

# COMMUNITY FINANCING

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OPERATIONS RESEARCH ISSUES

**COMMUNITY  
FINANCING**

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**Primary Health Care Operations Research**

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Other publications in the PRICOR Monograph Series:

*Operations Research Issues: Community Health Workers*  
*Operations Research Issues: Community Organization*  
*Operations Research Methods: A General Approach in Primary Health Care*  
*Operations Research Methods: Cost-Effectiveness Analysis*

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## PREFACE

Primary Health Care Operations Research (PRICOR) is a project of the Center for Human Services and is funded by the United States Agency for International Development (AID) under a cooperative agreement (AID/DSPE-5920-A-00-1048-00). The Center for Human Services is a 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. PRICOR's objective is to promote operations research as a tool to help program managers and policymakers find solutions to problems they encounter in designing and operating primary health care (PHC) programs.

This project's activities include: Funding and monitoring country studies; sponsoring workshops and conferences; conducting methodological and comparative studies; and disseminating the findings of sponsored research. PRICOR is particularly interested in research designed to overcome problems that limit the expansion of essential PHC services to high-risk populations in rural and peri-urban communities. Consequently, PRICOR has concentrated on operations research to find solutions to problems in four priority areas:

- Community health workers
- Community-based commodity distribution
- Community financing
- Community organization

Operations research provides a systematic approach to problemsolving. In operations research, rather than relying on the costly process of trial-and-error, a well-defined plan of analysis is used to select the best of several possible alternatives. A specific operational problem is first defined and analyzed. Alternative solutions are developed and evaluated to identify those that are most appropriate and feasible. Recommendations are then made for testing, or in some cases directly implementing, the best solution(s).

This is one in a series of five monographs on operations research that was prepared by 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 five monographs in the series are:

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



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## ABBREVIATIONS USED IN TEXT

AID	Agency for International Development (USAID)
APHA	American Public Health Association
CF	Community Financing
CHW	Community Health Workers
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
RDF	Revolving Drug Fund
TBA	Traditional Birth Attendant
UNICEF	United Nations Children's Fund
WHO	World Health Organization

## INTRODUCTION

Primary health care is gaining acceptance as a strategy for bringing basic health services to all people in developing nations who do not have access to such services at this time. Primary health care programs can have a significant impact on health by focusing on a limited number of health problems that are preventable by means of simple, relatively low-cost interventions.

Diarrhea, respiratory infections, malnutrition, and contagious diseases are among the most serious health problems in developing countries. They result in high rates of infant, child, and maternal mortality and morbidity, particularly in rural areas and in the surroundings of urban centers, where organized health services are most limited. Ironically, much of this suffering is avoidable, because a few primary health care interventions could dramatically reduce these problems if ways could be found to reach the target populations--particularly women and children--with such needed primary health care services as immunizations, oral rehydration therapy (ORT), growth monitoring, family planning, malaria prophylaxis, water supply, environmental sanitation, and antepartum and perinatal care.

In 1978, the International Conference on Primary Health Care was convened at Alma-Ata in the Soviet Union. At this historic event attended by representatives of 134 nations, primary health care was endorsed as a strategy for making fundamental health services universally accessible to the world's population. The Declaration of Alma-Ata defines primary health care as:

. . . essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford . . . [Primary health care] addresses the main health problems in the community, providing promotive, preventive, curative and rehabilitative services accordingly . . . [it] includes at least: education concerning prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; maternal and child health care, including family planning; immunization against major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs.(1)

Among those organizations helping to find ways to achieve this goal is the Agency for International Development, which has supported numerous primary health care projects around the world. These projects, extensively documented in a recent American Public Health Association publication, have demonstrated the efficacy of primary health care in reducing premature mortality and excess morbidity.(2)

The Agency for International Development has been particularly interested in finding ways to expand coverage of mothers and children in rural and periurban areas with such essential primary health care services as immunizations and oral rehydration therapy, among others. However, AID and other international donors have learned from experience that meeting this objective is not a simple matter.

### Role of Operations Research in Primary Health Care

A number of operational issues need to be resolved before primary health care can become universally available. For example, the Alma-Ata Conference report noted that:

Enough is already known about primary health care for much of it to be put into practice immediately. However, much still needs to be learned about its application under local conditions, and during its operation, control and evaluation problems will arise which require research. These may be related to such questions as the organization of primary health care within communities and of supporting services; the mobilization of community support and participation; the best ways of applying (existing and appropriate) technology . . . the planning for and training of community health workers, their supervision, their remuneration and their career structure; and methods of financing primary health care.(3)

Recognizing the importance of research into the operation of primary health care delivery, the AID Office of Health funded PRICOR to help primary health care program managers and policymakers find solutions to such problems through operations research. PRICOR has defined operations research as a problemsolving process consisting of three phases:

1. Systematic analysis of the operational problem;
2. Application of the most appropriate analytical methods to identify the best solution(s) to that problem; and
3. Validation of the solutions(s).

Although operations research has not yet been widely used as an analytical and decisionmaking tool to improve health services in developing countries, it can be applied to examine a number of issues pertinent to primary health care service delivery.

For example, in planning a community financing strategy, operations research can be applied to examine the advantages and disadvantages of completely different community financing alternatives (e.g., fees for service, revolving funds, social insurance, voluntary contributions); to help determine the best way to structure a particular financing system (e.g., how might each primary health care service be financed?); or to identify ways to improve existing financing mechanisms (e.g., how can a revolving fund be made solvent?).

This paper was prepared to help policymakers, program managers, and researchers identify problems in community financing that can be addressed by operations research. The paper is particularly relevant to those in developing countries who are actively involved in the planning or operation of community financing, investigators working with primary health care program managers, and health policy planners.

The specific objectives of the paper are:

1. To define community financing and explain why this subject is an important research topic;
2. To identify key operational problems and issues in community financing that 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 in community financing of primary health care to illustrate the application of operations research to this subject.

## NOTES

1. "Declaration of Alma-Ata," Primary Health Care, Report of the International Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September 1978, jointly sponsored by WHO and UNICEF (Geneva: WHO, 1978), pp. 3-4.
2. Primary Health Care: Progress and Problems, An Analysis of 52 AID-Assisted Projects (Washington, DC: APHA, 1982).
3. WHO and UNICEF, Alma-Ata 1978, op.cit., pp. 71-72.

CHAPTER I  
COMMUNITY FINANCING OF PRIMARY HEALTH CARE:  
A RESEARCH PRIORITY

## CHAPTER I. COMMUNITY FINANCING OF PRIMARY HEALTH CARE: A RESEARCH PRIORITY

Many of the developing countries that have endorsed the goals of the Declaration of Alma-Ata are finding it difficult to mobilize the resources required to pay for the drugs, commodities, health workers, and other elements needed to provide primary health care (PHC) services. Competing political demands on scarce resources, the worldwide recession, limited foreign exchange, and the reluctance of donors to continue financing recurrent health care costs have contributed to the problem.

In their search for alternative ways to finance primary health care, 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 primary health care 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 expenditures already being made for personal health care services. If indeed it can do so, community financing may increase total resources available for primary health care and, further, may help target those resources toward activities that are more efficient and effective than personal services in improving health status.

Because financing is such a critical issue in the delivery of primary health care services and because so little is known about community financing, PRICOR designated community financing of primary health care as a priority area for operations research. This chapter defines the term "community financing," presents a brief discussion of the evolving interest in this subject, and discusses the need for operations research on this alternative method for financing primary health care services.

### WHAT IS COMMUNITY FINANCING OF PRIMARY HEALTH CARE?

A community is commonly thought of as a group of people living in the same geographical area, such as a rural village, a town, or an urban neighborhood. Other types of communities, in which people come together in their work, their interests, or their social ties, include cooperatives, such as organizations formed for the purpose of marketing members' produce, labor unions, peasant associations, educational and religious organizations, tribal or kinship groups, and civic or charitable organizations. Members of such organizations form a "community" because they share common objectives.

Generally, individuals participate in community groups because they hope to benefit from the combined actions of all the members. Political supporters expect to benefit from the policies implemented by their representatives. Tribal group members, sharing a common heritage, expect to maintain their identity by working together as a community.

Members may use a community group to promote many different common interests. For example, if a group recognizes the health status of its members as a shared interest, it may become a vehicle for health services organization. This is possible because the interest is common to the group members and it does not detract from the primary purpose of the group. Depending on the structure of the community, various health services delivery and financing arrangements may be worked out with the community to bring them health benefits. It is particularly appropriate for such communities as cooperatives, marketing groups, and labor unions who already are involved in raising resources to use their established financing mechanisms to support health activities.

## Primary Health Care

As more fully described in the introduction, primary health care consists of making basic and essential health interventions universally accessible to individuals and families through their full participation and at a cost that the communities and country can afford. Primary health care services are particularly relevant to community groups because they are supposed to be locally based and tailored to the needs of the community.

Primary health care is the most basic of three levels of health care that a community may need. The more specialized levels--secondary and tertiary health care--complement PHC services. The Alma-Ata Declaration defines the relationship between primary, secondary, and tertiary health care as follows:

. . . the other levels of the system . . . converge on primary health care in order to support it and to permit it to provide essential health care on a continuing basis. At the intermediate level (secondary health care) more complex problems can be dealt with, and more skilled and specialized care as well as logistic support provided. At this level, more highly trained staff provide support through training and through guidance on practical problems that arise in connexion with all aspects of primary health care. The central level (tertiary health care) provides planning and managerial expertise, highly specialized care, teaching for specialist staff, the expertise of such institutions as central health laboratories, and central logistic and financial support.(1)

Primary health care services cannot be provided effectively in isolation from other health care services. They are part of the whole system. (See figure 1-1.)

## Financing

Financing is the raising of resources to support or pay for goods and services. These resources may be in the form of cash or such in-kind contributions as labor and materials. Daily operational requirements as well as the requirements of longer term investments must be taken into account in identifying the resources that are needed and how they will be used.

Health care is financed by many different sources. The most common can be divided into public, or government, and private, or community. (See figure 1-2.) Dieter Zschock describes these financing sources in a monograph entitled "Health Care Financing in Developing Countries."(2)

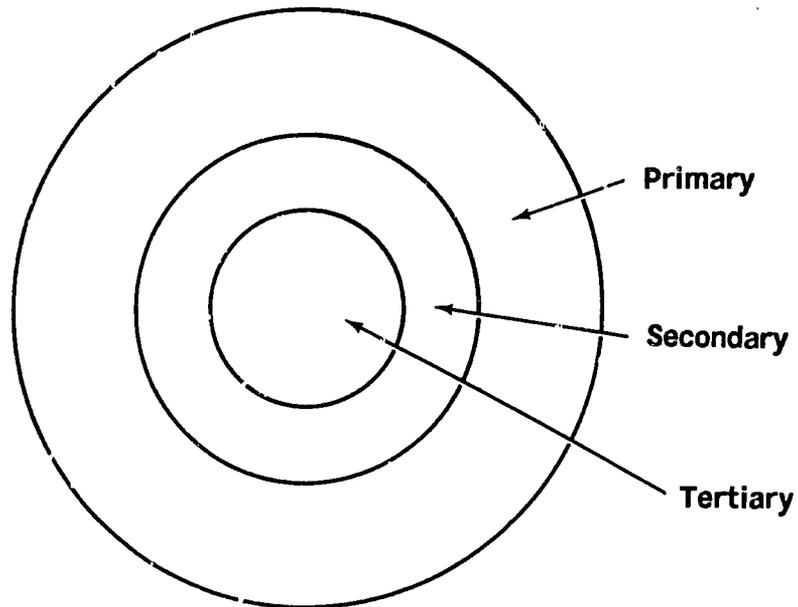
Collectively, those sources provide the cash and in-kind resources to finance tertiary, secondary, and primary health care. The level of contribution and the type of resources provided depend on the health sector needs and the willingness and ability of each source to pay for care.

## Community Financing of Primary Health Care

Community financing of primary health care, then, is defined as the mobilization of resources by a community to support, in part or in full, basic preventive and curative health services for its members.

