, and other traditional social science methods, to practical management science methods. These methods include systems models, heuristics, group decision techniques, and such optimization techniques as cost-effectiveness analysis and linear programming. [2,3,4]

What has emerged over the last few years is a practical and flexible problem-solving approach to OR comprising three phases, each of which is made up of a number of steps (see Table 5). In this approach, a delivery system is first analyzed and then broken down into smaller, more manageable problems for study (Phase I). These smaller problems are then investigated to identify possible solutions (Phase II). The potential solutions can then be examined systematically and critically, and the most promising selected for testing (Phase III).

The team that conducted a mid-project evaluation of PRICOR stated that:

It is the (9) steps leading up to the field test that most distinguish the PRICOR methodology from conventional field research...

This methodology is potentially a major theoretical advance in PHC research.

The practical contribution is that the steps show an investigator and a program administrator how to take operational problem-solving from the intuitive to the systematic. Thus, it is not only a contribution to research methods, but to PHC program management as well.

What is striking about the approach is its logic and simplicity. In a field that had been dominated by sophisticated research designs and complex mathematical

modeling, this approach has enabled local researchers and program managers to see an operational problem from a management perspective--that is, asking what can be done about it--and then to systematically examine the problem, identify solutions, and test them in the field.

Although it appears linear as shown in Table 5, the process is an iterative one, more cyclical than linear. For example, the testing of one solution may highlight other problems in the system that need to be studied. It is not always necessary to carry out all three phases, either. In cases where the problem is clear and the alternative solutions obvious, the research can concentrate on testing the solutions. In other cases, where the problem is ill-defined, the research must begin with a "diagnostic" analysis to describe the delivery system and identify the causes of the problems before developing and testing solutions. In a number of cases, PRICOR investigators have found that this initial problem analysis phase has been particularly valuable because it revealed aspects of the problem that had not been evident before and pointed to solution alternatives that had not been considered.

This problem-solving process was documented in a PRICOR monograph distributed to all PRICOR researchers and to many interested applicants. It was also incorporated into training materials that were used by staff and consultants to orient host country investigators to the concepts and procedures of operations research.

Regardless of whether the research involves one, two, or all three phases, each phase requires the setting of study objectives, development of a design, specification of key variables, sampling, data collection, and data analysis. This dynamic, interactive, and iterative process draws on research methods from various disciplines and for that reason is often interdisciplinary in nature.

The PRICOR staff does not see this approach to OR as a substitute for traditional social science. Rather, it is an enhancement which can help researchers and program managers move beyond description, evaluation, or hypothesis testing to take an explicit problem-solving approach to service delivery issues.

Investigators in a number of countries have found the three-phased approach practical and useful. In Jamaica, for example, a research team studied ways to improve health worker productivity by first analyzing the way health workers spent their time. Then they developed a model for reallocating personnel resources. Trial computations in two districts showed not only that services and population coverage could be increased, but that personnel costs could be reduced at the same time.

Local investigators have also learned to use simple, but effective OR techniques in both problem analysis and solution development. Investigators in Ecuador, for example, successfully applied decision trees to examine alternative CHW supervision strategies. During subsequent OR workshop in Ecuador, the local investigators made such an impressive presentation of how they used this technique that the workshop was modified to add a session for individuals interested in learning how they could employ decision trees.

PRICOR's approach to problem-solving was an important innovation and contribution to applied research because it advocated the appropriate use of heuristic techniques when others were still advocating quantitative methods as the only way to address problems. The PRICOR approach takes into account that in developing countries the data required for making valid and reliable quantitative estimates of system parameters and relationships are often unavailable, and obtaining them at reasonable costs is normally impractical. The time consumed in gathering and analyzing the data often exceeds the time available for a decision. Moreover, many decisionmakers find it difficult to accept conclusions based on mathematically sophisticated models they do not understand.

More importantly, many of the decision problems found in such complex social systems as community-based PHC test the assumptions underlying classical OR models. Community PHC systems in developing countries involve processes that are, to quote Kotler [5] "...dynamic, nonlinear, lagged, stochastic, interactive, and downright difficult." In such cases, heuristic methods have an accepted place among the tools of management science and OR for systematically analyzing and solving operational problems. Although the models do not guarantee optimal solutions, when carefully designed and executed they can result in good initial solutions which can be later refined or modified as needed in the field.

A heuristic model has been described as a "rule of thumb for solving a well-defined mathematical problem by an intuitive approach in which the structure of the problem can be interpreted and exploited intelligently to obtain a reasonable solution". [6] Although heuristic models may include variables whose values are estimated from "hard" data on, say, effectiveness, costs, coverage, utilization, etc., they often rely on subjective estimates and may combine categorical, ordinal, and ratio measurement levels. Nor do they assure optimal solutions. To those planners and program managers who prefer determinant solutions, a heuristic model may appear uncomfortably "soft." Nevertheless, there are many situations in which a heuristic process is an effective way of generating a satisfactory problem solution. These methods, which include Delphi, nominal group technique, and preference matrices combine group problem-solving and structured (often quantitative) techniques for processing data from the group.

Multiple Criteria Utility Assessment (MCUA) is an example of a heuristic technique that can be used to generate solutions to complex problems. MCUA offers a systematic procedure for disaggregating the decision criteria into separate explicit components (e.g., cost, effectiveness, rapid response, local acceptability, etc.), and for using these separate criteria to assess the value of each alternative solution (i.e., its utility for the decisionmaker). By considering the criteria one at a time, the issues involved in a decision are made clearer. The technique allows the decisionmakers to decide that the criteria are not of equal importance and to weight them accordingly. A given alternative is assigned a separate score on each of the criteria, considered one at a time. The overall utility score of that alternative is then computed as the weighted sum of its individual criterion scores. Each of the proposed alternative solutions is scored in the same fashion, and from comparison of the overall scores a preference for one alternative over another can be derived. [7] This approach is particularly advantageous when the decision is being made by consensus because it enables the group to come to a common understanding of the factors on which the decision should be made.

Any model is a highly simplified representation of reality and thus subject to error when used in decisionmaking. The analyst must always weigh the cost of adding realism to the model against the benefit (higher probability of correctness) it yields. We believe that where the model fits the problem, MCUA may be a valuable tool. In general, such problems are those where:

1. The criterion for selecting one course of action over others is actually a composite of factors that can be disaggregated; and
2. Partial achievement of one or more objectives of the decision (i.e., the criteria) is a possibility and has some utility.

If such heuristic decision methods are to result in effective solutions, much depends upon the sensitivity and skill of the analyst in performing several key tasks:

1. Interpreting the process to participants and decisionmakers;
2. Helping participants specify an appropriate set of alternatives and criteria for assessing them;
3. Selecting appropriate participant individuals and groups;
4. Finding ways to fill in gaps in participants' information;
5. Finding ways to minimize or mediate conflict.

In the final analysis one is left with a reasonable but untestable assumption that these solutions are likely to take more of the key factors into account and to be more acceptable than those arrived at through the decisionmaker's own knowledge and intuition alone. Since determinate solutions are not possible for most of the problems studied, for all practical purposes intuition and heuristics represent the two available alternatives.

The impact of this approach on other organizations involved in operations research has also been significant. PRICOR has become the recognized leader in the development of applied methodologies. The approach promoted by PRICOR has been adopted by other organizations active in this field; and PRICOR manuals have been widely requested for use in formal courses and workshops on OR. A recent publication on Operations Research: Lessons for Policy and Programs [8], contained 36 citations to papers written by PRICOR staff, consultants, and principal investigators. PRICOR organized other researchers interested in OR into an ad hoc group; this was recently established as an informal association, named Operations Research for Health and Development. In addition, PRICOR staff are often requested to address professional and student groups to describe the OR process and its application in the field.

4.2 USE OF THE PRICOR APPROACH IN COUNTRY STUDIES

A year after the external funding ended and outside consultants left Papua New Guinea, the host country personnel continue to send reports to PRICOR researchers documenting the ongoing use of the OR approach and its adoption by decisionmakers in other development related sectors in East New Britain.

Final Report from PRICOR Researchers

During the problem analysis phase, investigators employed a wide range of methods to gather data to help define and/or analyze the problem. Although roughly 80 percent of the investigators employed surveys and/or interviews, the great majority combined these data with other sources of information (e.g., review of existing documents, observation, or ethnographic investigation). Many found themselves unable to analyze all the survey data in the time they had available, although they were able to use information from preliminary tabulations for the solution development phase.

During the solution development phase, many PRICOR investigators found the use of heuristic decision techniques valuable. Matrix models, especially preference-based models and Multiple Criteria Utility Assessment (MCUA), were among the most frequently used heuristics during the solution development phase. These procedures share the advantages of all heuristics: relatively modest data and computational requirements, fewer restrictive assumptions about underlying statistical relationships, low cost, and easily communicated results. PRICOR studies that used one or more of these semi-quantified models constituted approximately one third of all studies and 43 percent of those reporting that their results had been implemented in some way.

These techniques also lend themselves to flexibility and creativity, as they can be modified for a given situation. For example,

- In Egypt, the researchers modified the interaction matrix technique by simplifying the numbers and using smaller groups composed of peers.
- In Brazil the same technique was modified by using x's to indicate that a relationship existed between variables instead of numbers. Using numbers to indicate strength and importance of the relationships would have been too complicated.

Generally these models were employed in a group setting, most often with program managers and decisionmakers, but frequently including representatives of relevant health worker and client groups. By including the insights and preferences of those closest to the decision, these and other group decision techniques can tap into knowledge not otherwise available to decisionmakers. Perhaps more importantly, they help to enlist the active involvement of those whose cooperation is essential if any solution is to succeed. Three-quarters of the PRICOR studies employed a group decision technique in the solution development phase. It is worth noting that nearly all the studies that reported implementation of their results had used some form of group judgment in this phase. Most researchers felt that the participation of relevant groups in identifying and evaluating solution alternatives was effective in helping to secure their commitment to the chosen solution.