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**Figure 1-1.--A Health Care System**



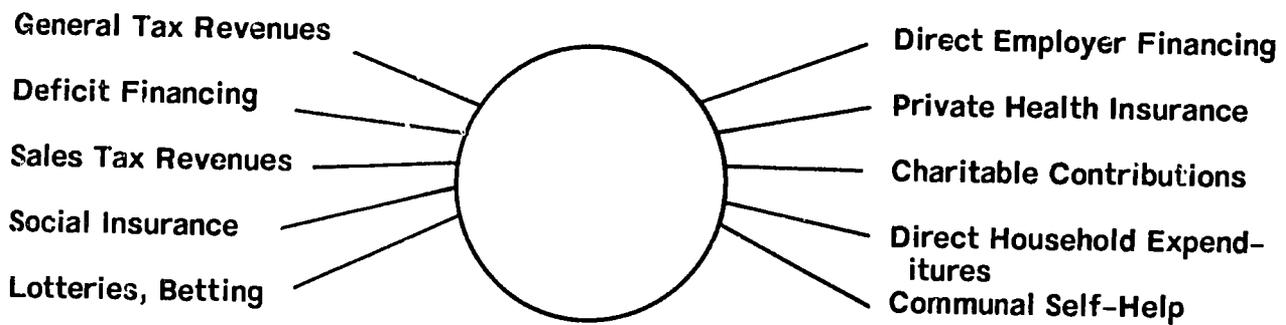
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**Figure 1-2.--Sources of Health Care Financing**

Public

Private



## EVOLUTION OF INTEREST IN COMMUNITY FINANCING

Milton Roemer traced the long history of health sector financing in the West back to prehistoric times.<sup>(3)</sup> He found that from the very first, household and community groups have played a central role in providing resources for health activities. In ancient times, they provided gifts, food, lodging, and other material compensation to healers. In classical Greece and Rome, as city-states developed, public taxes began to be collected and used for providing both medical care and water supplies and sanitation. During medieval times, feudal landowners financed the health care of the families who worked on their estates, while as towns grew, "artisan doctors" and "apothecaries" began to receive fees paid by households of individuals seeking care. Both Moslem and Christian religious institutions began to provide care, especially for the poor, financed by charitable donations from community members and, later, supplemented by city tax revenues.

Craft guilds during the Renaissance and Reformation began collecting regular contributions from members and used these resources to provide members with assistance in times of sickness and death. Later, as business organizations and factories came into being, workers began to form cooperatives, which established "mutual sickness assistance funds," the forerunners of present-day voluntary health insurance programs, as Roemer points out. During the industrial revolution, the formation of workers' unions and political parties stimulated European governments to establish "sickness funds," which were the beginnings of social security, or social insurance, methods of financing health care. At the same time, crowded, unhealthy conditions in growing urban areas led to the birth of the public health movement and the use of local tax revenues to finance improved environmental sanitation.

In the 20th century, national taxation gradually came to play an increasingly important, and finally a central, role in financing health activities. Other emerging sources of financing included industrial organizations (which financed workers' health services ranging from treatment for injuries to complete medical care and safety measures) and especially after World War II, foreign aid. Throughout these developments, private household financing continued to be important in both developed and developing countries.

As the above illustrates, the mobilization of community resources to support health activities (through mechanisms ranging from private household expenditures and contributions to workers' groups and insurance programs) is by no means something new. What is new is the concerted interest in community financing as an alternative to a continued expansion of the role of central governments in financing health activities.

### International Interest

Interest in community financing has emerged among international organizations involved in health in the context of concern with overall health sector financing. Twenty years ago, little information was available about how countries were financing their health activities and how this financing affected the services delivered. As a result, particularly in the past 10 years, working papers were prepared and country case studies undertaken by such organizations as the Pan American Health Organization (PAHO), the United States Agency for International Development (AID), and the World Health Organization (WHO), in an effort to fill the knowledge gap about overall health sector financing.<sup>(4-8)</sup> The principal health policy development during this time was a growing commitment by many countries to expand health services to include primary health care. Because of this, there was also interest in identifying ways to mobilize new financial resources to help support this expansion.

Several important findings have emerged so far from the working papers and case studies. They include:

1. The "resource gap" between the costs of primary health care and the expenditures being made for primary health care has become clear as country case studies have begun to document both costs and expenditures.
2. Although central governments had come to be viewed as the principal source of financing for the extension of primary health care activities, country case studies showed that nongovernmental expenditures for health were sizable. However, these expenditures were largely for private, curative services rather than for promotive or preventive services and other activities identified as having the greatest potential for improving health status.

Both of these findings helped to stimulate interest in identifying ways to fill the resource gap through a more rational allocation of all health financing resources. A renewed interest in community financing emerged in this context. In 1980, noting that "the mobilization of necessary resources is becoming a central issue to the development of primary health care," WHO launched a special project, "Costs and Financing Patterns of Primary Health Care at the Community Level," the purpose of which was "to identify different alternatives for economic support and resource mobilization of some or all elements of primary health care at the community level."<sup>(6)</sup>

The World Bank and AID sponsored a number of studies related to better understanding the health expenditures of households and communities.<sup>(7, 8)</sup> The National Council for International Health's annual meeting in June 1982 took "Financing Health Services in Developing Countries" as its conference theme, and a number of papers presented focused on community financing.<sup>(9, 10)</sup> In late 1982, the American Public Health Association, with support from AID, published a comprehensive review of community financing.<sup>(11)</sup> And PRICOR has identified community financing of primary health care as a priority area for research funding.

### National Interest

In addition to their interest in community financing as a way to expand primary health care, national policymakers began to see community financing in the larger context of overall economic and social development. Many ambitious development programs begun in the 1970's were financed by a combination of central government resources and external debt. Two consequences of these efforts began to emerge in the 1970's. First, the recurrent cost requirements of development projects that had matured into ongoing programs began to be realized and to fall squarely on the national budget. Second, the debt repayment burdens imposed by earlier borrowing began to stretch government expenditures to the limits of their fiscal capacities. At the same time, worldwide recession and reduced output caused national incomes to stand still or decline.

The convergence of these developments and the evolution of thinking about financing primary health care led to a fundamental reexamination of the role of central government in both financing and providing PHC services and activities. The assumption that Ministries of Health and other central government agencies are or should be the principal, if not sole, providers of primary health care has been called into question by the severe constraints upon governments' ability to finance these efforts and by the evidence that individual households and community groups are financing more of their health care than

had been thought. The commitment of primary health care to mobilizing greater community participation in and control of health care has given additional impetus to this reexamination.

Given the social nature of PHC benefits (i.e., the tendency for such benefits as immunization, sanitation, and maternal and child health programs to accrue to the community as a whole and not only to specific individuals), some governmental role seems appropriate. However, this does not mean that public sources either should or can completely finance primary health care. Community financing, though it has its limits, is an important source that has been successfully used in the past and has the potential to be more helpful in the future. Some mix of community and public financing of health care may be the most effective approach. Examining current PHC government and community financing represents an important step in the search for the most appropriate financing package.

### IMPORTANCE OF OPERATIONS RESEARCH ON COMMUNITY FINANCING

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. Few systematic studies have been undertaken that would begin to provide the answers to these questions. Research in the field of primary health care has often consisted of descriptive or evaluative studies and seldom been focused on clear identification and resolution of important operational problems. Further, even though program managers and researchers can learn a great deal from programs and studies conducted elsewhere, research is often needed onsite to solve local problems.

Operations research can make important contributions to the solution of problems that have impeded the development of effective PHC and community financing strategies. Well-designed operations research can effect economies and save time in arriving at preferable strategies by narrowing the range of choices and eliminating unproductive field trials. It can also strengthen adjustment of policies and strategies by systematically using information gained from experience.

The following chapter describes a number of issues related to community financing of primary health care that are amenable to operations research. Chapter III describes a general approach for conducting operations research on such issues.

## NOTES

1. Primary Health Care, Report of the International Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September 1978, jointly sponsored by WHO and UNICEF (Geneva: WHO, 1978), p. 53.
2. Dieter K. Zschock, Health Care Financing in Developing Countries (Washington, DC: APHA, International Health Programs Monograph Series, No. 1, 1979).
3. Milton Roemer, "Financing of Health Services: Proceeding of a World Health Organization Interregional Workshop, Mexico, 26-30 November, 1979," (Geneva: WHO, SHS/SPM/80.3), pp. 31-39.
4. Financing of Health Services: Report of WHO Study Group (Geneva: WHO Technical Report Series 625, 1978).
5. "Methods of Financing Health Activities: Background Document" (Geneva: WHO Study Group of Experts on Financing of Health Services, SHS/FIN/77.1, 21-25 November, 1977).
6. "Cost and Financing Patterns of Primary Health Care (PHC) at the Community Level" (Geneva: WHO, Project Document SHS/PHC, March, 1980), pp. 1-2.
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8. J. S. Akin, C. C. Griffin, D. M. Guilkey, and B. M. Popkins, "The Demand for Primary Health Care Services in Low Income Countries: A Review and Case Studies," draft (Washington, DC: AID, 1982).
9. \_\_\_\_\_, "The Demand for Primary Health Care Services in The Bicol Region of the Philippines," a paper presented at the National Council for International Health (NCIH) Conference, June 14-16, 1982.
10. Clive Gray, "Issues in Defining and Measuring Recurrent and Capital Costs of Primary Health Care Interventions in Africa," a paper presented at the NCIH Conference, June 14-16, 1982.
11. Wayne Stinson, Community Financing of Primary Health Care (Washington, DC: APHA, International Health Programs Monograph Series 1, No. 4, 1982), p. 13.

## **CHAPTER II**

### **OPERATIONAL PROBLEMS RELATED TO COMMUNITY FINANCING**

## CHAPTER II. OPERATIONAL PROBLEMS RELATED TO COMMUNITY FINANCING

This chapter presents community financing (CF) research issues, or "problem clusters," and the variables to consider both in examining the operational problem more precisely and in analyzing potential solutions to the problem. It provides: 1) A presentation of the range of possible research problem clusters; 2) A review of one important community financing research 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.

### COMMUNITY FINANCING PROBLEM CLUSTERS

As discussed in chapter I, both national and international organizations are exploring ways to build community financing into primary health care systems. Countries differ, however, in the objectives they set for community financing, the participating populations, the methods for raising revenue, and the procedures for setting fees, collecting revenues, and managing and supervising the financing systems. Operations research is invaluable to making tactical and strategic decisions about resource allocation, program structure, and procedures.

Experience has shown that policymakers and program managers must deal with some, or all, of 12 sets of issues, or problem clusters, in designing or operating community financing systems. They are:

1. The role of the community
2. The objectives of community financing
3. Linkages to other financing of primary health care
4. Contributors to and beneficiaries of community financing
5. Services and commodities to be financed
6. Revenue mobilization methods
7. Prices, fees, and charges
8. Training and education
9. Management and administration
10. Payment and revenue collection
11. Supervision and control
12. Monitoring and evaluation of CF performance.

Of these problem clusters, revenue mobilization methods has received much more attention than all the others combined. Accordingly, a review of recent experience follows.

### REVENUE MOBILIZATION METHODS: A REVIEW OF RECENT EXPERIENCE

Program managers and policymakers have been particularly interested in finding alternative ways to mobilize community resources to support primary health care. Thus, more is known about revenue mobilization methods, or financing schemes, as they are sometimes called, than all other operational problems combined. The American Public Health Association (APHA) monograph by Wayne Stinson, "Community Financing of Primary Health Care," mentioned in chapter I, provides a comprehensive overview of recent country-level experiences with community financing.(1) Relevant findings are

summarized here to provide some idea of the range of community financing schemes that exist and to identify some of the advantages and disadvantages of those alternatives. Table 2-1 provides an overview of each of the schemes discussed.

Stinson identified more than a hundred PHC projects and programs using community financing, ranging from the national program in the People's Republic of China to small demonstration projects. He found several major categories in which to group existing community financing schemes. They are:

- Service fees
- Drug sales
- Personal prepayment
- Production-based prepayment
- Income-generating schemes
- Community labor
- Individual labor
- Donations and ad hoc assessments
- Festivals, raffles, and similar activities.(2)

As to the objectives, or uses, of community financing, Stinson found that the major expenditures are for compensation of health workers, restocking of basic drugs, general revenues, partial defrayal of training costs, partial defrayal of hospitalization costs, and supplementation of government health services.

Most projects report the use of community financing for more than one of these purposes; however, the communities represented in the review did not help finance evaluation, vehicles, petrol, or major equipment.(3)

Recent experience with revenue mobilization methods and their advantages and disadvantages are summarized below. (For more detail, see Stinson's "Community Financing," chapter 2.)

### Personal Service Fees

The payment of personal service fees to health care providers is a widely used method of financing both public and private health care services. Although payments in kind (e.g., livestock or produce) are accepted more often by traditional practitioners than by practitioners of contemporary medicine, it is not uncommon for patients to contribute labor in exchange for clinic consultations. Service fees are most frequently used for compensating health workers or raising general revenues, which may be used to purchase drugs and supplies.

Different patterns of revenue collection and management were found. In some instances, health workers collect and retain fees themselves; in others, clinic staff or health committees handle the funds.

**Table 2-1.--Advantages and Disadvantages of Alternative Community Financing Methods**

<i>method</i>	<i>strengths</i>	<i>weaknesses</i>	<i>appropriate uses</i>	<i>supplemental needs</i>	<i>common problems</i>
Fee for service	Familiarity; may draw current private spending into public sector	Mostly supports curative services for those who can afford to pay; no risk sharing	Payment of health workers if moderated by sliding scale	Support for preventive and community work	Many are reluctant to pay minimally trained community worker when traditional or private practitioner is available
Drug sales	Reduces drug costs through use of unpaid labor and emphasis on limited range of essential drugs	Supports mainly curative care for those who can afford to pay; no risk sharing	Coverage of in-country drug costs	Help for the poor; foreign exchange for imports; support for preventive and community work	Supply interruptions; "decapitalization"; black marketing
Personal prepayment	Spreads health costs between the healthy and the sick	People often reluctant to pay for health care, expect when specifically required	Prepayment of fixed costs, if adjusted for family income	Back-up funds may be needed for cost overruns	Many people prefer service fees when given the option; adverse selection
Production-based prepayment	Bases financing on existing economic unit	Available for limited population groups (except where production is communal)	Appropriate for employed persons or for cooperative or communal production	Support for subsistence groups	Especially subject to economic forces
Income generation	Allows community labor to be used for recurrent costs	Start-up costs may be especially high	Most appropriate for multisectoral (especially PVO) projects	Back-up funds	Especially subject to economic forces
Community labor	Uses an abundant resource	Only seasonally available and only for one-time costs	Appropriate for facility construction and maintenance	Support for recurrent costs	Community loses interest if government does not provide expected inputs
Individual labor	Uses an abundant resource	Generally available only part-time; high turnover may raise training costs	Mainly for part-time and supplemental health activities	Referral links for all but simple problems	May be unavailable when needed
Donations and ad hoc assessments	May use readily available local materials; donations allow people to contribute according to ability	Limited utility, mainly for one-time costs	Purchase of equipment or initial drug supply	Support for recurrent costs	May be difficult to motivate
Festivals, raffles, etc.	People may "enjoy" paying	Limited utility, mainly for one-time costs; low efficiency	Purchase of equipment or initial drug supply; capital construction in some countries	Support for recurrent costs	

Source : W. Stinson, Community Financing of Primary Health Care, Table 3.6, "Overall evaluation of community finance alternatives," p. 39.

Three basic patterns were found for establishing fees: negotiation between health workers and patients; joint consultation between communities and professionals; or unilateral professional or government decision. Stinson's review found that the principal factor in setting fees is often subjective estimates of the ability and willingness of patients to pay. In very few instances have surveys or other formal means been used to assess patients' ability and willingness to pay. Nor have factors such as total revenue requirements or utilization levels received enough consideration in establishing fees. Many projects, however, do report using variable fee scales and exemptions for certain types of patients or conditions.

### Drug Sales

The second most frequently noted method of financing is the sale of drugs, whose costs are a major component in the recurrent costs of primary health care. The community financing efforts that APHA reviewed placed emphasis on providing a relatively small number (from five to fifteen) of "basic" drugs. Prices are often kept below those charged by private pharmacies through the use of government subsidies, wholesale price controls, or nonprofit marketing through community pharmacies. Potential competition with the private sector has emerged, but successful programs have carefully developed good relations between the private sector and community efforts.

Although many projects sell drugs to raise general revenues, more than half of those surveyed are engaged in "self-financing" revolving drug funds (RDFs), which use the proceeds from sales to purchase new supplies. Any surplus is typically used to compensate health workers or to cover other costs. These funds require startup capital, usually enough to purchase a 3-months' supply, which is often generated through either community-wide fundraising or the sale of shares in the revolving fund. The latter appears to have been more successful.

The principal management arrangements used are sale by individual health workers, sale through community pharmacies, sale at health clinics, and sale through established merchants. A few projects have instituted special arrangements to insure that drugs are available to the poor or to promote desired health behaviors. For example, in one project, a patient pays all charges for subsequent required doses of vaccine when the first dose is given.

### Personal and Production-Based Prepayment

The principle behind fee for service and drug charges is that individuals pay when the goods and services are needed, usually in times of sickness. The principle behind prepayment or insurance programs is that people pay for health services and activities before they are sick; the costs and "risks" of sickness are shared among all participating members, regardless of individual use.

Prepayment financing programs in developing countries rarely attempt to cover all costs, and copayment by patients (i.e., payment of a portion of the charges at the time of service) is common. Additional fees enable nonmembers to receive services and provide disincentives to overuse. They allow prepayments to be used for predictable or "fixed" costs (e.g., workers' salaries), as the additional income from the direct charges can be used for costs that vary with utilization, for example, medicines. In the methods reviewed by APHA, the most common use of additional income was to finance health workers' salaries and drug costs.

Personal prepayment and production-based prepayment differ from one another. In the former, individuals or households pay premiums or membership fees directly—either in cash or in kind. In order for personal prepayment methods to be financially viable, they must enroll a minimum number of people and have a balance between the number of healthy and sick people. As the APHA monograph points out, there is little consensus or guidance to suggest what the minimum enrollment or balance needs to be. Only a few projects have taken household income (i.e., ability to pay) into consideration when establishing membership premiums, although some do make special exemptions for poor households.

Experience indicates that renewal and premium collection rates are low if nonmembers can pay directly for services on an "as-needed" basis. It also indicates that since households' ability to pay varies with economic conditions, "backup" or reserve sources of income should be established to keep the basic program in operation during hard times. One program, Dana Sehat in Indonesia, uses a community credit union to hold any surplus income, which is then loaned back to the program to cover deficits. External sponsors are another source of reserve income.

Production-based prepayment relies upon marketing levies, taxes, or other such mechanisms for deriving the surplus accumulated by productive enterprises and may be supplemented by contributions from workers (e.g., through payroll taxes) and governments. The APHA review identified nine schemes based on production or marketing and notes that one, the Chinese system, has been adopted by 85 percent of the production brigades, representing 80 percent of China's population. Programs in Japan, Ethiopia, and Benin aim to cover large segments of their national populations.

Other studies have noted that between 40 and 75 countries now have either voluntary or required social insurance or social security programs. Many are based upon cooperation among government, workers, and economic enterprises, and they are among the most rapidly expanding forms of health financing.

The economic units upon which prepayment methods reviewed by APHA are based include communes and factories, farmers' and producers' cooperatives, and community marketing associations. Funds are used to finance health-related activities in a variety of ways; the contributors may operate their own health service systems, contract with private practitioners or organizations, or even contract with Ministries of Health to provide services.

#### Community or Individual Labor and Income-Generating Schemes

Community labor, contributed by volunteers, is often associated with community participation in primary health care. Volunteers frequently assist in such basic environmental improvement activities as building latrines, improving water supplies, and disposing of refuse. They also build and maintain clinic facilities and housing. Some unpaid village health workers provide basic health care services, and volunteers are widely used in such activities as immunization campaigns, health education, and oral rehydration therapy distribution programs. Although contributions of voluntary community and individual labor have proven difficult to sustain over long periods of time, they have served to reduce recurrent costs and to expand and extend health-related activities.

Income-generating schemes are used in a number of countries to provide general revenues for financing health activities. Rice mills, fish ponds, community gardens, dairies, bakeries, and locally run pharmaceutical companies are all mentioned in the APHA monograph as income-generating schemes currently in use.

## Ad Hoc Contributions and Fundraising

Contributions by community members, including sizable donations from wealthy individuals, are commonly used to defray some of the costs of health-related activities. Contributions may take the form of cash, materials (e.g., for construction), livestock (as compensation for health workers), or land or space for health facilities. Special fundraising methods used to encourage community contributions include assessments, festivals, raffles, and lotteries.

In summary, the APHA study found that community financing most often supports costs associated with worker compensation, drugs, and construction and maintenance. The activities supported are principally basic service delivery and other activities that occur within the paying community. The resources generated--local currency, labor, produce, and materials--are often of variable dependability and have proven difficult to sustain over time.

As to the effects of community financing on the scope of services, only activities with high community demand are supported, and these may not include PHC activities. Community financing has increased accessibility of services in underserved areas. Whether it is more effective than other types of financing in achieving this objective remains to be demonstrated conclusively.

The APHA monograph notes throughout that many decisions must be made and questions answered in the course of planning and implementing a community financing system. Further, it concludes, "Studies of successful community finance must consider both process and outcomes; this review found few details about either."<sup>(2)</sup> Research is just beginning to yield the information to guide planners and decisionmakers on how best to structure and manage community financing efforts.

## SYSTEMATIC ANALYSIS OF COMMUNITY FINANCING PROBLEMS

The nature of a community financing operational problem will vary somewhat, depending on whether the researcher is studying an ongoing system or trying to provide relevant data for designing a new system. For example, management of a community financing system is a common problem, but the researcher will take one approach in analyzing the management problem of an ongoing financing system and another in analyzing the management needs for a system that is being designed. In either case, the general problem must be carefully described, smaller operational problems defined, and priorities set for developing solutions.

A review of relevant information that has already been prepared is helpful at the start of a major problem analysis effort. For example, surveys, site visit reports, interviews with key informants, and observations often identify operational problems. Analysts may need to supplement these data with new information. Quade suggests an investigative reporter approach, interviewing people to answer the key questions about the problem: who, what, when, where, how, and why.

When beginning work on a study, the analyst should interrogate the sponsor and all other persons associated with the problem situation who seem likely to be able to help. In particular, he seeks answers to such questions as

1. How did the situation arise? Why is it a problem?
2. Who are the people who believe it to be a problem?

3. Why is a solution important? If an analysis is carried out, what will be done with it? Will anybody be able to act on the recommendations?
4. What should a solution look like? What sort of solution is acceptable?
5. Is it the right problem anyway? Might it not be just a manifestation or a symptom of a much larger or deeper problem? Would it be better to tackle this larger problem if there is one?
6. Analytical resources are always limited; at this stage does it seem that there would be a return from the study effort that would be justified, or would the analytic effort be better applied elsewhere?(4)

This type of problem analysis may be sufficient. However, in conducting operations research on community financing, a more formal systems approach to problem analysis may be necessary.

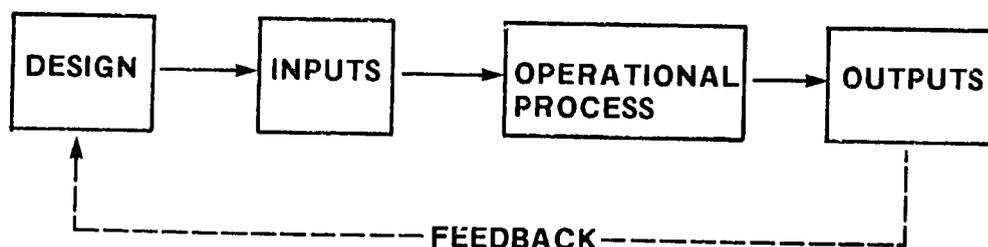
A system absorbs inputs according to some plan or design and then processes them to produce outputs. (See figure 2-1.) Johnson, et al., suggest that:

The best way to view (a) system is by describing the flow process, analyzing each segment, and investigating the relationships and contributions of the parts to the whole. In this way it is possible to direct attention and study to those segments which fail to optimize their contribution to the total system.(5)

The authors give this description of a system.