Although heuristics can be useful decision tools, they have several limitations. Where they involve individual or group judgment, the decision criteria employed are subjective, and thus depend upon the knowledge, experience, and values of those selected to participate. If the participants are poorly informed, make hasty judgments, or do not represent those most affected by the decision, the result will be less effective or even unacceptable solutions. In Liberia, for example, one of the four community financing strategies chosen by village leaders using a preference matrix proved to be unacceptable to both community members and CHWs when tested in the field. In Nigeria, special care was taken to ascertain the preferences of women since services were intended primarily for children under five and for pregnant and lactating women.

Where there are serious conflicts among participant groups, it may be necessary to undertake negotiation or other strategies to identify a set of alternatives acceptable to all relevant factions before attempting a group-based heuristic. For example, researchers in Haiti first determined the preference of health officials, then offered the reduced set of alternatives to the community for their selection.

Quantitative techniques such as regression analysis and cost-effectiveness analysis were also used in PRICOR studies. These techniques were applied to such problems as logistics in Ecuador, inventory management in Egypt and India, and productivity in Jamaica. Cost analyses were carried out in Benin and Zaire with results that supported management decisions about pricing and future resource allocation. In each of the four studies which attempted to apply a classic OR optimizing model (Tanzania, Haiti, Korea, Ecuador), the model itself proved to be impractical, although the data gathered in developing the model were used in less formal ways.

Field studies were undertaken in approximately half of the studies; most of these employed a quasi-experimental design, but a significant proportion implemented the chosen solution in a pilot or demonstration area. Though the majority were tested for only short periods, the results in most cases confirmed the solutions chosen.

There is no formal way of evaluating the PRICOR investigators' skill in appropriately using OR techniques, nor the quality of the solutions chosen for field implementation. Field observations by PRICOR staff monitors or others has complemented the documentation in order to make a judgment on how well the

studies were carried out. (The country study monitoring plan is discussed in detail in Section 2.2.2.)

Not all of the projects have followed the approach fully. There is a strong temptation to jump right from the analysis of the problem to testing the first solution that comes to mind, without going through the systematic solution development phase. PRICOR staff have learned that most researchers need direct technical assistance at this stage. In studies where the key steps in the methodologies were carried out appropriately, good solutions were generated. For example, MCUA was used in five studies (the Philippines (2), Nigeria, Thailand, Papua New Guinea) to select CHW training, supervision strategies, or community financing strategies. Observation and documentation suggest that two followed the method closely, two modified it, and one failed to complete the process, therefore, the results from the MCUA were problematic. But the lesson that seems to be emerging is that the process is logical and productive if it is applied. Helping researchers learn how to apply it is the current challenge.

4.3 ADVANTAGES OF THE PRICOR APPROACH

Being service providers before researchers, simple methods are the best and most motivating and replicable.

--Researcher from Haiti

Having examined the results of the 45 completed PRICOR studies, we have concluded that this OR approach to problem-solving has been quite productive. Investigators and decisionmakers alike have found the general approach a logical one and the suggested OR techniques relatively easy to use. The practical advantages of the PRICOR paradigm included:

- A logical and systematic OR approach, coupled with flexibility in the use of analytical models or techniques at varying levels of mathematical sophistication;
- Simple decision heuristics which can be used at the community level;
- Systematic problem analysis at the beginning, thus reducing the chances of studying the "wrong" problem;
- A strategy for developing and formally assessing alternative feasible solutions, before selecting any for field testing;

- A research process which, by involving decisionmakers at every step, enhances the likelihood that the study results will be incorporated in on-going PHC programs;
- An approach which facilitates the transfer of OR capacity to host country researchers and decisionmakers;
- A commitment to disseminating both substantive and methodological information to potential users (i.e., those who will make program decisions).

These advantages are amplified and illustrated below.

4.3.1 A Flexible Problem-Solving Strategy

This approach allows for a range of OR techniques to be applied—from very simple heuristics to complex quantitative models—to improve decisionmaking, making it possible for researchers with sophisticated experience or practitioners with limited research training, accessing various levels of data and resources, to conduct this type of investigation. It is flexible because there are numerous techniques that can be used to accomplish these steps, although the process is much more important than the specific techniques.

The majority of OR techniques used in the PRICOR studies are heuristic techniques, and this may be one of the unexpected, but important contributions of PRICOR to applied research field methods. The reason for this is that real life problems, like those we are dealing with, are complex; and the only practical way the numerous variables can be pooled and processed to reach an acceptable conclusion may be through using these kinds of techniques.

4.3.2 OR Techniques for Community Use

Host-country researchers have also been able to learn to use OR techniques effectively in the community. For example,

- Project staff in Liberia have been able to teach village leaders to use a very simple OR technique (a preference or interaction matrix). Together, staff and leaders conducted their problem analysis and solution development phases quite effectively, selecting a community financing strategy which has since been successfully implemented in the study area and extended to other villages in the district.
- Villagers in Papua New Guinea have actually applied a simplified MUA model to set priorities for their own health problems and to recommend strategies for dealing with them. Moreover, use of the technique by government officials and PVO managers now has spread beyond the health sector.

4.3.3 Systematic Analysis of Problems

The PRICOR approach provides a methodology for analyzing delivery system problems in a systematic manner. The initial phase of the research involves collaboration between researchers and program managers in identifying what the problem really is, and thereby reducing the chance that the researchers would investigate the wrong problem. For example,

- In Egypt, the problem the researchers set out to solve through OR was the lack of access to ORS. However, through the process of problem analysis they discovered that the real problems were poor inventory management and low demand for ORS.
- Researchers in the Philippines began looking at community organization as the problem only to find out during problem analysis that the type of health workers was really a bigger problem than community organization.
- In Swaziland, researchers started out trying to develop a community financing scheme for rural health motivators. Through problem analysis, they found that the community was unwilling to pay CHWs because they did not provide preventive services. Consequently, the focus of the study had to be changed to redefine and add to the functions of the CHWs before a financing scheme could be developed.
- In Nigeria, PHC managers thought that high VHW attrition rates were due to inappropriate selection processes and criteria. Problem analysis showed that the communities did not respect the skills of the VHW and would not use (and therefore compensate) them. Consequently, the operational problem became how to find ways to upgrade the health courses and skills of community workers.

As these examples demonstrate, the systematic analysis of the operational problem in the context of the delivery system has proved vital to the development of appropriate solutions, and in gaining the credibility and respect of critical decisionmakers.

4.3.4 Formal Development of Feasible Solutions

The PRICOR approach to OR shows how to develop and test solutions to problems. After analyzing the problem, investigators set the objective(s) for a solution and identified all the important decision variables and constraints that must be taken into account in developing alternative solutions. Then, in the solution development phase (Phase II of the PRICOR paradigm) a series of alternative solutions are developed, incorporating the important decision variables and constraints. By systematically examining each alternative in terms of variables and constraints



before a field test, solutions that look good superficially, but in fact are not feasible, can be identified and eliminated, thereby economizing resources. The process also enables decisionmakers to participate, understand, and buy-into this decision process. PRICOR experience suggests that the development of appropriate decision models for solutions is the area where researchers need most help.

The approach is flexible enough to evaluate the best options even before field testing or, if necessary, guide the researchers in designing a test of the best alternatives in an experimental, quasi-experimental, or non-experimental field test. In many cases, it facilitates the use of a much smaller, faster, and less costly field test. The approach is a practical, management-oriented process for the purpose of solving an operational problem.

4.3.5 Utilization of Research

The PRICOR approach is very effective in promoting use of research findings because not only does it generate good, feasible solutions, it also shows how to involve those who must implement the solutions (i.e., the program managers and policymakers) in the research itself so that they come to "own" the research. In studies where results were implemented, all involved the users of the research in solution development. For example,

- In Papua New Guinea, early in the study a planning group was formed comprising personnel from all levels of the Church Health Service (which provides much of the direct service in the area) and the Provincial Health Service. Using brainstorming, nominal group process, and MCUA the planning group came to agreement on the important elements of PHC, defined and set priorities among program objectives, and decided upon a strategy for training not only health workers but also community leaders. By involving these decisionmakers in this process, it was possible for them to agree upon a solution that resulted in training the Aid Post Orderlies and community leaders.

4.3.6 Capacity Building

The PRICOR approach to OR facilitated training of host-country staff in techniques and applications of operations research. The approach itself is a training tool in that as it is applied, decisionmakers have become sensitized to its utility in problem-solving. For example,

- A Principal Investigator from Liberia began a second OR study on another operational problem even before his initial study had been completed.
- In Zaire, PRICOR investigators developed the format for a workshop on decentralization using the OR approach to

problem-solving as a model. It has enhanced the ability of researchers and decisionmakers in solving other management problems.

- We have already noted the independent expansion of the use of the multiple criteria group decisionmaking by government and other managers in Papua New Guinea.

In countries where several PRICOR studies were carried out (Liberia, Haiti, India, the Philippines), the investigators learned from one another, sharing methods and results. The level of research activity also generated wider interest, in each country leading to a seminar or workshop organized by the investigators for their colleagues. In Haiti and Philippines, an OR capability has been institutionalized; in India, a local management training institution has added a program in rural health management to its curriculum.

Workshops and other dissemination activities are more fully discussed in Chapter 6. The results have been impressive.

- Researchers from 32 countries have been trained in operations research.
- Many of these researchers (Thailand, Nigeria, Ecuador and Bangladesh are examples) have continued to carry out OR studies after their PRICOR studies ended.
- Several countries (Honduras and Zaire are examples) have institutionalized OR by establishing Operations Research Units.
- A number of universities both in the United States (Johns Hopkins, North Carolina, and Michigan are examples) and in developing countries (in Thailand and Tanzania, for example) have developed courses in operations research based on PRICOR materials.

Although PRICOR established and implemented innovative programs and training in capacity-building, our resources were limited. We foresee the need for the institutionalization of training programs and capacity-building in PHC programs.

4.4 FUTURE DIRECTIONS

The PRICOR approach is not without its limitations, however, and it is clear that improvement can be made in the current approach to ensure that this kind of research becomes even more productive. Among the most significant of these suggested improvements are the following:

4.4.1 Identifying Priority Problems for OR

The initial project was designed to study problems "identified in the field by host-country health officials and program managers." There is no doubt that this was one of the main strengths of the project—its responsiveness to locally-identified problems. However, PRICOR staff noticed that a large number of research proposals dealt with such familiar areas as staff training, while other problem areas—including supervision, information systems, logistics and supplies—were much less frequently proposed. We realized that this was because many PHC managers did not have a way to examine all of their operational problems and set priorities. Where possible, our staff began to encourage health managers to conduct a systems analysis to identify priority problems. Ideally, this should be done prior to selecting any OR project.

4.4.2 Building an OR Capacity into Ongoing Programs

The original project was designed to respond to requests to study "specific PHC policy and program issues" and to gather and analyze data "for immediate use." Although this was also a strength of the project, PRICOR studies tended to be "one-shot" studies of isolated problems. No provision was made for continuity among studies or for the sequential study of components of the larger program, although in some cases, a number of substudies were proposed. For example, the Ecuador study mentioned previously was actually three interrelated studies of CHW supervision, training, and logical support. A study in Dominica was made up of a large number of very small substudies, all steps in the development of a revolving drug fund. Ideally, OR should be an ongoing process, built into a program and used to find solutions to a variety of operational problems.

4.4.3 Developing Generalizable Findings

Since the PRICOR project was designed to concentrate on finding solutions to "country-specific" problems and each study was to be independent of the others, there was no intent to develop generalizable findings. As the project developed, however, it became clear that there was a growing interest in generalizing from these studies, and the staff carried out a series of comparative analyses to meet that need. However, as the studies were not designed with that objective in mind, generalizations are constrained somewhat by that limitation. Ideally, methodologies should be standardized to permit generalizations.

4.4.4 Designing More Rapid OR Studies

Many of the PRICOR studies took 18-24 months to complete, while PHC managers often require results in much shorter periods of time. Priority should be given to designing smaller and much more rapid OR studies to provide managers with timely solutions.

4.4.5 Developing Computerized OR Models

With personal and portable computers becoming more powerful and more readily accessible, there is an opportunity to conduct operations research more rapidly and in a standardized way through computerized models. PRICOR sponsored the development of two computerization projects in its first phase. More of this kind of work needs to be undertaken. Development of simple models for doing cost-effectiveness analysis, MCUA, decision trees and other popular solution development methods would be particularly useful to PHC program managers.

4.4.6 Transferring OR Technology

One of the biggest problems encountered by the current staff is finding adequate ways to transfer OR technology to host-country researchers, most of whom have had very limited social science training and almost none in operations research. PRICOR staff designed and conducted workshops to train local staff in proposal preparation as well as operations research methods, and developed manuals to help address this need. Staff also increased monitoring visits to projects to provide more technical assistance. This has yielded very positive results. Ideally, applied research programs of this kind should emphasize technology transfer and development of host-country research capability.

* * * *

If well designed and carefully conducted, operations research can be a powerful problem-solving tool for primary health care managers. By systematically analyzing service delivery activities, measuring their performance objectively to identify strengths and weaknesses, and then developing and testing solutions to improve service delivery, operations researchers can contribute to the removal of operational obstacles and the achievement of the ultimate goal of PHC programs--improved health.

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TABLE 5
STEPS IN A GENERAL APPROACH TO OPERATIONS RESEARCH

PHASE I: PROBLEM ANALYSIS

1. Define the problem.
2. Analyze the problem, divide it into smaller operational problems, collect needed data.
3. Set priorities and select the problem for study.

PHASE II: SOLUTION DEVELOPMENT

1. Specify the objective for the solution to each problem.
2. Identify the controllable (decision) variables and uncontrollable factors (constraints) of each problem.
3. Select and construct an appropriate model for solving each problem.
4. Collect required data.
5. Use the model to develop the optimal solution(s) for each problem.
6. Conduct a sensitivity analysis of each problem.

PHASE III: SOLUTION TESTING AND VALIDATION

1. Design the test of the solution(s).
2. Conduct the test and collect needed data.
3. Evaluate and modify/adjust the solution(s).
4. Integrate the solution into the larger system.

5.0 TECHNICAL MONOGRAPHS

Thank you for the set of PRICOR monographs. I think they are excellent because they are clear, procedural, and easy to apply to your own work.

-- Letter from a researcher

5.1 BACKGROUND AND PURPOSE

Five monographs on operations research methods and issues were completed by the PRICOR staff. The monographs are intended to guide and maintain consistency in the design, data collection and analysis of country-specific studies and to support the development of comparative analysis. The monographs were prepared by the PRICOR staff and consultants for researchers in the developing world who are interested in learning more about this approach and applying it to their own primary health care programs. The topics reflect PRICOR's research priorities. In addition to the PRICOR monograph series, Stewart Blumenfeld designed a computerized methods model of ORT resource allocation based on the World Health Organization training model for ORT service delivery.

Two of the monographs describe OR methods, three describe research issues. These monographs include:

- Methodology Papers:
 1. Operations Research Methods:
A General Approach in Primary Health Care
 2. Operations Research Methods:
Cost-Effectiveness Analysis
- Issue Papers:
 1. Operations Research Issues:
Community Financing
 2. Operations Research Issues: Community Health Workers
 3. Operations Research Issues:
Community Organization

The writing process involved consultants and staff, although the first OR paper was drafted principally by Stewart Blumenfeld. In each case, except the OR paper, an advisory panel suggested key topics and reviewed drafts as they progressed. All of the papers have comparable format and style.

The writers of the methods/issues papers were supported by the PRICOR literature repository that was developed for the purpose of cataloging published and unpublished literature on topics relevant to the PRICOR work.

Sections 5.2 through 5.6 describe PRICOR monographs (divided into methods and issues), our computerized methods model, our OR literature repository, and the process we used to distribute the monographs.

5.2 METHODS MONOGRAPHS

5.2.1 Operations Research Methods: A General Approach in Primary Health Care (PHC)

The operations research methods monograph introduces health care researchers and program managers to basic operations research concepts and techniques for solving particular problems in service delivery in the developing country primary health care context. PRICOR's three-phased OR approach is explained in depth with examples of problem analysis, solution development, and solution validation.

The utility and appropriateness of specific OR techniques are reviewed. Techniques discussed include: system modeling, interaction matrices, logical framework, nominal group process, delphi, interaction matrices, multiple criteria utility assessment, and cost-effectiveness analysis.

This reference has proven particularly useful in introducing OR methodology to an audience that is not familiar with applied research. Though many texts are available that deal with traditional social science research, this reference goes beyond this into the use of OR as a problem-solving technique.

5.2.2 Operations Research Methods: Cost-Effectiveness Analysis

The Cost-Effectiveness Analysis (CEA) monograph describes CEA methods and illustrates how CEA can be applied as a research tool to a variety of operational issues in the design and delivery of PHC programs. The first two chapters give a brief overview of CEA and how it can be applied to planning and improving primary health care programs.

More detailed explanations of the significant steps in CEA are included in the four appendices to this monograph. Appendix A describes the principles and procedures for determining the costs of PHC alternatives. Appendix B describes the principles used to measure the effectiveness of selected alternatives. Appendix C shows how to analyze costs, effectiveness, and the cost effectiveness of PHC alternatives. Finally, Appendix D discusses refinements that can be made in basic CEA procedures.

The CEA monograph differs from other texts on CEA in that it specifically addresses how CEA can be applied to typical problems in the PHC delivery system

by health providers/researchers. While it has been reviewed and revised based on comments from health economists, the material is presented in a simple, straight forward, and distinctly non-academic style.

5.3 ISSUES MONOGRAPHS

PRICOR's priority issues--community financing, community health workers, and community organization--were selected as topics for monographs that discussed how OR could be applied to resolve key operational problems in those areas. The three papers have common objectives and a common format. The specific objectives of the issues monographs are:

1. To define the substantive topic and explain why this subject is an important research topic;
2. To identify key operational problems and issues in that topic than can be addressed by operations research;
3. To describe a general approach to operations research that can be used to study such problems; and
4. To describe a number of recent operations research projects to illustrate the application of operations research to primary health care problems.

Each of the monographs closes with summaries of PRICOR-supported research studies and a glossary of terms specific to that topic area.

5.3.1 Operations Research Issues: Community Financing (CF)

In their search for alternative ways to finance PHC, experts and policymakers alike have begun to examine more carefully the role communities play in paying for health services and the feasibility of initiating, or improving, community support for PHC in particular. This alternative has drawn increasing interest because most individuals and communities already pay for some health services, and the amount they spend on private health care often exceeds the amount spent by governments. Community financing may draw upon private expenditure already being made for personal health care services. If indeed it can do so, community financing may increase total resources available for PHC and, further may help target those resources toward activities that are more efficient and effective than personal services in improving health status.

There are a number of questions to be answered and decisions to be made in the course of planning and implementing a community financing system, including determining the most appropriate objectives for community financing, setting the best prices, and deciding how and when to collect revenues. Prior to the PRICOR project, few systematic studies had been undertaken that would begin to provide the answers to these questions.