A system will be defined as an array of components designed to accomplish a particular objective according to plan. There are three significant points in this definition. First, there must be a purpose, or objective, which the system is designed to perform. Second, there must be a design, or an established arrangement of the components. Finally, inputs of information, energy, and materials must be allocated according to plan . . . . These same ingredients are basic to every system. . . . However, the emphasis in the systems concept differs slightly. Information, energy, and materials are classified in terms of whether they are used 1) to create the system or 2) to operate the system.(6)

Figure 2-1.--A Simple System



Operations research is concerned with identifying problems and assessing possible solutions to both design and operational processes. The 12 problem clusters listed at the beginning of this chapter serve as a starting point in the description of a community financing system. Although a relationship among these problem clusters is implied, it is not explicit. Operations research requires that the relationships be made explicit and defined in causal terms. For example, what is the relationship between the objectives of a community financing system and the revenue mobilization methods? This is where a system description is useful.

Figure 2-2 is an example of one diagram (or model) that illustrates how the community financing system functions. The diagram shows the 12 problem clusters within a rectangle that defines the "boundaries" of the community financing system. The seven problem clusters that are primarily related to planning decisions are shown in the "design" box, and those that are primarily related to implementation decisions are shown in the "operational processes" box. However, since the problem clusters involved in implementation (training/education, management/administration, payment/revenue collection, and supervision/control) must be planned as part of the whole financing system, the design and operating decisions often overlap.

The larger rectangle represents the environment within which the community financing system operates. This environment is made up of other health systems (private, social security, etc.), other socioeconomic sectors (agriculture, transportation, and so forth), infrastructure (roads, communications systems), and natural forces (climate, terrain) that affect the system in one way or another.

The community financing system originates with the PHC strategy, which is often developed outside the community; for example, by the Ministry of Health. That strategy may require that communities contribute to the financing of primary health care. Before that can happen, the financing system must be planned. Decisions have to be made, for example, on what role the community will play in the system, what the financing objectives will be, who will contribute to the system and who will benefit from it, what services will be procured, and how resources will be mobilized. These problem clusters are interrelated, so that a decision on one part of the system, for example, the price to charge for oral rehydration salt packets, must be considered in relation to the other parts.

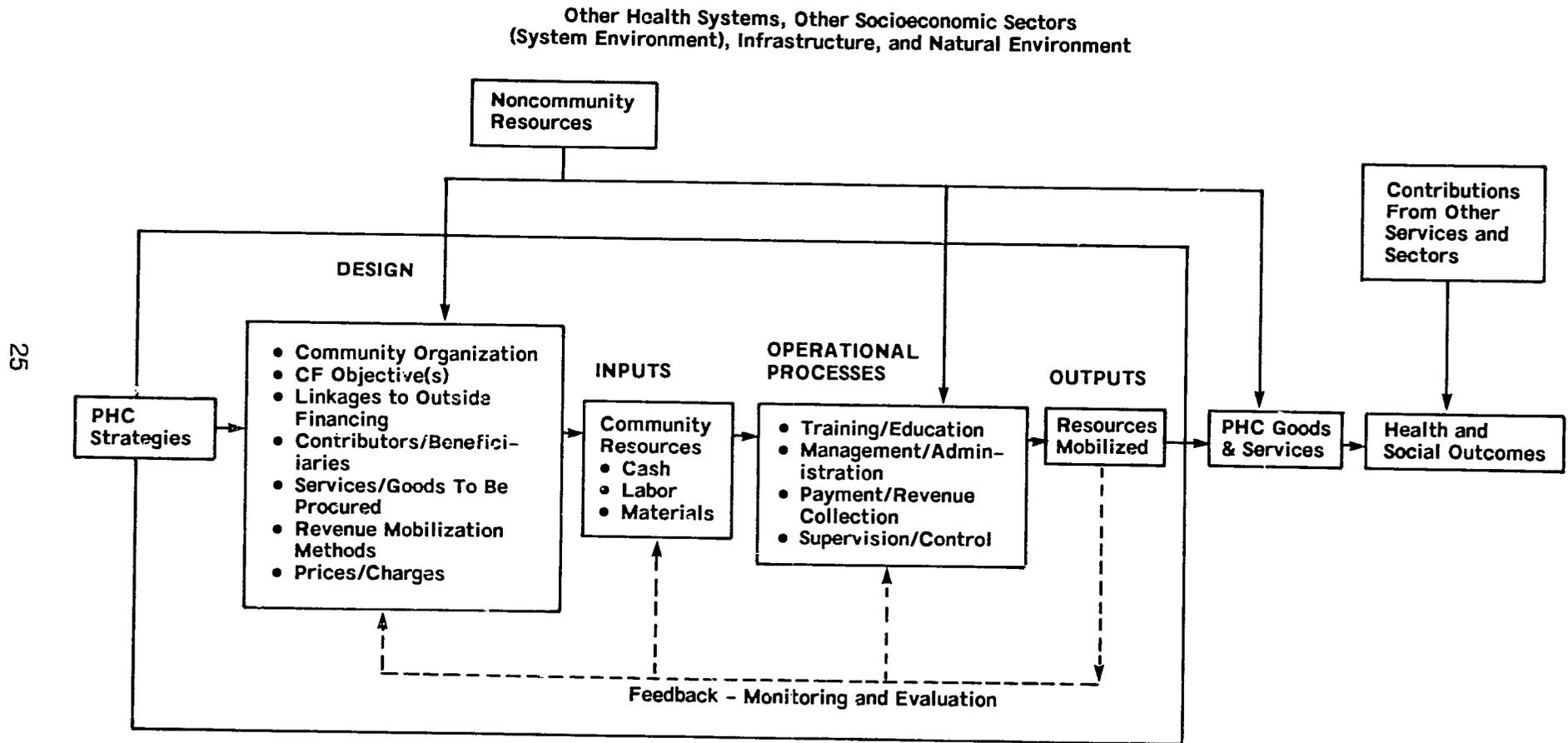
After the system has been designed, it is ready to operate by drawing inputs from community and noncommunity sources. The most significant inputs will be cash, labor, and materials.

The choice of procedures to pay for and collect these resources is an operational problem that depends on decisions made in the planning, or design, of the system. Other operational problems include the training of staff and education of community participants, the management and administration of the system, and the supervision and control of the system.

Inputs are transformed into outputs according to the system design. The outputs of the system are the resources mobilized to purchase PHC goods and services that, when properly used, are expected to have a positive impact on the health status of the community. Providing feedback to the decisionmakers on the actual operation of the community financing system enables them to adjust the design, as necessary.

Figure 2-2 is a general description of a community financing system and the key variables for a particular problem. Operations research in a particular country must proceed from a description of the actual relationships in that country's PHC program.

Figure 2-2.--Diagram of a Community Financing System



A financing diagram such as figure 2-2 can be a helpful tool for problem analysis, since it can display the principal problem clusters and show how they are related to one another. Narrowing this simple model into a more detailed description of one or more problems allows the researcher to identify the relevant variables, and their relationships, that need to be studied.

### IDENTIFYING THE KEY VARIABLES OF A PROBLEM

When analysts begin to examine an operational problem they are usually confronted with a large number of variables which affect the system, and they must decide which ones are relevant to the problem. The most relevant variables that make up a problem can be divided into two categories: those that are controllable and those that are uncontrollable. The former are called decision variables because they are under the control of the decisionmaker (e.g., prices and fees).

There are several types of uncontrollable variables. One of the most relevant are the constraints. Constraints tend to limit the range of choices available to a decisionmaker. Some constraints are external to the system, for example, the weather, which may limit program activities to particular seasons. Other constraints are imposed by the system itself and can affect inputs (the community cannot contribute cash), processes (resources must be under community management), or the outputs (resources will be used to buy drugs). Sometimes uncontrollable variables expand the range of choice or favor a certain decision (e.g., the willingness of villagers to pay for drugs). Some authors call these "facilitating factors."\*

Figure 2-3 lists common decision variables and constraints related to the problem of raising revenue. The solution to this problem is a function of the interaction of these sets of variables. Thus, in looking for a solution to a problem, the operations research analyst must first identify the most relevant decision variables and the constraints and facilitating factors.

The operations research approach to problemsolving is described in more detail in chapter III, but at this point, a brief example may help explain the relationships among these variables and demonstrate why it is important to identify them.

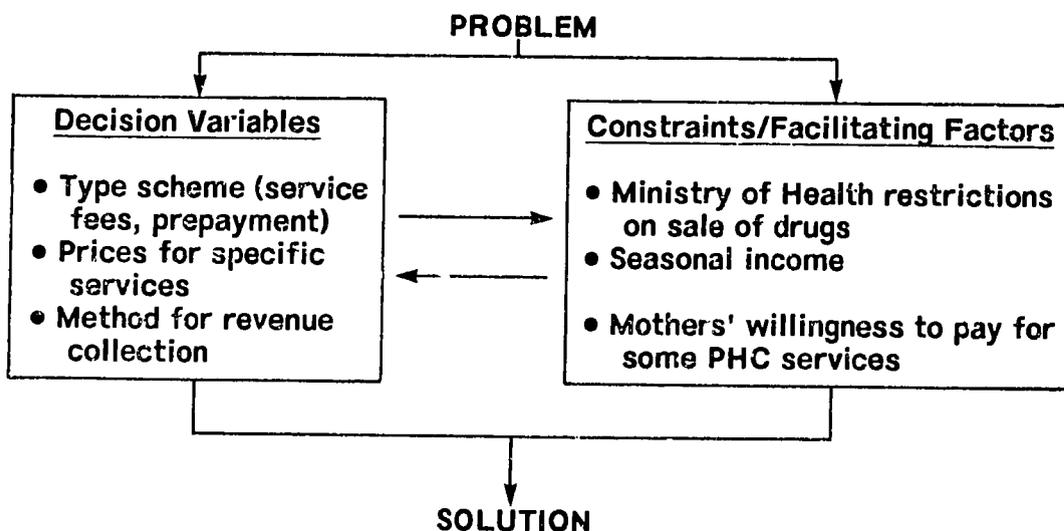
The analyst usually begins with an objective, a statement that describes what the solution should accomplish. If the operational problem is one of revenue mobilization, the objective of the solution might be stated as: to define a strategy for mobilizing revenue that will be acceptable to the community and capable of raising enough resources to pay for the desired PHC services and commodities.

Given that objective, the analyst needs to identify all of the relevant decision variables that can be manipulated to bring about desired changes. For example, the program manager and community can select the type of scheme they want (direct payment of fees for PHC services, prepayment of an annual premium, etc.), they can set the prices for various services and commodities, and they can decide what payment procedures they will adopt.

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\*For a discussion of the types of variables that are important in operations research, see the PRICOR monograph Operations Research Methods: A General Approach in Primary Health Care, by Stewart Blumenfeld.

Figure 2-3.--Some Variables Related to Revenue Mobilization



Then, the analyst assigns the value for each decision variable that will best achieve the stated objective. For example, what is the amount of revenue to be generated by the scheme(s), and what specific prices will be set, given the dual objective of selecting a scheme that will be acceptable and will raise the needed revenue?

The analyst must also identify all of the relevant constraints, the "givens" that limit the range of choice. For example, the Ministry of Health may prohibit the sale of drugs except by registered pharmacists. If so, the community could not raise funds by selling drugs, unless there were a pharmacist in the community willing to cooperate.

Facilitating factors favor certain choices, and the analyst must identify them. For example, if most mothers in the community are willing to pay for immunization and a few other PHC services, that is a facilitating factor.

To summarize, a community financing objective may be to raise enough revenue to cover PHC costs. A constraint may be that the Ministry of Health prohibits drug sales except by registered pharmacists. One of the decision variables would be the mix of schemes for raising revenue. The value of that decision variable would be the amount of revenue to be generated by each scheme in the mix. An optimal solution to this problem, therefore, would be to find the mix whose value, that is, the amount of revenue to be generated by each scheme, covers costs, given the constraint that funds cannot be raised by selling drugs.

Thus, in conducting operations research on a problem, the analyst needs to state that objective and identify the relevant decision variables, constraints and facilitating factors--those elements on which research will concentrate to reach the optimal solution.

### INVENTORY OF OPERATIONAL PROBLEMS AND DECISION VARIABLES

This section identifies the most common decision variables for each community financing problem cluster as an aid to identifying potential operations research topics related to community financing. Where possible, it also identifies common constraints as seen in the relevant experience of community financing programs and studies on these

problems. Unfortunately, the literature on these problem clusters is uneven. Much more is known about some problem areas, especially revenue mobilization methods, than others, such as management and administration of community financing systems. This lack of information indicates the need for more research on these problem clusters.