The community financing monograph presents research issues, or "problem clusters," and the variables to be considered both in examining the operational problem more precisely and in analyzing potential solutions to the problem. In discussing operational problems related to community financing, it provides: 1) a presentation of the range of possible research problem clusters; 2) a review of one important community financing problem--revenue mobilization methods; 3) an explanation of a systems approach to analyzing community financing problems; 4) a discussion of how to identify the variables that could be of interest in examining solutions to operations research problems in community financing; 5) a listing of the most common of these variables for each of the community financing problem clusters; and 6) a technique for setting priorities.

In the concluding chapter of the monograph, a case example of a how an appropriate community financing scheme is selected for use in a Latin American country is used to demonstrate the three-phased OR approach.

5.3.2 Operations Research Issues: Community Health Workers (CHWs)

Many national plans and policies for "Health for All by the Year 2000" envisage PHC as the crucial strategy to attain health improvement goals that are linked to socioeconomic development. Within many national strategies, the use of CHWs is seen as one of the major ways to implement PHC. CHWs are viewed as the key to improving PHC acceptability, affordability, and accessibility.

As the PHC movement gained momentum, many countries began pilot or prototype CHW demonstration projects, and several developed large-scale PHC programs centered on the use of CHWs. These experiences helped identify a number of operational issues that countries need to resolve to ensure the effective development of their CHW programs. These critical issues can be summarized by two broad questions about community health workers. They are:

1. What are CHWs expected to accomplish? On what health improvement objectives are they to focus? To what extent are they to accomplish these objectives? How do CHWs relate to such other PHC elements as mobile services, services at fixed facilities, commodities distribution, school-based services, environmental modifications, and local economic development programs?
2. What arrangements are most likely to enable community health workers to meet those expectations? How are CHWs to be selected, trained, supervised, supplied, supported, motivated, rewarded, and linked with other health services and with the community?

The monograph provides a framework for identifying important research problems related to CHWs and the variables that need analyzing in the search for solutions. In discussing this process, the monograph: 1) identifies ten of the more common issues or "problem clusters" related to the use of CHWs in PHC; 2) presents a

framework for viewing these problem clusters as a subsystem of interrelated components; 3) explains how to identify the key variables of the problem; 4) identifies controllable and uncontrollable factors that influence or constrain solutions to these operational problems; and 5) provides a technique for setting priorities.

The operational problems of training and supervising CHWs are used in the case example at the end of the monograph to illustrate how the PRICOR OR approach is applied to a specific situation.

5.3.3 Operations Research Issues: Community Organization (CO)

There is strong theoretical and empirical evidence that effective community organizations have great potential for helping maximize community participation, essential for extending PHC in the developing countries. Many Ministries of Health and international development organizations have rewritten their policies to add the directive that PHC projects "will include community participation." Throughout the developing world, many multimillion dollar projects now feature plans for using community organizations in PHC.

However, no clear and reliable answers are available as yet on precisely how such organizations should function. Experience has shown that health planners still lack the operational knowledge necessary to design projects that can overcome existing constraints and successfully stimulate community members to participate in organized health improvement activities on an on-going basis.

A review of experience in various developing countries with PHC programs involving community organizations indicate that there are certain problems that operations research can help to resolve. The CO monograph provides a framework for identifying important research problems related to CO and the variables that need analyzing in search of solutions. It includes: 1) a presentation of the nine common issues or "problem clusters" related to CO; 2) an explanation of a systems approach to analyzing CO problems; 3) a discussion of how to identify the variables that could be of interest in developing solutions to operational problems in community organizations; and 4) a listing of the most common variables for each of the problem clusters.

The case example selected to illustrate the PRICOR OR approach in the last chapter addresses the problem of low community involvement in a PHC program.

5.4 MICROCOMPUTER AS A PLANNING TOOL: THE PRICOR/WHO ORT EFFECTIVENESS MODEL

Stewart Blumenfeld designed a prototype computer model to assist in planning national oral rehydration therapy programs. The paradigm used in the model is a modification of the course designed by the World Health Organization for training managers of national programs for control of diarrheal diseases. The model runs

in Symphony, published by Lotus Development Corporation. (The program requires 512 KB of RAM.)

On-screen directions and requests for data-input take the user through a sequence of estimates of the number of at-risk children under five by a target date specified by the user, projected coverage of this population with providers of ORT, expected efficacy of ORT in reducing mortality, expenditures for ORT, subsequent reduction in mortality due to diarrhea by the target year, and number of lives saved between the present and the target year. The program is designed to enable the user to change the value of one or more variables (e.g., population growth rate, number of health facilities, number of active village health workers, provider coverage standards) and to observe the effect of these changes on projected costs, mortality reduction, and lives saved. On-screen instructions and explanations are expected to make the model usable by persons with little or no experience using a microcomputer. Although the present version is primarily a planning tool, a second version is planned to assist in training.

The computer model has been demonstrated at annual NCIH meetings and shared with other interested PVOs such as Save the Children. The response has been very positive because the model is very "user-friendly" yet powerful. During his most recent trip to the World Health Organization (WHO) headquarters, Dr. Blumenfeld discussed the model with the managers of the training program on which the model is based and would like to update the model as the program is revised.

5.5 OR LITERATURE REPOSITORY

PRICOR created a literature repository to provide a central source of recently published or unpublished documents pertaining specifically to the application of OR techniques to solving service delivery problems in primary health care. The physical collection and cataloging of articles aided PRICOR staff and consultants in surveying priority research issues--what questions have been studied, methods used, findings, etc.--and was particularly useful as the methods and issues papers were being developed. Relevant articles were also xeroxed and made available to PRICOR study investigators.

Articles were collected on the following subjects:

1. Four PRICOR priority topic areas: community financing, community organization, community health workers, and commodity-based distribution;
2. PHC interventions, ORT and immunizations in particular;
3. General OR methods;
4. Other PHC areas related to developing countries.

The literature repository was automated using Leading Edge Nutshell software. Each of the 500 currently entered documents has been abstracted and assigned

appropriate keywords. The 200+ possible keywords cover subjects ranging from Family Planning Evaluation, Family Planning Material and Logistics, Cost-Effectiveness Analysis, Traditional Birth Attendants, and Multiple Criteria Utility Assessment.

While very useful for cataloging documents for the intensive research effort that went into the methods and issues papers, the literature repository proved less cost-effective for general day-to-day use. This was attributed to the cost of resources required to write abstracts and the availability of other literature data bases.

5.6 DISTRIBUTION OF THE TECHNICAL MONOGRAPHS

Three thousand copies of each of the five PRICOR monographs were printed. Of the 15,000 total copies, the following have been distributed:

Operations Research Methods	2400
Cost-Effectiveness Analysis	2600
Community Financing	2150
Community Health Workers	2100
Community Organization	2050

The PRICOR Monograph series has been requested and used by researchers from all over the world. Given their utility, many people including AID Mission staff asked that PRICOR translate them into French and Spanish to increase their distribution and impact. In response, the monograph series has been translated and has already been used for reference materials in OR workshops in Haiti and Guatemala. We have maintained a computerized record of all recipients of the monographs; this allows us to track the institutional affiliation and regional location of the recipient.

Monographs were sent to all USAID Missions and AID Representatives, Regional Bureaus, and members of the PRICOR project AID advisory/coordination group. The initial dissemination also included PRICOR investigators, multilateral agencies, schools of public health, centers for health services research, universities with international health interests, and private organizations working in health development.

PRICOR monographs can be found in libraries of such well-known universities such as Johns Hopkins, Tulane, and the London School of Tropical Medicine. They may also be found in smaller universities less known in the circles of international health such as the Universities of Texas, Kansas, Nebraska, and Arizona. Universities from around the world have requested the series of monographs including Gujarat Institute of Area Planning in India, University of Ile-Ife, Nigeria, Universitaire Instelling Antwerpen, and Australian National University. The University of Exeter, England, requested a number of series to distribute to researchers in developing countries. The Center for Research on the Epidemiology of Disasters at the Catholic University of Louvain in Belgium requested a complete series. Graduate students in public health increasingly request the monographs from schools such as Johns Hopkins, University of North Carolina, and the

University of Illinois. A set of monographs is available in the WHO/EMRO library in Alexandria, Egypt as well as the Health Services Research and Development Center at the Ministry of Public Health in Indonesia.

PVO's also have requested the monographs. These include such PVOs as AMREF/Nairobi, CRS/Thailand, Aesculapius International Medicine, the ORBIS Project and CMC/Geneva. PROFAM/Mexico requested a number of copies to distribute to their staff in Latin America.

The PRICOR monographs have been used in a variety of workshops for health care professionals including the Second Pan Africa Workshop on Natural Family Planning as well as a workshop in Kuwait; monographs were requested for all the participants. The University of Illinois at Chicago is using the monograph series as a required text for a course in health service research in developing countries, as is Howard University.

A wide variety of agencies continue to request the monographs, for example the International Organization for Cooperation in Health Care/Switzerland, Management Sciences for Health, a U.S.-based consulting firm, the Population Council's Mexico Office, and the International Planned Parenthood Federation's London Office. Requests have come from agencies as far away as Australia (the Health Economics and Technology Assessment Corporation Pty. Ltd.) and from consultants in health care and community development.

What kind of professionals are requesting the monographs?: an Associate Professor of Statistics in the Department of Statistics, Jahangirnagar University, Bangladesh; the Director of MCH/FP at Gedaref Teaching Hospital in the Sudan who heard about monographs at a workshop on the Improvement of Managerial and Technical Skills in MCH/FP Projects given by WHO/UNFPA in Nicosia, Cyprus; the associate editor of a newsletter from the Health Services Research and Development Office at Hines Hospital, Hines, Illinois; a lecturer and researcher on the faculty of Public Health, University of Indonesia, Jakarta; a doctor studying in the Department of Population Planning and International Health, School of Public Health, University of Michigan; a doctor from the University College Hospital on the departmental task force committee to develop a model for PHC for a local government in the state of Ibadan, Nigeria; the coordinator of an MCH/FP Extension Project in Dhaka, Bangladesh; a Boston University, CEDH consultant left her copies of the PRICOR monographs for the staff in Arusha, Tanzania.

6.0 DISSEMINATION OF FINDINGS AND METHODS

I have been receiving your interim reports on the progress of PRICOR projects. I find these reports to be interesting and useful and many of them have direct relationship to the progress activities of our CCCD project in Africa... The reports reflect very well on the quality and usefulness of PRICOR projects.

Letter from Health Program Officer

6.1 OVERVIEW OF DISSEMINATION ACTIVITIES

Although dissemination of PRICOR methodology and study results has been a primary focus of years 4 and 5 of the Cooperative Agreement, dissemination has been an ongoing activity of the project from the beginning. Dissemination activities have been intended in the first instance to help inform and actively involve local program managers and health officials in the research process, from problem identification and concept paper preparation to interpretation of study results. Beyond this, however, we have used a number of different channels to reach a wide range of PHC audiences, through print and other media, and face-to-face briefings, workshops, seminars and conferences.

Strategies used to secure the participation of PHC managers included:

- Requiring PRICOR proposals to demonstrate a close linkage between investigator and decisionmaker. Although this was demanded of all proposals, perhaps the clearest example was the requirement that each researcher who attended a proposal development workshop in Swaziland be accompanied by a decisionmaker;
- Encouraging proposals from health officers and other PHC program staff;
- Including managers in decisionmaking, especially during the solution development phase;
- Sponsoring participation of managers in in-country and regional OK workshops and seminars.

Other dissemination strategies were developed to reach the broader international health community. All research projects produce reports, and researchers often complain, correctly, that no one reads them. Many research reports are too long, too technical, and too late to be of much use. Although each of the 45 completed studies produced a final technical report, in addition to these reports PRICOR

developed some innovative ways to disseminate information in a variety of other formats. Printed materials included:

- The PRICOR Announcement (1982, 1983, 1984)
- The PRICOR Monograph Series on OR methods and research issues
- Interim Reports
- PRICOR Abstracts
- Country study summaries
- Articles in professional journals, including a special issue of Socio-Economic Planning Sciences
- Comparative analyses of study results in Community Financing, Oral Rehydration Therapy, and Community Health Workers
- Contributions to summary reports prepared by other organizations on PHC research
- Newsletters, Bulletins, etc.

In addition to written material in a variety of formats, PRICOR staff and researchers shared information through a number of other activities. These included:

- Television and radio interviews
- Briefings to interested organizations
- Workshops, both regional and host country
- Seminars
- The PRICOR International OR Conference (June 1986)
- Presentations at professional meetings and to other professional groups
- Exhibits at professional meetings.

In addition, PRICOR staff have taken the lead in developing an informal network of OR researchers in the U.S. and abroad who have met on several occasions to share experiences and insights into better ways of using OR to solve operational problems in PHC. Some examples of the ways PRICOR study results and methods

have been made available to hard-to-reach audiences are described in detail in the following sections.

6.2 PUBLICATIONS

PRICOR prepared and distributed many publications throughout the project. These publications constitute an impressive body of materials and case studies for workshops, training courses and briefings, both for those seeking to apply an OR approach to problem-solving, and specifically for PRICOR II activities. Selected publications will be catalogued through Columbia University's OR library and made available to the larger health services research community through MEDLINE. PRICOR publications include:

6.2.1 The PRICOR Announcement

In 1982, 1983, and 1984 an announcement was prepared in English, Spanish, and French in order to inform developing country and U.S.-based researchers, PHC program managers, AID Missions, host governments, PVOs, and other interested health professionals and organizations about the availability of funds for operations research (OR) activities in Primary Health Care. The brochure detailed the three-phased PRICOR approach to operations research, identified priority topics for OR, and also gave instructions on how to apply for PRICOR funds. These announcements were distributed to some 43,000 (8,000 in 1982, 20,000 in 1983 and 15,000 in 1984) individuals and institutions worldwide.

The PRICOR announcement is primarily responsible for the large number of concept papers submitted to PRICOR. A total of 400 concept papers were received in the three-year solicitation period. This was a cost-effective strategy for educating a mass audience about the new project and the availability of funds for operations research, and for encouraging those outside the ordinary network of international research to undertake such investigations.

6.2.2 The PRICOR Monograph Series on OR Methods and Research Issues

Five monographs on OR methods and research issues in PHC were prepared. These monographs explained how to carry out operations research, described several of the most useful OR techniques, identified some typical problems in PHC that lend themselves to OR, and gave illustrations drawn from actual studies. These monographs are described in detail in Chapter 5 of this report. Over 11,000 copies in three languages (English, Spanish, French) have been distributed worldwide to universities, research institutes, Ministries of Health, PVOs, and USAID Missions and projects, and requests are still being received. Titles include:

- A General Approach to OR
- Cost-Effectiveness Analysis
- Community Health Workers
- Community Financing
- Community Organization.

6.2.3 Interim Reports

Because most users do not want to wait for months after a study is completed to learn about the results, nor do they want to read voluminous technical reports, PRICOR developed and distributed Interim Reports, two-page summaries of ongoing research providing up-to-date information in a condensed format for people working in the field. Twenty Interim Reports were produced and mailed to a targeted mailing list of approximately 500. The French and Spanish translations have been useful in complementing the principal investigators' own in-country dissemination strategies.

6.2.4 PRICOR Abstracts

Two-page abstracts have been prepared for each of the 45 completed studies. The format of these abstracts is similar to that of the Interim Report series: concise, easy to read, and targeted to the development community. PRICOR Abstracts provide readers with a rapid means of learning about a study's objectives, methods and findings. Most of these have been translated in Spanish and French, and more than 500 sets have been distributed worldwide.

6.2.5 Study Summaries

Longer summaries have been prepared for 34 of the PRICOR studies, providing more detailed results to interested researchers. Each of the summaries serves as a case study of the application of OR to the solution of an operational problem in PHC. These will also be distributed worldwide, on request.

6.2.6 Articles in Professional Journals

PRICOR researchers, consultants and staff have prepared a large number of articles for professional publication. A special PRICOR issue of the international journal, Socio-Economic Planning Sciences, was prepared in September 1986. Jeanne Newman and PRICOR consultant Barnett Parker were the co-editors, assisted by Karen Johnson. The articles presented findings from a number of the PRICOR studies, and discussed some of the methodological issues arising in applying an OR approach to improving PHC services in developing countries. The solution methods illustrated by these articles range from simple preference heuristics to sophisticated computer simulations. A wide variety of operational problems are addressed, some narrowly focused, others diffuse and more complex. Together, these articles demonstrate the potential of an OR approach to problem solving, even for those more complex system problems not usually amenable to

highly sophisticated mathematical OR models. (These articles are cited in the bibliography in Appendix B.) A second partial issue of the same journal will contain an additional 4-6 articles from PRICOR studies. Both issues are expected to appear during 1987. Articles written by principal investigators have also appeared in local professional journals, such as the Haitian Public Health Journal.

6.2.7 Comparative Analyses

PRICOR staff analyzed the results of the 45 completed studies and prepared comparative monographs on the findings and issues addressed by 16 studies in Community Financing, 16 in Oral Rehydration Therapy (ORT) and 30 in Community Health Workers. These monographs are described in detail in Chapter 3 of this report. They are available for distribution to interested researchers, donor agencies, and program planners. Titles include:

- Community Financing of Primary Health Care: The PRICOR Experience
- Reaching Mothers with ORT: A Comparative Analysis of PRICOR-Funded Studies
- Community Health Workers: A Comparative Analysis of PRICOR-Funded Studies.

6.2.8 Contributions to Other Agency Reports

Given the wealth of data available through the individual studies, it is not surprising that PRICOR staff have received numerous requests to contribute to various technical reports being prepared by other organizations.

For the Latin America Health Care Financing Project that is being managed by the State University of New York at Stony Brook, all the financing studies were analyzed by the three content areas that formed the framework for the first background paper of that project: cost, demand, and alternative financing schemes. After the report, Health Care Financing, had been prepared, Marty Pipp and Wayne Stinson represented PRICOR at a workshop (March 19-20, 1986) called to critique the report and to develop their initial country studies.

Results from the financing studies have also been provided at AID's request for a meeting of major donor agencies (1986), as well as for an internal meeting of AID staff who were preparing a health financing statement for the Administrator. Staff members of the World Health Organization, World Bank, and CARE have expressed considerable interest in the results and processes used in the PRICOR financing studies.

Cost data from selected studies were provided to researchers from Columbia University who were completing an analysis of maternal mortality.

Documentation of all PRICOR studies addressing ORT program issues was prepared for inclusion in an AID background document for the ICORT Conference in December 1985.

Summaries of study impacts were collated for AID's 1987 Child Survival Report to Congress, prepared to demonstrate the concrete results of budgetary allocations to health.

Summaries of study findings and methodologies were prepared for Population Report: Operations Research, prepared by the Johns Hopkins Population Information Program. Jeanne Newman was a reviewer for the final document before its publication.

6.2.9 Newsletters, Bulletins, etc.

In many parts of the developing world, newsletters reach a larger percentage of the professional community than do international journals. Promoting PRICOR's methodology and study findings in newsletters has been one way of getting information to hard-to-reach researchers and program managers. Information about the PRICOR project has been published in numerous newsletters and bulletins such as Salubritas (a publication of the American Public Health Association) and Diarrhea Dialogue. In 1987 a newsletter about the PRICOR project was produced and distributed as an informational and marketing tool. It described operations research and the PRICOR project, and gave examples of PRICOR studies and other activities and outputs of the project.