This section does not discuss in detail the specific operations research methods which may be used to solve the problems or make the decisions-- although some examples are given. Rather, the intent of this section is to identify the types of decisions suitable to operations research and to show how these decision clusters relate to the community financing system.

### Problem Clusters Primarily Related to Design

Figure 2-4 illustrates those problem clusters primarily related to design and their relationship to one another and to the overall community financing system. Each of these seven clusters is described below.

#### 1. Role of the Community

Deciding what the role of the community should be in community financing is a particularly important problem. Experience shows that community involvement is essential to a successful system because it is linked to all of the other components of the system. In some countries, the community plays an important role in primary health care. In others, the community is only minimally involved. What needs to be determined is the nature and degree of community involvement, for example, in setting objectives, identifying the target population, and selecting the financing scheme. This decision variable is a continuous one; that is, the range of choice is from zero involvement to 100-percent involvement, with the optimum level somewhere in between. Research on the optimum level of involvement has been rare; thus, it remains an important operational problem.

Decisions also need to be made concerning which activities the community should be involved in. This is a discrete decision variable; that is, specific and separate activities can be identified. These could include planning, setting prices, collecting revenue, or supervising the collection of revenue by community health workers. For example, in the Pikine project in Senegal, community representatives are responsible for collecting fees, accounting, and paying medical staff for their services.(7) This works very well in Pikine, but it may not be appropriate in other settings. Operations research is required to identify both the most appropriate activities for community participation and the level of participation in each activity.

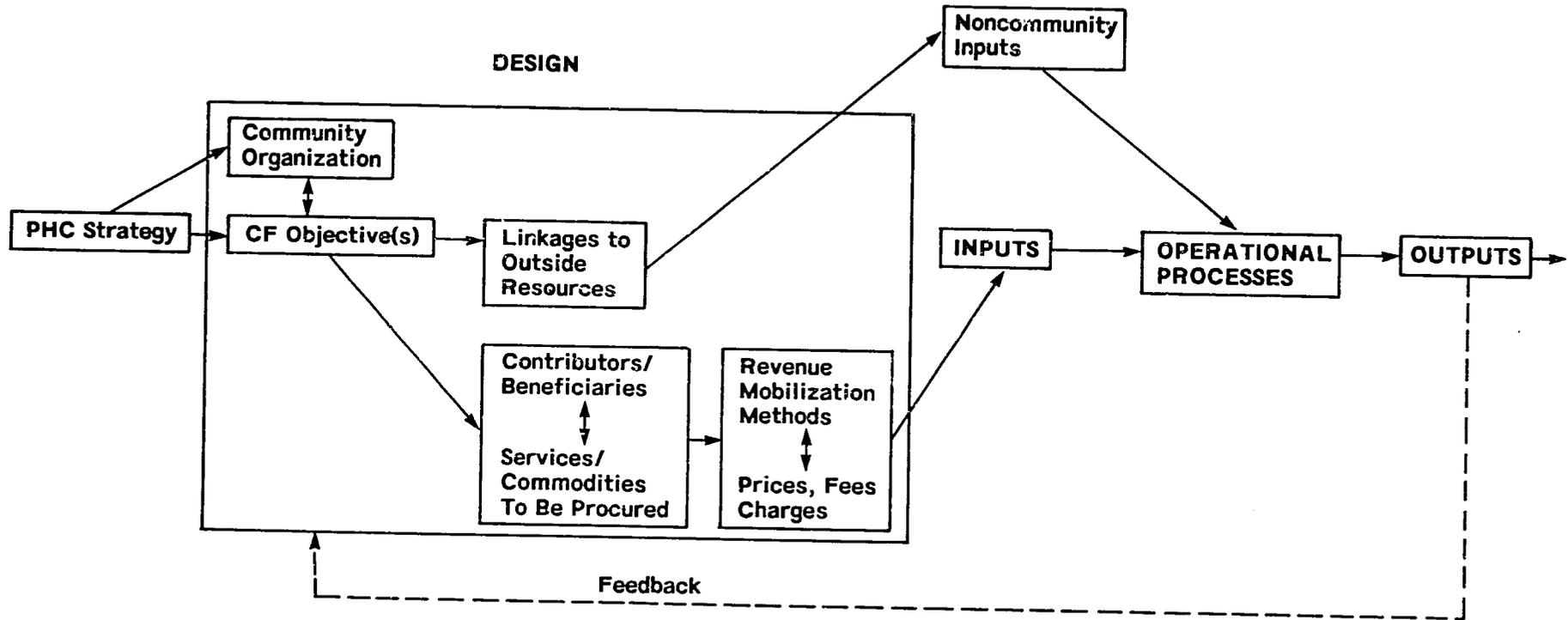
Another problem is deciding on the most appropriate formal and informal structures for organizing community participation, including who should be involved (everyone, mothers only, community leaders) and how they will participate (periodic meetings, committees, voting). Research in this area has been very limited, but many communities rely on committees to represent them and define their role.

For example, in the Vanga Hospital Community Medicine Program in Zaire, village health and development committees represent the communities in PHC financing decisions. These committees are responsible for constructing and maintaining buildings, staff houses, and airstrips and play an important role in deciding which services to offer, when to schedule services, and how to allocate project funds.(8)

In other countries, health workers act as the intermediaries between the health system and the community. In a PRICOR-funded study in the State of Mexico, for

Figure 2-4.--Problem Clusters Primarily Related to Design of a Community Financing System

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## ROLE OF THE COMMUNITY

### Common Decision Variables

- Level of community participation: high (very active) to low (not active)
  - Activities in which the community is involved: planning; contributing resources; operating and managing; motivating community members
  - Mechanism(s) of community participation: committee; CHW; communal meetings
  - Procedures for organizing community participation and its continued promotion in community financing
  - Incentives for organizing participation: recognition; availability of desired services; compensation
- 

example, health promoters survey community members and hold small group discussions to obtain community input. Other mechanisms through which a community could be involved include local government councils, women's clubs, and periodic meetings of all community members. Deciding which mechanism will work best in a given setting is an important operations research problem.

Decisions about how a community can insure the continuation of a community scheme also require the attention of those developing a financing system. Alternative strategies include educating the community members about the benefits of the community financing system, identifying organizations in the community that could be involved in PHC financing, and assisting in maintaining links between the community financing system and other PHC financing sources.

One other important area for research is determining what incentives will best motivate participation; for example, money, civic pride, and community recognition.

Many uncontrollable factors influence the role the community can play, and these should be considered in the development and analysis of possible solutions to this operational problem. The degree of cohesion within a population is one such factor. For example, if the area's primary social unit is the family and there are no other community groups, a community financing system that depends upon close cooperation among participants from different families is likely to be less successful than one that builds upon kinship organization.

Geographic isolation can also affect community cohesion. For example, in Swaziland, where families live in scattered rural homesteads, distance may limit people's interest and ability to participate in the decisionmaking process.

Other constraints are social organization of the community (democratic, autocratic, hierarchical), patterns of disease in the community, the community's perceived health needs that will be met by financing PHC services, and the educational level of community members most likely to participate in the community financing system.

## 2. Objectives of Community Financing

Another problem cluster that cannot be ignored is the objectives of community financing. Improved health is the implied objective of the PHC strategy, but which specific health problems or conditions should be addressed through community financing, and will these be addressed by preventive, curative, or rehabilitative services?

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### OBJECTIVES OF COMMUNITY FINANCING

#### Common Decision Variables

- PHC objectives of CF: curative; preventive; rehabilitative
  - Specific health problem or condition to be improved as a result of the CF system: diarrhea; measles; neonatal tetanus
  - Economic objectives of CF: amount of resources to be mobilized by the CF system; type of resource to be mobilized by the CF system (e.g., cash, labor, materials, land)
- 

For example, a labor union in an urban textile factory may recognize work-related lung disease as its principal health problem and set as an objective to finance the cost of services to diagnose and treat that disease. A rural village may decide that high infant mortality from diarrheal disease is its most important health problem and set as an objective to finance treatment and prevention. Research will provide data to help community members decide which health problem(s) would be best attacked through community financing and which type of services would be most appropriate to finance.

Just as important are the economic objectives of community financing. Should community financing pay all of the costs to meet the health objectives, or only some? For example, in Dominica, researchers expect to recover all drug and drug administration costs with their proposed financing schemes. In other countries where financing schemes will support only some of the costs, how will the remaining resources be raised? What types of resources should be raised (cash, in-kind contributions), and how much of each?

Although cash contributions would usually be preferred, the types of contributions that are feasible depend on the economic base of the community. Some communities contribute a portion of their annual harvest, which is sold by the PHC managers to pay for medications and workers' salaries throughout the year. Others contribute labor; for example, building and maintaining shelters where PHC services and activities are conducted. Still others provide meals for the health workers who provide services in their community. In some cases, flexible contribution plans must be developed that allow some people to pay in kind when they do not have cash. Operations research on the best mix of contributions is an important topic in countries with limited cash resources.

There are a number of constraints on setting objectives. One of the most important is the community's ability and willingness to pay for certain services. Although a basic objective of primary health care is to promote preventive services (e.g., immunization and sanitation), many people are only willing to pay for curative services. Some countries deal with this by setting dual objectives, asking communities to pay for selective

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## DOMINICA

One of the problems impeding the expansion of primary health care in Dominica is its financing. After examining alternatives, the Ministry of Health decided to implement a fee-for-service scheme and a revolving drug fund (RDF) to help pay for expansion. A PRICOR-funded study in Dominica is developing solutions to operational problems involved in implementing these schemes. Although the specific objectives for the proposed RDF will be formulated after a systematic analysis of the current drug distribution system has been completed, one possible objective of the RDF which was mentioned in the research proposal is "to recover 100 percent of the cost of drugs dispensed at health facilities including the cost of administering the RDF."

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preventive services together with highly desired curative services. Others offer to have the public sector pay for preventive services if the communities pay for most curative care. One thing seems clear: people will not normally support a scheme that does not address their perceived basic health problems, or that does so in an unacceptable way.

For example, conflict arose in the Chaquicocha Health Services Project in Peru when a successful popular pharmacy that used a drug sale markup system was replaced by a Ministry medical post. Villagers found the new post's services inadequate and its nurse's performance unsatisfactory, and they resented the Ministry's requiring them to pay the nurse's salary.

Obviously, people cannot pay for primary health care if they do not have the resources. In many farming communities, income is seasonal and people do not have the funds to pay for services at certain times of the year. Thus, many community financing studies include surveys to describe current household and community expenditures on health care as a way to estimate the resources available for community financing of primary health care.

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## SENEGAL

A PRICOR study in Senegal analyzed sources of PHC financing in an effort to identify available resources to pay for recurrent PHC costs, which are currently financed by foreign aid. It was found that it is unlikely that additional community resources could be generated since the communities already support a significant portion of health costs. In 1982, receipts from CF sources approached 75 percent of the Ministry's nonpersonnel budget for the medical districts and health posts.

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When people do not have cash, they may be willing to contribute their labor, furniture, food, or other items. For example, the Bangladesh Rural Advancement Committee in Sylhet, Sulla Thana, organized a community health worker system based on in-kind contributions from the community. If 70 percent of a community agrees to participate in the scheme by paying a yearly premium of 5 kilos of rice, a health worker is trained and works in the community 1 day a week.(9)

### 3. Linkages With Other Financing of Primary Health Care

Community resources are only one of the possible sources of financing health care, and most communities will tap other resources. Thus, an important operational issue is deciding which of these resources to link into and how. In some cases, the Ministry of Health may finance selected drugs and services, social security may pay for others, and missionary groups and employers may finance still others. Establishing formal linkages with these sources of funding can result in a broader package of primary health care services for community members than if community financing were the only source.

The private sector is also a potential source of financing. In Bolivia, for example, where a PRICOR study is underway, researchers learned that a district health office in Santa Cruz solicits contributions from wealthy individuals outside the community to help pay for imported drugs. In many countries, private physicians and other health providers are sometimes willing to contribute their time for community service or to take referrals at low or no cost to the patient.