6.3 MASS MEDIA

Interviews on the Voice of America and television programs in Liberia and Dominica are examples of the dissemination of PRICOR results through the mass media. One study in Peru made a video-taped documentary of its activities, while another was filmed by NOVA for U.S. national television. In future OR studies, greater attention should be given to the possibility of using non-print media for dissemination.

6.4 BRIEFINGS, PRESENTATIONS, WORKSHOPS, CONFERENCES, ETC.

In addition to a variety of publications, PRICOR staff and researchers shared information widely through a number of other mechanisms. Although no workshops or conferences were specifically called for in the Cooperative Agreement, PRICOR and AID staff both realized that the investigators would need training in proposal development and OR methods. Accordingly, eight workshops and an international conference were held during the course of the project, along with numerous briefings and presentations to various audiences. In addition, a number of the principal investigators themselves organized workshops to share their findings and methodologies with colleagues in their own countries. A

summary of the objectives and outcomes of a few of our workshops, seminars, conferences, and other presentations follows.

6.4.1 Workshops

- Swaziland

The purpose of the first workshop was to address an important priority of AID: to develop research studies in Africa. As the unsolicited concept papers sent to PRICOR from Africa were, in general, of poor quality, a proposal development workshop was held in Swaziland in June 1983. During this workshop PRICOR staff assisted fourteen teams who had submitted concept papers which had been rejected to develop technically acceptable proposals. The agenda included training in OR methodology, guidance in research design for identified problems, and assistance in writing a solid grant proposal.

In relation to its main objectives--to improve the quality, quantity and funding of OR proposals from Africa--this workshop was very successful. The 28 participants (14 teams with one researchers and one program manager/policy maker) from 11 countries followed a three-stage schedule: preparation, macrodesign, and microdesign. Prior to the workshop, each team had developed or revised the concept paper to be submitted to the PRICOR staff, who reviewed and discussed it with the applicants during the first session. At the workshop, the concept papers were systematically analyzed technically and modified by the staff and consultants with the participants. At the end of this phase the decisionmakers left with a clear understanding of the objectives of their country's study and its significance for problem-solving in PHC.

The researchers, remaining for another three and a half days, refined the proposal again with the professional guidance of PRICOR. This was the third, or microdesign phase. The results of the workshop were 12 completed and reviewed proposals, 11 of which were approved and funded.

There were significant lessons for the PRICOR staff, as well. It was this workshop that demonstrated the need for simpler terminology, good reference materials, case studies, and manuals that clearly explained OR principles, procedures and techniques. The staff developed those resources and used them in follow-up workshops in Mexico, Tunisia, Ecuador as well as in one-on-one technical assistance site visits.

- Tunisia

At the Tunisia course and workshop (May 7-18, 1984), managers and researchers were trained in the principles and uses of OR for problem-solving in PHC.

In the one week course, 40 participants attained the knowledge, skills, and attitudes that would enable them to apply an operations research approach to problem-solving in their daily work. Participants included officials of the MOH, physicians responsible for PHC programs in rural areas, and researchers interested in PHC issues. They were trained in a range of methods used to solve problems, the three general phases of the OR approach, and specific OR techniques and their applications. They then developed action plans for applying this approach to problems in their work.

The course was followed by a four-day workshop for 15 participants who actually prepared proposals for OR studies. The participants were organized into teams of three to four people who worked in the same geographic area. Four proposals were prepared by the teams on the following topics: drug distribution, pre-natal care follow-up, referral system between health centers and the hospital, and mobilizing use of PHC services. These were reviewed by a select group of PHC experts who found them all technically acceptable.

The OR course and workshop were designed and conducted by the PRICOR staff at the request of the MOH and AID Mission. Local costs were supported by MOH funds. After review by OR experts, the proposals were to be discussed by MOH staff, prioritized by topic, and funded with MOH counterpart funds.

- Mexico and Liberia

Two regional workshops were conducted by PRICOR staff at the mid-point of the project in order to provide training and technical assistance to funded researchers. The objectives of the workshops in Mexico City and Monrovia were to improve the technical ability of researchers to carry out approved PRICOR studies, monitor the progress of the studies, and resolve administrative/contractual problems. Participants had maximum opportunity to exchange ideas, experiences, partial results, constraints, and prospects regarding the outcomes of their studies and strategies for assuring use of the results.

PRICOR investigators from Asia, Latin America, and the Caribbean participated in the workshop in Mexico City from May 23 to 25, 1984. Principal Investigators or key study staff

from 19 PRICOR studies attended. The workshop in Monrovia was held from June 13 to 15, 1984 for PRICOR investigators in Africa and the Near East. Twenty-five investigators from eighteen country studies participated in the Monrovia workshop.

The workshops covered five principal topics: problem analysis, solution development, solution validation, dissemination of results, and subagreement administration. PRICOR staff presentations were supplemented by presentations by researchers. Small group discussions focused on each research phase as well as on systems analysis, qualitative measurement, cost-effectiveness analysis, and microcomputer applications. Each investigator also had an opportunity to meet privately with the relevant PRICOR staff monitor and the Budget/Subagreement Officer.

This type of workshop is an effective way to identify problems and generate ideas for solutions for the country studies. However, because the African studies were all at the initial stages of their studies, a longer workshop with more of a training orientation would have been useful.

■ Ecuador

PRICOR staff delivered a two and a half day OR workshop in Quito, Ecuador in April 1985. The purpose of the workshop was to create an awareness and appreciation of OR procedures and methods in PHC among Ecuadorian decisionmakers and researchers. Forty Ecuadorians from the Ministry of Health, Social Security, private voluntary organizations, and universities attended. The workshop logistics were managed by the Fundacion Eugenio Espejo, and held outside of Quito, in Ibarra.

The first day of the workshop put OR in context, showing its relationship to other problem-solving and research approaches. The second day was devoted to the processes and techniques of OR, beginning with simple approaches and illustrating more complex ones. The third day consolidated what was learned and encouraged participants to identify priority operational problems in PHC.

The agenda, which focused on key OR concepts and applications, succeeded in giving participants an overview of OR and some appreciation for specific uses and techniques. In the last small group session, participants were able to articulate several problem areas in which they could apply the OR approach in their work. In the closing, participants

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indicated that they were interested in further training on specific OR techniques.

6.4.2 In-Country Seminars

A number of in-country seminars were organized by PRICOR researchers to share results of their studies with local colleagues; PRICOR staff participated in several of these. The seminars were particularly productive in those cases, as in Liberia, Haiti, and India, where there were several PRICOR investigators, all of whom helped to organize and/or participated in the discussions. In other countries, however, for example in Tanzania, PRICOR researchers gave useful sessions on OR at local professional meetings, training programs, or seminars.

6.4.3 Workshops for Other Organizations

PRICOR has designed and delivered workshops for other organizations. We have found that the accomplishments and lessons learned as a result of the PRICOR studies have been helpful in assisting program managers and researchers in the health field in general. Workshops were conducted by PRICOR staff for:

- The Centre for Development and Population Activities (CEDPA). In 1982, CEDPA invited Jack Reynolds to develop a one-day workshop on OR and specific OR techniques as part of their 30-day "Supervision and Evaluation as Management Tools" course. Sessions on Operations Research and Cost-Effectiveness Analysis were presented to 40 participants from around the world.

PRICOR staff have been asked to continue to deliver these workshops each year since 1982. Jack Reynolds repeated the workshop in 1983; David Nicholas and Stewart Blumenfeld conducted sessions in 1984; and Marty Pipp and Stewart Blumenfeld conducted the sessions in 1985 and 1986. The PRICOR sessions have received consistently high ratings in participant evaluations because of their utility for problem-solving.

- National Council for International Health (NCIH). Jack Reynolds designed and delivered a workshop at the 1984 annual NCIH Conference on the "Use of Microcomputers in PHC."
- University of Hawaii. During the summer session of the School of Public Health of the University of Hawaii, Jack Reynolds conducted a workshop on the OR approach and its use in PHC.

6.4.4 International PRICOR OR Conference

The PRICOR International OR Conference was held in Bethesda, Maryland in June of 1986. The objectives of this two and a half day conference were to discuss substantive and methodological findings from PRICOR studies and to share experiences among PRICOR investigators in the use of the operations research approach.

The conference format emphasized small group discussions, with the aim of identifying trends and important observations from the studies, and suggesting future directions for primary health care operations research. Initial results from comparative analyses in the areas of community financing, community health workers, oral rehydration therapy, and the use of OR methods served as a basis for discussion among PRICOR researchers. Participants also designed posters of important findings from their studies. An open plenary session held at the end of the conference provided an opportunity for summation of discussions for a larger audience of PHC professionals.

The participants included sixty-two PRICOR investigators from thirty-one countries in Africa, Asia, Latin America, the Caribbean, and the Near East; PRICOR staff and consultants; and observers from the Agency for International Development, and other organizations involved in primary health care and family planning operations research.

6.4.5 Briefings and Other Presentations

- Briefings. Over the life of the project PRICOR staff met with numerous groups and organizations on both formal and informal bases. These sessions were very useful for informing people about PRICOR activities, sharing progress and problems as they emerged, and receiving insights and feedback from our colleagues. The briefings and meetings were conducted largely on an ad hoc basis, although briefings at the AID Office of Health and the Regional Bureaus were conducted on a regular basis during the first three years of the project, so that AID would have maximum opportunity for input into the development of the country studies. Informational briefings were also carried out for the Office of Population (AID), the Office of Nutrition (AID), PPC (AID), PAHO, WHO, and numerous others as appropriate.
- Presentations at Professional Meetings. PRICOR staff, consultants, and investigators made more than 40 presentations at professional meetings between 1983 and 1986. PRICOR staff have contributed papers to the annual NCIH and APHA meetings since 1983. In the most recent (1986) NCIH meeting, PRICOR staff moderated four complete panels on operations research. The panel themes paralleled the PRICOR priority areas: community health workers, community financing, oral rehydration therapy, and OR methods. Each panel was

composed of a PRICOR staff member and two PRICOR researchers. Helping host country researchers to submit abstracts for conferences has enabled them to achieve greater visibility for their research and more experience in dissemination.