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## *LINKAGES WITH OTHER FINANCING OF PRIMARY HEALTH CARE*

### *Common Decision Variables*

- *Choice of external financing sources: Ministry of Health; social security; private service providers; employers; cooperatives; missionary groups; private individuals*
  - *Linkage procedures: referral; co-financing; reimbursements; contributions*
- 

Thus, another operations research problem is to study the advantages and disadvantages of linkages with different sources of financing. Obviously, the more sources there are, the greater the number of possible financing combinations and the more useful operations research can be for examining the alternatives.

Operations research can help determine which type of linkage would be best for a given community. Among the options are direct referral to another health provider for care or payment of health care costs, direct contributions from donors into the community system, and co-financing of certain services and commodities. Experience has shown that communities often are not interested in supporting the intangible aspects of primary health care, for example, supervision and training of health workers. Some countries are exploring co-financing arrangements, where the Ministry of Health pays for the intangibles (health worker training or supervision and some preventive services), and the communities pay for the tangible items (wells, latrines, and curative services).

In deciding how community financing might be linked with other health systems' financing sources, analysts must evaluate the dependability of those sources. For example, the government might promise to commit foreign exchange to import and distribute basic drugs to health workers or to provide a supervising physician. The ability of the government to sustain its planned contributions has significant effects on what community financing schemes can reasonably achieve. This is only one of many constraints that analysts must consider. Others include the existence and accessibility of other sources of financing, the willingness of those sources to contribute to the cost of health care for the community, and politics.

For example, political considerations may greatly influence the availability of supplementary financing. A government may have expressed commitment to PHC objectives and may have allocated a sizable portion of its national budget for health. But if those allocations go largely to build tertiary care centers or to finance training of specialist physicians, little co-financing may be made available to mix with community financing of primary care. As another example, physician resistance to community health workers may result in their role being so limited that they are unable to provide the type of service or commodities necessary to attract the minimum population required for a community scheme to be financially viable.(10)

#### 4. Contributors to and Beneficiaries of Community Financing

In the design of a community financing system, decisionmakers must determine who will contribute to the financing scheme and who will be eligible to receive benefits from it. Should everyone, only those who enroll, or only those who can afford to, contribute? Should all beneficiaries contribute, or should some be exempt (infants, mothers, low-income, or unemployed persons)? Decisionmakers must consider similar questions on who will benefit from community financing. Should the target population be limited to high-risk women and children, members of the community, or low-income groups?

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### **CONTRIBUTORS TO AND BENEFICIARIES OF COMMUNITY FINANCING**

#### Common Decision Variables

- Who contributes: *everyone in community; working families; beneficiaries only*
- Who benefits: *needy groups; contributors to CF scheme; members of community*

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Some communities have targeted specific groups with special health needs and are trying to plan PHC services accordingly. For example, a PRICOR-supported study of community financing in the commune of Pahou, Benin, is concentrating on services for "poor and isolated people within the commune, particularly infants, young children and mothers." In Honduras, one of the financing alternatives considered included certain exemptions.

Consultation charges by health personnel including the community health worker (Guardian de Salud) as well as by the physician and auxiliary nurse. Exempted from the charge would be pre- and postpartum consultations, consultations for children under 5, tuberculosis treatment, vaccinations, and cases of suspected rabies.(11)

In a PRICOR-funded study in Thailand, case studies of ongoing community financing schemes will measure equity in three ways to determine how it relates to successful community financing systems. The studies will measure 1) the degree to which households make similar contributions and receive similar services; 2) the degree to which households contribute in proportion to their resources; and 3) the degree to which people receive the services they need.

Among the more significant constraints to consider when conducting research on these issues are the economic base of the community, the health needs of the community, community willingness to contribute, the availability of outside sources of revenue, contributions to and beneficiaries of other health systems in or near the community, and competing demands on community resources.

#### 5. Services and Commodities To Be Financed

What services and commodities should be financed? This operational problem is closely related to a number of other problem clusters, including the objectives, the financing scheme, and linkages to other PHC financing. Should all PHC services and commodities be included, or only selected interventions, such as oral rehydration therapy, immunizations, growth monitoring, and family planning? Should financing be limited to preventive services, or also include curative services? What would be the effect of financing public goods (those that benefit the entire community, such as water and sanitation services) rather than private goods (those that benefit individuals, such as oral rehydration salts)?

Primary health care includes a number of services, and decisionmakers must determine which of these will be financed by the community. Here, again, is the minimum list from the Alma-Ata report:

- Education concerning prevailing health problems and the means of preventing and controlling them;
- Promotion of food supply and proper nutrition;
- Adequate supply of safe water;
- Basic sanitation;
- Maternal and child health care, including family planning;
- Immunization against major infectious diseases;
- Appropriate treatment of common diseases and injuries; and
- Provision of essential drugs.

In the 72 community financing projects identified in the APHA monograph, the two most common uses of community financing were health worker remuneration and provision of basic drug supplies. Table 2-2 summarizes these findings. Excluded from this list are construction and maintenance of local level facilities, as these forms of community support occurred in practically all of the projects.

**Table 2-2.--Community-Financed Activities Having Specified Objectives,  
by Objective and by Project**

<b>by objectives</b>	<i>number of projects</i>	<i>percentage of projects</i>
Compensation of health worker	42	58.3
Restocking of basic drugs	46	63.9
Partial defrayal of training costs	2	2.8
Partial defrayal of hospitalization costs	6	8.3
General revenue	24	33.3
Supplementation of government health services	<u>4</u>	<u>5.6</u>
<b>TOTAL OBJECTIVES</b>	124	172.2 <sup>a</sup>
<b>TOTAL PROJECTS</b>	72 <sup>b</sup>	
Mean number of objectives per project	1.72	
<b>by project</b>		
Health worker compensation only	10	13.9
Drug costs only	11	15.3
General revenue only	10	13.9
Supplementation of government services only	3	4.2
Worker compensation plus drug costs	18	25.0
Worker compensation, drug costs, and general revenue	7	9.7
Other combinations	<u>13</u>	<u>18.1</u>
	<u>72</u>	<u>100.0</u>

NOTE: Table excludes facility construction and maintenance (see text).

a. Total exceeds 100 percent because many projects have multiple objectives

b. Excludes 32 projects with unknown objectives.

**Source:** W. Stinson, Community Financing (Washington, DC: APHA, 1982), table 2.1, p. 19.

**Table 2-3.--Evaluation of Alternative Means for Compensating Community Health Workers**

<i>source of funds</i>	<i>frequency of use for worker compensation</i>	<i>adequacy of revenue</i>	<i>expected effect on worker performance</i>	<i>problems</i>
Fee for service	Service fees frequently earmarked for worker compensation	Potentially adequate, but depends on fee levels and other uses or income	Worker likely to neglect uncompensated activities, such as prevention, services to poor, community work	Services linked to drugs, so income may fall if supply is interrupted
Drug sales	Drugs often sold at 10-30 percent markup to compensate worker for labor and distribution expenses	Markups yield \$3.00 to \$20.00 per worker per month, generally considered unsatisfactory	Worker may encourage excessive drug use and neglect uncompensated work	Sensitive to drug supply; also worker may retain receipts rather than restock drugs
Personal prepayment	Such schemes, though rare, usually compensate health workers	Potentially adequate	Depends on degree of community and supervisory control, but curative work generally stressed	Premiums need to be managed so as to give worker a steady income
Production-based prepayment	Such schemes, though rare, usually compensate health workers	Potentially adequate	Depends on degree of community and supervisory control, but curative work generally stressed	
Income generation	Few examples available	Few examples available	Few examples available	Few examples available
Community labor	Not appropriate for recurrent costs	N/A	N/A	N/A
Individual labor	Used frequently	May be adequate for part-time or socially prestigious work	Depends on worker interests and on informal community rewards	If turnover is high, training expenditures may be wasted
Donations and ad hoc assessments	Many programs encourage donations to worker; they are generally more appropriate for one-time than for recurrent costs	Not adequate in any reported program	Worker likely to stress rewarded activities	Donations appear to be rare
Festivals, raffles, etc.	Not appropriate for recurrent costs	N/A	N/A	N/A
Government or other outside finance	Frequently used	Adequate, if available	Supervisors may encourage preventive and community work—even if demand is low	Salary payments may be irregular; workers tend to expect permanent employment

N/A Not applicable.

Source: W. Stinson, Community Financing (Washington, DC: APHA, 1982) table 3.4, p. 36.

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## SERVICES AND COMMODITIES TO BE FINANCED

### Common Decision Variables

- Services and commodities to be financed: CHW in the community; monthly immunization program; complete PHC services; drugs; nutrition; family planning
  - Amount of services and commodities to be financed: 0-100 percent
- 

Community health worker compensation is an operational issue of great interest to program managers and community members. The types of services for which health workers will be responsible is an important decision that relates to their financing. Community health workers often perform such tasks as the promotion of proper nutrition, family planning, sanitation and water supply, and basic first aid. Compensation can be problematic, because the community may be reluctant to pay someone to do certain types of preventive services for which they have not reimbursed people in the past. Communities may be accustomed to paying a health worker who performs such personal services as the distribution of oral rehydration salts. But, where governments have often paid for health personnel, communities may be expecting the government to continue to do so.

Some of the various means of paying community health workers were evaluated in the APHA monograph and are summarized in table 2-3.

After deciding which services to finance, analysts must determine the amount to be financed. For example, should the community finance all of some services or only a portion of them? If the latter, where will the remaining financing come from? An analyst could set up a matrix to display the possibilities, which can become very large when a number of services are being considered. Table 2-4 illustrates a sample matrix.

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**Table 2-4.--Matrix of Services and Amount To Be Financed**

Service/Commodity	Amount To Be Financed (Percentage)									
	10	20	30	40	50	60	70	80	90	100
Immunizations										
DPT										X
Polio										X
Tetanus										X
Oral Rehydration										
Salts					X					
Malaria tablets		X								
Growth monitoring			X							
Prenatal care							X			

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Operations research is appropriate for this problem cluster because of the number of uncontrollable factors. In addition to the obvious ones (disease patterns and health service needs; ability and willingness to pay for specific services and commodities), the absence or presence of other sources of health care is particularly important. People may not be interested in community financing of those services. For example, low enrollment of women and children in a health insurance plan was considered a problem until analysts realized that a government-run maternal and child health center met much of the community need.(12) Traditional practitioners are not often mentioned when such alternative sources of care are identified. Yet in some areas, custom and accessibility make them the most frequented source of health care.

## 6. Revenue Mobilization Methods

Perhaps the most common operational problem is deciding which revenue mobilization methods to select. Eight common methods were discussed in detail earlier in this chapter, with service fees, drug sales, and prepayment the most popular in the developing world. Which method or combination of methods would be most appropriate in a given community?

The revenue mobilization methods selected will depend on other decisions made regarding the community financing design, including the role the community will play in community financing, the objectives of the scheme, the target population, the services to be procured, and the likely linkages with other financing. Decisionmakers can develop selection criteria to rank or rate feasible financing alternatives. A PRICOR study in Benin followed this procedure, using an operations research technique called multiple-criteria utility assessment. (See table 2-5.)

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### REVENUE MOBILIZATION METHODS

#### Common Decision Variables

- Type of scheme: service fees; drug sales; personal prepayment; production-based prepayment; income-generating; community or individual labor; donations and ad hoc assessments; festivals; raffles; similar fundraising activities
- Prices for specific services
- Methods for revenue collection

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In selecting revenue mobilization methods, planners must take into account the community's willingness to try each method of financing. Even if a method has worked well elsewhere, a community may not be willing to try it because it is new, risky, or complicated, or for whatever reasons. This has proved to be an unforeseen constraint in the PRICOR study in Zaire. Researchers studied various financing alternatives and determined that a fee-per-episode scheme would be successful. However, they have found it difficult to identify many rural health zones that are willing to try the new method. To date, only a few scattered communities have implemented this method. Others seem unwilling to take a risk and change from the fee-for-consultation method, which is much more prevalent.