Technical staff have also made presentations to other audiences. Lectures or seminars have been given at such places as American University, Harvard University, and Johns Hopkins University. Leslie Traub presented preliminary results of the ORT comparative analysis at an ORT conference in Port-au-Prince, Haiti (June, 1986), where approximately 100 managers and researchers spent two days reviewing and discussing ORT issues. Jack Reynolds made a presentation at a Cost-Effectiveness Analysis Conference at Tulane University in early December 1985. In May 1983, PRICOR staff made presentations at the annual meetings of the American Association of Schools of Public Health, and at a workshop on OR sponsored by the Center for Family Health and Population (Columbia University). These papers are cited in the bibliography in Appendix B.

- Exhibits at Professional Meetings. PRICOR was represented at NCIH annual meetings and the 1985 annual APHA meeting in Washington at the exhibition booth of the Center for Human Services. Interim Reports, PRICOR Monographs, technical papers by PRICOR staff and researchers, and other relevant materials were distributed to interested health professionals. Technical staff were available to answer questions about particular studies and the PRICOR OR methodology.

6.5 DEVELOPMENT OF AN OR PROFESSIONAL NETWORK

Because of a mutual interest in developing a forum for exchanging information about OR methods, findings, and resources, Jack Reynolds and a small group of other health professionals interested in operations research met at the APHA Annual Meeting in Anaheim, California on November 14, 1984. The group has met informally since then to continue to network with others who have a common interest in OR. Most organizations who have been funding or managing OR projects in developing world, including Columbia University, the Population Council, Westinghouse, and the Ford Foundation, have participated in the group.

Two useful documents prepared by the group were an annotated bibliography on available OR materials and a listing of relevant microcomputer software. Perhaps its largest success, under Jack Reynolds' direction, has been getting a large number of OR presentations included in the APHA and NCIH programs in 1985 and 1986.

Because of the continued interest among researchers to continue this type of exchange on a regular basis, AID has agreed to provide initial support for a permanent group on Operations Research in Health and Development. This group will hold its first formal meeting in conjunction with the NCIH conference in June 1987. A steering committee has been formed with representatives from institutions involved in OR to plan this event.

6.6 CONCLUSIONS: SHARING INFORMATION

Because our objective has been to assist managers in resolving operational issues in ongoing PHC programs, PRICOR has made a major effort to disseminate the research findings and methods to those who could use them—PHC program administrators and policymakers. A variety of strategies have been employed and a number of different formats developed in an attempt to reach as wide an audience as possible, both in-country and internationally. Information on both the research process and its results has been widely shared--through frequent briefings with PHC program managers and decisionmakers, in-country and international conferences and seminars, presentations at professional meetings, publication of technical monographs and journal articles, and distribution of abstracts and study summaries around the world. The materials produced constitute an important resource for future operations research training and investigation. Continued requests from around the world for these materials give evidence of their utility, while implementation of the research results in the majority of the study areas is one indication that local dissemination has been effective. This emphasis upon information dissemination is probably one of the important reasons for the success of the PRICOR project in strengthening research capability in 32 developing countries, and in helping to ensure that study results are accepted and implemented by local decisionmakers. In its second Cooperative Agreement, PRICOR will continue our commitment to information dissemination, making use of some of the specific techniques, such as the frequent publication of concise, readable Interim Reports, developed during the initial PRICOR project.

APPENDIX A SOLICITATION, REVIEW, AND FUNDING OF PROPOSALS

SOLICITATION

PRICOR relied primarily on the extensive distribution of the 12-page PRICOR brochure to solicit research proposals. This effort was remarkably successful in that the project received over 400 written proposals (many from researchers in remote locations). In addition, AID Missions were able to sponsor a proposal, which then received special attention, including assistance in developing a technically acceptable study. Each Mission received a Guide to Funding which clearly detailed the purpose of the PRICOR project, the review process, and the components of a good concept paper/proposal.

PRICOR's research priorities were the result of recommendations from USAID, a specially created Technical Advisory Committee and other outside experts. Each year the priorities were updated and revised to reflect changes in research needs. All the studies focused on community level problems. The four principal areas of research throughout the project were community financing, community health workers, community organization, and community-based commodity distribution. Oral rehydration therapy and immunizations were added in the third year of the project as priority interventions.

Although no limit was set for any given study, applications were classified as small (under \$10,000), medium (\$10-50,000), and large (over \$50,000). Preference was given to small- and medium-sized studies and to projects of shorter duration. A Small Grants Program was created in the third year of the project to facilitate smaller studies.

FUNDING TRACKS: MISSION-INITIATED AND OPEN SOLICITATION

PRICOR developed two funding tracks: one limited to USAID Mission-initiated studies and another open to researchers interested in conducting studies in eligible countries worldwide.

One of PRICOR's objectives was to respond to USAID Mission's requests for assistance to develop and conduct operations research. PRICOR was able to respond to these requests when:

1. The proposed research was linked to an on-going or planned PHC program funded by AID.
2. The results of the research was critical to the development/operation of an AID-funded program/project.
3. The proposed research conformed to the research, administrative, and methodologic priorities established for PRICOR.

4. The USAID Mission originating the request was able to assist in a meaningful way in developing and conducting the research.

USAID-initiated proposals could be submitted at any time. They were neither subject to the deadline specified for the open solicitation track nor in competition with other proposals submitted to PRICOR. Each was reviewed individually.

USAID Missions applied for funding by submitting a formal request for PRICOR assistance to the S&T/Health Project Manager. The proposed research idea, the tentative schedule for preparation of the proposal and, if needed, the type of technical assistance needed to prepare the proposal and conduct the research was described.

In the open solicitation track, research proposals were submitted by one or more individuals, organizations, institutions, or consortia which had a relationship with a primary health care delivery system in a developing country. Unless otherwise justified, research proposals were expected to be developed and conducted by host-country researchers and actively involve local decisionmakers in all stages of the research in order to be considered for funding. Collaborative studies involving experts from outside the host country were also encouraged as long as host country researchers were involved in leadership roles.

OPEN SOLICITATION TRACK FUNDING: REVIEW PROCESS FOR CONCEPT PAPERS AND FULL PROPOSALS

Solicitation of Applicants

The application procedure for the open solicitation track was described in the PRICOR announcement. This announcement briefly described the purpose of the PRICOR project, provided an overview of operations research and the research priorities of the project, and detailed the application process for concept papers, limited to 6 pages which were required as the first step. The PRICOR announcement recommended 2-3 pages on the research problem, 2 pages on methodology, and 1-2 pages on the plan for managing the research. The schedule for the review of concept papers was published in the PRICOR announcement.

Screening

When a concept paper was received at PRICOR's Office, it was logged in, an acknowledgement sent to the applicant, and a file set up.

The concept paper or proposal was then assigned to one of the PRICOR staff who screened it for completeness and acceptability. The PRICOR staff and the outside reviewers met biannually to classify the concept papers as unacceptable or reviewable. Applicants in the first category were sent letters explaining why the concept paper was not acceptable (e.g., request for operating expenses, training project, study tour).

Review of Concept Papers

The concept papers which passed the screening process were reviewed. The panel which rated the papers was comprised of outside reviewers who were specialists in the substantive areas that made up the PRICOR research priorities and in applied research. The review evaluated proposed methodology, significance of the operational problem as an impediment to effective delivery of PHC services, probable success in carrying out the study, and probable impact of the research findings on service delivery. Degree of participation by host country staff was also an important factor. Those papers which passed this review were submitted to the AID Project Manager for approval.

Invitation

Notification of the review outcome was then sent to all applicants. For those invited to develop full proposals, comments and suggestions were included with the Application Kit, which included the instructions for preparing the proposal. Copies of these comments were sent to the AID Project Manager for distribution to the appropriate USAID Missions and regional bureaus.

Preparation of Proposals

Applicants had approximately 6 weeks to prepare and submit proposals. In most cases they were asked to clarify issues, provide more detail, or consider other suggested revisions. Applicants were informed that USAID concurrence was required before proposals could be funded and were encouraged to get in touch with the Mission about their research interests as early as possible. Applicants were instructed to send copies of their proposals to the USAID Mission at the same time as they were submitted to PRICOR.

Technical Assistance

A limited amount of technical assistance was available to help develop proposals. Requests for assistance were made through the USAID Mission and directly to PRICOR; approval by AID Project Manager and USAID concurrence were required before any technical assistance could be provided.

Review of Proposals

Proposals were processed and rated using the same criteria as the concept papers; however, each proposal was assigned to two outside reviewers. A Proposal Review Committee met to discuss each proposal and to make recommendations. The recommendations were then submitted to the AID Project Manager for approval.

Approvals and Awards

Approval by the AID Contracts Office and concurrence by the local USAID Mission (or US Embassy) in the host country were required before PRICOR could make an award.

Negotiate Subordinate Agreement

Once AID had approved a proposal for funding, the PRICOR Budget/Subagreement Officer negotiated a subordinate agreement with the institution sponsoring the research. This subordinate agreement also had to be approved by AID, and in some cases by host country officials, before funds could be disbursed. Once that approval had been obtained, PRICOR sent a notification and signed subordinate agreement to the Principal Investigator to sign and return.

PRICOR used an "incrementally-funded, cost-reimbursable" subordinate agreement. Funds to cover the costs expected to be incurred during the initial months of the study were advanced upon receipt of the executed subordinate agreement. Succeeding payments followed a schedule outlined in the subordinate agreement and were subject to receipt of technical and financial reports. Recipients were also required to adhere to U.S. Government Standard Provisions and the Center for Human Services General Provisions.