**Table 2-5.--Preliminary Results of Multiple-Criteria Utility Assessment  
in Benin**

Based on group consensus, the health team agreed on the most acceptable and feasible financing alternatives. On a scale of 0-100, they ranked an alternative in terms of how successful they thought it would be on several attributes: sustainability, utilization of services, participation in the CF scheme by the community, CHW motivation, and effectiveness. The preliminary results of this multiple-criteria utility assessment were as follows:

<u>Attributes</u>	<u>Alternatives</u>			
	<u>Health Team*</u>		<u>Health Center</u>	
	<u>Health Center</u>			
	Prepay	Fee	Prepay	Fee
<b>1. Sustainability</b>				
--If CHW paid on time	80%	35%	100%	100%
--Maintenance of drug inventory	60%	75%	60%	75%
<b>2. Utilization</b>				
--Consultations	100%	50%	90%	40%
--Medications	100%	50%	90%	40%
<b>3. Participation</b>				
--Families per population	75%	20%	75%	20%
<b>4. Motivation</b>				
--CHW doing assigned tasks	80%	40%	0%	0%
--CHW taking initiative, problemsolving	70%	40%	0%	0%
--Villagers				
-Health post w/equipment	90%	55%	0%	0%
-Health activities	90%	55%	10%	10%
<b>5. Effectiveness</b>				
--Cost of the system per person (in CFAFs)	500	750	500	750

\*Health Team = CHW, TBA

The next step will involve ranking attributes of success from the most important to the least important, comparing the scores of the various financing schemes, and selecting for testing the alternatives most likely to succeed.

Another important operational problem is deciding how much capital is needed to establish the community financing scheme, and how to raise that capital. Will it be a one-time investment or will there be recurrent needs? How often will capital have to be raised--every few months, every year, indefinitely? Which revenue mobilization methods can best raise the needed capital? This is a significant problem that is being examined in a PRICOR-funded study in the Philippines. Communities have expressed a willingness to support a revolving drug fund, but they are reluctant to contribute toward its capitalization. Determining how to raise the needed capital is crucial to the establishment of this community financing scheme.

The economic environment and the resource base of the community are among the basic and most critical uncontrollable factors to consider in selecting revenue mobilization methods. In the aggregate, individual expenditures for health care services and commodities are often substantial, and the ability of a specific community group (e.g., households, members of a cooperative) to participate in a community financing scheme will depend upon the resource base from which its income is derived, whether it be agricultural or industrial production.

Other uncontrollable factors may interact with the resource base to affect the adequacy and dependability of that base as a source of household and community income. For example, variations in geography and climate affect agricultural production; demographic characteristics, including education and skill levels, affect output; health status, taxes, export policies, and many other variables can also affect output.

The APHA report found that "only a small number of projects have formally assessed the community's ability to pay before their inception"(13), yet many operational problems can be clearly traced to a community's resource base. For example, a case study examining why some communities did, and others did not, pay their health workers as planned found that those villages that did pay shared one characteristic: they had a definable resource base--a village herd, a community garden, a handicraft center--that is, some production base to generate needed income.(14)

## 7. Prices, Fees, Charges

Establishing prices, fees, and charges is a particularly important problem cluster. It usually involves valuing services and commodities so that total revenues will at least cover the total costs of the resources needed to accomplish the financing objectives. Sometimes, however, prices are set below costs to encourage use of services and commodities. When this happens, other sources must be found to cover the difference.

The APHA report found three predominant patterns of fee setting: 1) negotiation between individual health workers and patients; 2) joint consultation between the community and the professionals; and 3) unilateral professional or government decision.(15) The report further noted that subjective price setting is more common than formal assessment of a community's ability and willingness to pay, of total resource requirements, or of expected utilization levels. An analysis of this type can be extremely useful. For example, in Honduras a formal assessment of community expenditures for health care has been helpful in developing community financing schemes, especially in price setting.

Little research exists on specific methods used by communities to establish prices, and there are many questions to resolve. For example, who should decide how prices are determined: the Ministry of Health, the community, a health committee? Should the fees and charges be the same for everyone, set on a sliding scale, exempted for some

individuals? Should there be a separate policy for nonmembers and people outside the community who use the services? Should prices be established to encourage the use of some health services relative to others? Finally, what should the exact price be for each service and commodity?

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## *PRICES, FEES, CHARGES*

### *Common Decision Variables*

- *Pricing strategy for specific services and commodities: sliding scale; uniform prices for everyone*
  - *Fee policy for people outside the community who want to use the services*
  - *Value of specific services and commodities: the actual price; fee; charge*
- 

Sometimes prices are based on current market prices. For example, people may be accustomed to paying for such personal services as medical consultations and emergency treatment. Usually a range of acceptable prices already exists, and these data will help in establishing prices. But some public services, for example, general support of health workers, will be difficult to price because there is no experience upon which to draw.

One of the most important factors to consider in establishing prices is the amount of revenue that must be raised to cover the cost of services and commodities financed by the system. That, in turn, requires consideration of a number of economic factors, including

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## HONDURAS

A PRICOR study in Honduras, seeking to identify viable financing mechanisms, began with an analysis of baseline information, including community health expenditures, as a way of determining what prices and fees would be acceptable. The study

. . . showed that Honduran families now spend an average of US\$21 per month for health care, representing 11.4 percent of monthly expenditures. There was little variation in this figure between rural and urban areas, and health expenditures occupied third place behind food and clothing, respectively. This represented an average expenditure of US\$8.25 per illness episode, and 25 percent of family members recorded an illness in a two week period. Purchase of medicines accounted for almost 50 percent of these expenditures, principally through pharmacies and small stores. Nearly 95 percent of respondents reported they were willing to pay for both medicines and consultations through the MOH, provided the quality of these services improved. A qualitative analysis showed that a minimal fee for services (US\$.50) and charging the cost of drugs to MOH, plus administrative costs and a small profit for local use are the most cost-effective financing alternatives. Both also would save rural families substantial amounts of money.(16)

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the anticipated cost of the services and the resource base of the community. Information about income and its distribution, including seasonality of income and the competing needs of a household, are relevant to decisions about the fee or price to charge for each service. Often, special provisions must be made for segments of the population unable to pay (e.g., poor households, women and children who may have little or no access to household funds).

The health status of participants in a scheme is another important factor to consider in determining fees and charges. For example, if an insurance scheme is being planned, actuarial findings concerning the incidence and prevalence of illness may be of use in establishing premiums.

Compiling data on past expenditures may or may not provide a good indication of what people would be willing to pay for different PHC services or for the same service available at a greater distance. These data will include payments for specific illnesses and will not describe patients' willingness to pay an insurance premium to protect them against future health care expenditures.

Factors outside the community also have a significant effect on pricing decisions and must be considered in the research design. In some countries, prices of certain commodities are controlled by the government. For example, in Peru, drug distributors are permitted a 19-percent markup over the manufacturer's price, and retailers are allowed a 25-percent markup over the distributor's price.<sup>(17)</sup> Another constraint from outside the community that causes great difficulty in pricing is domestic inflation. In countries that have large external debts, such as Bolivia, Brazil, and Argentina, community financing schemes have to be particularly sensitive to changes in price levels and changes in consumer purchasing power.

### Problem Clusters Primarily Related to Operational Processes

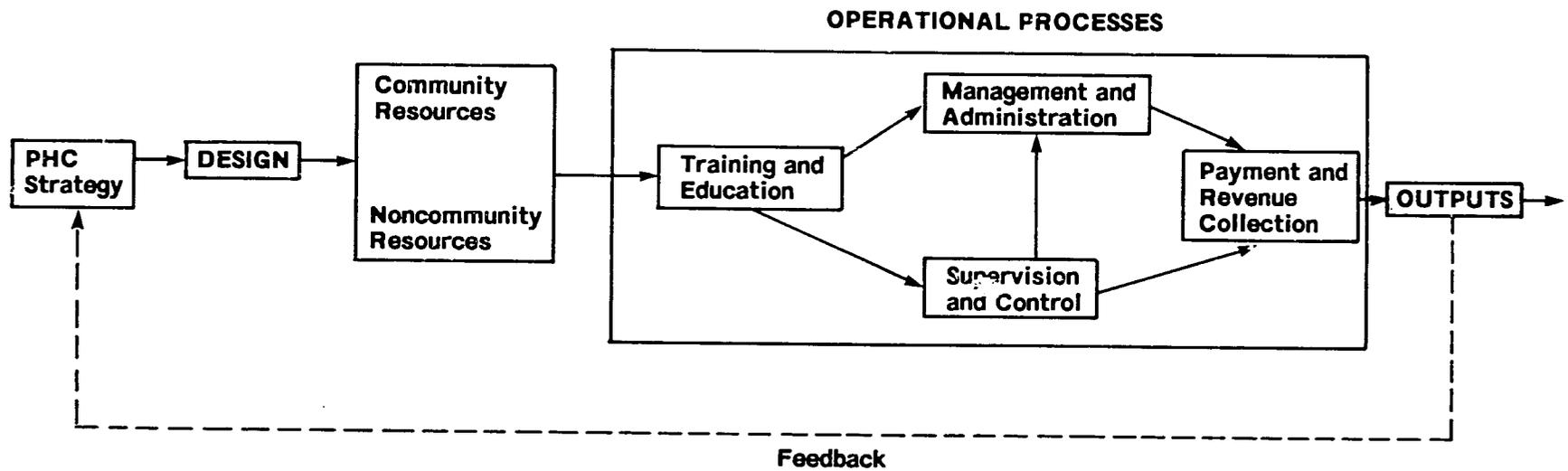
Figure 2-5 illustrates those problem clusters primarily related to operational processes and their relationship to one another and to the overall community financing system. Each of the four clusters is described below.

#### 8. Training and Education

Community financing schemes usually require some training and education of all those involved, and this operations research area is often overlooked. Education may be needed to gain community support for a financing scheme. Such support is more likely if the community fully understands the objectives, procedures, and benefits of the scheme, and especially if the members are aware of the expected community resource commitment and the projected use of those resources. Similarly, those responsible for providing non-community resources may need to be oriented to the community financing scheme as will people responsible for internal administration and management.

For example, in a PRICOR-funded study in the Philippines, two operational issues arose that indicated a need for community education. First, people had become accustomed to government financing of health services and were, not unexpectedly, reluctant to assume this responsibility themselves. Second, even though communities had selected a revolving drug fund as their community financing scheme, they believed that the initial investment, the "seed money," should be provided by some agency outside the community. Clearly, these operational problems must be resolved before the community financing system can begin.

Figure 2-5.—Problem Clusters Primarily Related to Operational Processes of a Community Financing System



Community members will need to learn about the financing scheme and its objectives. Some problems to resolve include where, when, and how long training should be. What audiovisual techniques, if any, should be used? Is a single educational campaign sufficient, or would continuing education be preferable?

Training those people responsible for specific financial activities is most important in schemes dealing with resources that could be misallocated, such as cash and drugs. Past experience shows that training sessions have focused on accounting, leadership, and management.

Little research exists on the best ways to carry out such training. The need for continuing education and training will usually depend on the depth and quality of the initial background and skills of those who will be involved in managing and administering the schemes, as well as the complexity of tasks faced by the managers. Considering the importance of maintaining a good bookkeeping system for a community financing scheme, in-service training would be as important as initial training, if not more so. How often managers need in-service training and who should provide the training are research questions that merit further study.

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## **TRAINING AND EDUCATION**

### **Common Decision Variables**

- **Target groups for training and education: community members; supervisors; managers; evaluators**
- **Training/education content: CF purpose; accounting; budgeting**
- **Training/education methods and materials**
- **Location of training/education**
- **Duration, timing of training/education**
- **Provisions for continuing training/education: monthly; single annual session; at time of resupply**

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Among the more common uncontrollable factors that affect education and training are the cultural norms and beliefs of the community, the educational level of community members and financial managers, the availability of skilled educators and trainers, and such environmental factors as distance, transportation systems, and weather.

### **9. Management and Administration**

Community financing systems have experienced significant problems in management and administration, particularly where payments and revenue collection are concerned. Operations research is needed on ways to solve the administrative problems that arise. As one report put it, "Fund raising efforts in a community are of little value if there is not a simultaneous development of fund management skills in the community."(18)

A key decision variable concerns the choice of individuals to manage the funds. Many options have been tried: health workers, members of cooperatives, members of health committees, project staff, government employees, local business people, paid managers. No one choice emerges as being universally suitable. Other relevant problems include whether one person or several should manage the scheme, and if the latter, who should manage what. Should the managers be compensated for their work, and if so, how? Where is the best place to locate management: in the community, at a health center, a store, in town?