SMALL GRANTS PROGRAM

The application and review procedures detailed above ensured a reasonably prompt processing of Mission-initiated studies, but for studies in the open solicitation track, the process from concept paper to award took from 6 to 12 months to because of administrative requirements. In order to expedite the review and funding process for short, inexpensive studies in this track, PRICOR developed the Small Grants Program. In this program the interval between an acceptable proposal and the award of funds was reduced to a few months.

Studies submitted under the small grants mechanism were expected to follow the same OR methodology and be subject to the same eligibility requirements as larger PRICOR studies, but differed in the following ways:

1. Topic. Preference was given to studies in PRICOR priority research areas, but other appropriate PHC topics were considered as well.
2. Nature of the Proposal. Applicants were to submit a full proposal, not to exceed 20 single-spaced or 30 double-spaced typewritten pages (not including budgets and research staff resumes). The proposal should follow the same format as that of a concept paper but should describe the proposed study in much greater detail.

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3. Budget. The proposed study budget must be under \$10,000. (The specific budget format was provided in the Small Grants Application Kit.)
4. Application and Review Schedule. Proposals could be submitted at any time and would be reviewed by outside experts soon after being received by PRICOR.

A Small Grants Application Kit was available for interested researchers as a guide for their submissions.

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No. 1	Philippines	Philippines Project Tries Community Drugstores
No. 2	Honduras	Survey Shows Community Willingness and Ability to Pay for Health Care
No. 3	Liberia	Liberian Villages Organize to Finance Health Care
No. 4	Thailand	PHC Revolving Funds Numerous and Widespread in Thailand
No. 5	Sierra Leone	Study Examines Means for Increasing Use of ORT
No. 6	Nigeria	Study Explores Why VHW's Drop Out
No. 7	Egypt	Study Finds ORS Distribution Limited by Demand, Not Supply
No. 8	Dominican Republic	Pricing Strategy for ORS Developed
No. 9	Mexico	Profam Decides to Produce and Market ORS Packets Not Tablets
No. 10	Brazil	Traditional Healers Deliver ORT
No. 11	Haiti	Community Resources Key to ORT Strategy in Rural Haiti
No. 12	Brazil	Community Survey Identifies Patterns of Use and Payment for Health Care
No. 13	Papua New Guinea	Villagers Use OR Techniques in Health Planning
No. 14	Jamaica	Study Develops Model to Improve Productivity of PHC Teams
No. 15	Haiti	Financing Scheme Links Promotion of Preventive Health Care with Revenue Generation
No. 16	Liberia	Pilot Test Shows Mothers' Preferred ORT Solution
No. 17		Overview of PRICOR ORT Studies
No. 18	Liberia	Study Tests Ways Adolescents Can Promote Health
No. 19	Bolivia	Villagers Willing to Support CHW Salaries Through In-Kind Payments
No. 20	Haiti	Study Evaluates Community Groups' Willingness to Support Health Workers

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COUNTRY	TITLE	
Bangladesh	Determinants of Health Care Utilization in Rural Bangladesh	
Benin	Community Financing of PHC Services in the Pahou Health Development Project, Benin	F S
Brazil	Community Financing of Primary Health Care in Rio de Janeiro	F S
Brazil	Mobilizing Traditional Healers to Deliver ORT	S
Brazil	The Use of Visitadoras and Financing of Community Water Supply	F S
Bolivia	Community Financing to Reduce Attrition of Community Health Workers and Increase Health Service Coverage in Rural Communities	F S
Bolivia	Determining Alternative Community Financing Mechanisms for Supporting Primary Health Care Services in Bolivia	S
Dominica	Revolving Drug Funds in Dominica	F S
Dominican Republic	Improving Distribution of ORS in the Dominican Republic	F S
Ecuador	Operations Research to Improve the Supervision, Logistical Support and Training of Rural Health Promoters in Ecuador	F S
Egypt	Improving ORS Inventory Management in Rural Health Facilities of Egypt	F S
Egypt	Adding Nutrition Repletion Education to ORT Programs in Egypt	S
Grenada	Promoting the Use of ORT in Grenada Through the Development of Community Organizations	F S
Haiti	Alternative Methods of Motivating Community Health Workers	F S
Haiti	Community Organization in Promoting Effective Use of ORT in Haiti	F S
Haiti	Resource Allocation in Primary Health Care Planning for Haiti: Optimization of Task Allocation for Community Health Workers	F S

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 S - Available in Spanish

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COUNTRY	TITLE	
Haiti	Role of Traditional Birth Attendants in Maternal Health	F
Honduras	Financial Alternatives to Support Extension of Basic Health Services in Honduras	F S
India	Identification of an Optimum Distribution System for Vaccines in Rural India	F S
India	An Operations Research Study of Financing, Organizational, and Managerial Problems of Community Health Projects in India	
Jamaica	The Study of Primary Health Care Teams in Jamaica	
Korea	Primary Health Care in Korean Rural Communities with the Support of Existing Village Organizations	
Liberia	Diarrheal Disease Intervention in Liberia	F S
Liberia	Planning and Evaluating Community Financing in Liberia	F S
Liberia	Training Adolescents to Promote Health in Liberia	F S
Liberia	Training Mothers to Use ORT in Rural Liberia	F S
Mali	Community Financing of Primary Health Care in Peripheral Areas	F S
Mexico	A Market Research Study of the Quantitative and Qualitative Aspects of the Marketing and Distribution of Oral Rehydration Salts in Mexico	F S
Mexico	Microplanning of Activities of Community Health Auxiliaries in the State of Mexico	F S
Nigeria	Attrition Among Village Health Workers in Nigeria	F S
Nigeria	Increasing the Productivity of Community Health Workers Through Supervision in Rural Areas of Nigeria	F S
Papua New Guinea	Training Health Workers in Papua New Guinea	F S
Peru	An Improved System for the Delivery of Basic Health Services in a High Jungle Area of Peru	F S

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PRICOR Abstracts." Chevy Chase, MD: PRICOR, Center for Human Services 1987.
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COUNTRY	TITLE	
Philippines	Alternative Strategies for Financing Primary Health Care in the Philippines	F S
Philippines	Alternative Training Strategies for Barangay Health Workers	F S
Philippines	Increasing the Effectiveness of Barangay Health Workers in Providing Nutrition Services within the PHC Framework	F S
Senegal	Community Financing of Primary Health Care in Rural Areas of Senegal's Sine Saloum Region	F S
Sierra Leone	Training Mothers to Use Oral Rehydration Therapy	
Somalia	Operational Procedures to Improve Availability of PHC Drugs	F S
Swaziland	Development of Appropriate Methods for Sustaining Rural Health Motivators	F S
Tanzania	Community Participation in Improving Village Health Worker Supervision in Tanzania	F S
Thailand	Alternative Approaches to Supervision of Community Health Workers in Thailand	
Thailand	Community Financing of PHC Activities in Nutrition, Water, and Sanitation	S
Uruguay	Community Organization in Resolving Health Problems	F S
Zaire	Testing Alternative Payment Schemes in Health Centers in Zaire	F

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Dominica	Developing a Revolving Drug Fund for Dominica
Ecuador	Operations Research to Improve the Supervision, Logistical Support, and Training of Rural Health Promoters in Ecuador
Egypt	Adding Nutrition Repletion Education to ORT Programs in Egypt
Egypt	Improving ORS Inventory Management in Rural Health Facilities of Egypt
Haiti	Alternative Methods of Compensating Community Health Workers in Haiti
Haiti	The Role of Traditional Birth Attendants in Providing Maternal Health Services in Haiti
Haiti	Increasing Oral Rehydration Therapy in Rural Haiti Through Community Participation
Honduras	Financial Alternatives to Support Extension of Basic Health Services in Honduras
India	Identification of an Optimum Distribution System for Vaccines in Rural India
India	Financial, Organizational and Managerial Problems of Community Health Projects in India
Jamaica	Productivity Analysis of Health Facility Staffing Patterns in Jamaica
Korea	Supporting Primary Health Care Programs in Korean Rural Communities Through Existing Village Organizations

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Country	TITLE
Liberia	Training Caretakers in Rural Liberia to Prepare and Deliver ORT
Liberia	Planning and Evaluating Community Financing in Kolahun District, Liberia
Liberia	Testing the Effectiveness of Adolescents as Health Promoters in Liberia
Mali	Community Financing of Health Care in Peripheral Areas of Mali
Mexico	A Market Research Study of the Quantitative and Qualitative Aspects of the Marketing and Distribution of Oral Rehydration Salts in Mexico
Mexico	Planned Health Services and Community Needs: A Model from Mexico for Closing the Gap
Nigeria	Increasing the Productivity of Community Health Workers Through Supervision in the Rural Areas of Nigeria's Ife-Ijesha Zone
Nigeria	Attrition Among Village Health Workers in Nigeria
Papua New Guinea	Training Health Workers in Papua New Guinea
Peru	An Improved System for the Delivery of Basic Health Services in a High Jungle Area of Peru
Philippines	Increasing the Effectiveness of the Barnagay Health Worker in the Philippines for Providing Nutrition Services within the PHC Framework
Philippines	Alternative Strategies for Financing Primary Health Care in the Philippines
Somalia	A Survey of Drug Utilization at the Village Level in Six Regions of Somalia and Its Implications for the Primary Health Care and Essential Drugs Programs
Tanzania	Community Participation in Improving Village Health Worker Supervision in Tanzania
Thailand	Alternative Approaches to Supervision of Community Health Workers in Thailand

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Country	TITLE
Thailand	Community Financing of PHC Activities in Nutrition, Water, and Sanitation
Uruguay	Community Organization in Resolving Health Problems in Blue-Collar Neighborhoods of Montevideo, Uruguay
Zaire	Testing Alternative Payment Schemes in Health Centers in Zaire

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