The management of the community financing scheme is a general activity that may include such tasks as bookkeeping, inventory planning, budgeting, reporting, and analyzing past activities. Good management is essential to any program or project that must mobilize resources to accomplish specified objectives. Without good management, a well-designed scheme will not sustain itself.

This is clearly demonstrated in the case of an RDF. Revolving drug funds are technically the most feasible method for financing basic drugs in many countries because they operate like small businesses; prices are based on costs, and revenue is used for restocking.(19) However, as in small businesses, if the inventory is not maintained or payments are not documented, a good RDF will quickly become ineffective. In the Montero project in Bolivia, the RDF was terminated because of management problems. Stock was not maintained, costs increased faster than prices charged because inflation was not considered, and stock was lost because of poor storage.(20)

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## MANAGEMENT AND ADMINISTRATION

### Common Decision Variables

- Criteria for managers/administrators: *personal attributes; experience; capabilities*
  - Management tasks: *accounting; revenue collection; inventory management; reporting financial status to others*
  - Location of managers
  - Incentives for financial managers: *salary; commission; recognition; free health services*
- 

How can projects be organized to avoid these problems? Are there controls that can be built into the management system to alert the community to problems? Minimally, what bookkeeping must be done to insure that resources can be accounted for? Research on creative solutions to RDF management problems, particularly poor pricing and accounting that can decapitalize stock, would contribute significantly to the development of this community financing method. The Gossas Project in Senegal, for example, changed its management mechanism after recognizing that the health post nurses were having problems carrying out financial tasks. The project was able to continue because successful community businesses accepted the responsibility of managing the scheme.(21)

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## SENEGAL: Gossas Project, Sine Saloum Region

Revolving drug funds were initially managed by Ministry of Health nurses, but two of the eight participating health post nurses experienced serious difficulties managing the funds.(22) Drug sales were then turned over to trusted local shopkeepers; these merchants sold drugs upon prescription by the nurse and took responsibility for resupply. The merchants kept half of the 20-percent markup as a personal incentive, reserved 5 percent for a contingency fund, and gave 5 percent to the treasurer of the health committee.(23)

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As is demonstrated in the Senegalese example, the choice of a community financing manager is critical to the success of the scheme. Many communities have tried to use village health committees with varying degrees of success. Several social and cultural factors have caused difficulties. For example, if literacy skills are low, community members may not be able to administer the system. In some communities, the potential social pressure from the extended families of health committee members to receive special treatment may eventually strain the system. In other cases, committee members may be politically acceptable choices but may lack the necessary skills and experience to manage. For any of these reasons, it would be more advantageous to engage paid managers who possess required skills than to use the voluntary services of community members. Community members, then, may serve as advisers to the managers and provide feedback on the system's operations.

Solutions to management problems are the responsibility of the organizations administering the services that need financing. These may be the government, a mission, a women's club, a business, or another community group. In a PRICOR study in Dominica, the Ministry of Health has decided to introduce RDFs throughout the country to finance basic drugs. Before the system begins, analysts are developing administrative and accounting procedures. They are examining alternative means of procuring drugs at the central level, evaluating personnel roles, and developing a management information system based on the RDF needs. On a less centralized scale, a PRICOR study in India will analyze management problems in local health cooperatives, including how to plan for seasonal variation, how to collect member prepayments, and how to achieve the transition to genuine community control of externally initiated PHC programs.

Many uncontrollable factors contribute to management problems. Unknown patient demand, uncertain external supply, inflation, and poor management skills of health system supervisors are the kinds of factors that act as constraints on possible solutions to management problems.

### 10. Payment and Revenue Collection

The payment and revenue collection process involves actually getting the desired resources from the contributors into the system according to the plan. When should payments be made? How often should fees be collected? Would a prepayment mechanism be more productive than pay-as-you-go or a monthly assessment? Should the same payment and revenue collection methods be used for all services, for all individuals, or should they vary?

Sometimes the success of revenue collection depends on the pricing. For example, a program in Korea tried a subsidized premium for the poor. When the effects on revenue

collection were evaluated, it was found that "more revenue was actually collected from the poorest people when the monthly premium was subsidized ... by 60 percent ... in comparison with that collected from the non-subsidized, more well-to-do."(24)

Decisions about the collection method relate to how this process can be effective while minimizing the costs and complexity of revenue collection. For example, in an RDF, is it better to have the person who dispenses medicine also collect the payment, or should someone else collect it at a different time? When should a person pay for personal services, and how will this affect service use? This is a question that a PRICOR study in Zaire plans to investigate. Two payment plans will be compared: fee per consultation and fee per episode of illness. The researchers are interested in determining if one of these payment methods will make it easier for low-income households to use services when they need them, and if the bookkeeping for fee per episode will require more administrative time than for the fee-per-consultation approach.

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## **PAYMENT AND REVENUE COLLECTION**

### **Common Decision Variables**

- **Timing and frequency of payment and revenue collection**
  - **Payment and revenue collection method(s)**
  - **Persons responsible for payments and revenue collection**
- 

Another research issue related to the timing of payment and revenue collection is how the process affects risk sharing. Does a collection method requiring full payment at the time of service place too heavy a burden on the sick, who also may be the poorest? For what services or commodities are people willing to pay in advance, thereby "sharing the risk" of the payment burden?

An important external factor to consider in planning payment and revenue collection procedures is the agricultural output cycle and the timing of income receipts. In the Pikine project in Senegal, analysts found that payments to the financing scheme declined before payday and rose again when people had cash available.(25) Is it possible to link payment and revenue collection to these cycles in order to make health services more accessible to the community? Or, is it possible to combine resource collection for PHC services with other collection mechanisms? For example, when PHC services are provided through a community organization, such as a cooperative or a women's club, using their established revenue and payment collection procedures can facilitate revenue collection.

Health status is another uncontrollable factor that will affect people's willingness to pay, especially in prepayment schemes. In one insurance scheme, researchers found that people tended to join only when they became sick, if the benefit period started when they joined. When the benefit period was changed to a fixed calendar year (so that those who joined later received fewer months of benefits), people joined earlier.(26)

What can be done about people who do not pay for the services or commodities that they have received? Dealing with debtors is a very sensitive and serious operational issue. Decisionmakers must distinguish between people who are able to pay and owe money and those who do not have the resources to pay for the service. Sometimes the solution is simply to develop a procedure for reminding those who have not paid, or set up a payment schedule. Special arrangements should be made for poor people who do not have the means to pay. Health services or commodities could be exchanged for a specified amount of labor by that person or a family member. In some communities, the village health committee may keep a list of people who are eligible to receive benefits free of charge.

A community financing scheme that has a policy to exempt certain people from payment must find additional revenue to cover these costs, and analysts must include this factor in the development of solutions. Schemes that do not recognize this factor and do not recover this lost revenue often fail. For example, a clinic among the Paya Indians in Honduras had to close because the community health worker gave away too much medicine.(27)

Donated labor is one way to offset this lost revenue. Another is to have those who can afford to pay more. In some cultures, there is social pressure to be "easy" on debtors. If this is the case, planners should incorporate this constraint into the system as it will be an additional cost.

#### 11. Supervision and Control

Design of an appropriate supervision and control system of checks and balances may be as critical as the choice of managers of the system. Supervision is a means of providing feedback on their performance to workers who are responsible for completing financial tasks. As stated in the previous section, supervision activities are directly related to the training and past experience of the workers.

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### *SUPERVISION AND CONTROL*

#### *Common Decision Variables*

- *Supervisory and control mechanisms*
- *Criteria for supervisors*
- *Personal attributes, experience, and capabilities of supervisors*
- *Frequency and depth of supervision*

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Who should supervise the community financing managers? This is one of the key operational problems in this cluster. The supervisor should be someone familiar with the community financing scheme who has the background and experience to assist the managers and give suggestions on improving their job performance. The person who trained the workers is one possibility. That person would be the one most familiar with the requirements of the job. A successful local merchant is another option, because

merchants are usually knowledgeable about financial management. But planners must consider how well the merchant can help the manager better understand financial matters.

A third possibility is the nurse or physician who supervises the PHC services provided to the community. This may be a convenient option, since these people often make regularly scheduled visits and they are highly respected. However, they may have limited time, and medically trained personnel do not necessarily have the experience to advise workers on financial problems. Other options may be a health committee, a more experienced health worker from another community, or a schoolteacher.

The choice of supervisor depends on many factors, including the managers' needs, the support provided by the community, attitudes toward authority, social relationships between the sexes, and past experience with supervision. Supervision mechanisms may be very intensive; for example, daily review of recordkeeping by a local merchant. Less intensive supervision; for example, a quarterly visit by a health official to review the past months' activities, may be sufficient for managers who are able to resolve practical problems that occur in the community financing scheme.

The timing and frequency of supervision is another issue. When it comes from outside the community, timing may depend less on need than on such uncontrollable factors as distance. In general, the cost of traveling to outlying areas often precludes frequent visits by noncommunity members. The resources needed for these trips, particularly a vehicle and petrol, are expensive and not always available. Most community PHC programs are not able to support these costs by themselves. External sources, such as the government or foreign donors, may have to pay for these supervision costs.

For example, in a PRICOR study in Senegal, researchers found that foreign aid pays for the recurrent costs of community health worker supervision, and it is unlikely that the government or the communities will ever be able to support these costs. This raised questions about the need for regular supervision, the possibility of providing primary health care without regular onsite supervision, and the desirability of identifying different modes of PHC delivery that are not dependent on such supervision. Identifying competent supervisors within the community to assist community financing managers in their daily tasks is an issue that deserves further attention from researchers.

Control mechanisms go hand-in-hand with supervision. Both are incorporated into the community financing scheme to help those responsible for financial management perform their tasks. For example, a control such as an inventory checklist for drugs serves to remind the health worker of the status of supplies. This facilitates the timely ordering of drugs used most often and prevents overstocking of drugs. Other examples of controls include seeing that several signatures are required for disbursement of funds, insuring that receipts are tallied and compared with expected and actual funds at several checkpoints, and providing for safekeeping of funds in such designated locations as banks.

## 12. Monitoring and Evaluation of CF Performance

An important component that is often overlooked is an accurate and reliable monitoring and evaluation system. Most PHC programs have some sort of information system and conduct some evaluations periodically, but many of these do not produce information that is useful for decisionmaking. If CF performance is to be improved, a clear and simple monitoring and evaluation system should be included.

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## MONITORING AND EVALUATION OF CF PERFORMANCE

### Common Decision Variables

- Users of the information: central level, regional, or local decisionmakers; different information provided to different users
  - Topics for monitoring and evaluation: which components should be monitored routinely (training, supervision, services provided) and which should be evaluated with special studies
  - Scheduling: how often should data be collected and reported for the monitoring system; how often and in what order should the evaluation studies be conducted
  - Personnel: who should conduct the monitoring and evaluation (CHWs, their supervisors, community members, outside experts, a combination); should some personnel be responsible for data collection and others for analysis and reporting; should different personnel be responsible for different monitoring tasks or evaluation studies
  - Nature of monitoring and evaluation: centralized or decentralized systems; computerized or not; standardized or flexible; based primarily on registration and service statistics or on surveys and experiments
- 

If too many controls are put into the system, this will hinder good management. Identifying the optimum number and mix of control mechanisms that are needed is the type of problem to which operations research can be applied.

### SELECTING THE OPERATIONAL PROBLEMS FOR STUDY

Each problem within a problem cluster is a potential topic for operations research. When there are more problems than time and resources available to study them, priorities need to be set. Researchers will need to work closely with the decisionmaker(s) in selecting priority problems for study.

Generally, the decisionmaker and researcher should study those problems that are most critical to solving the overall problem; i.e., those that are likely to have the greatest impact on the operation. When factual data are available to rate each problem objectively, then setting priorities is a relatively straightforward procedure. Those problems with the highest values (scores, weights) would receive the highest priority.

However, many such decisions must be based on opinions and informed judgments, and sometimes a number of decisionmakers have to be involved. Several techniques have been developed to aid this sort of decisionmaking. Each involves setting criteria by which to "grade" each problem. For example:

1. Most significant (greatest obstacle to community financing);
2. Greatest uncertainty (have no idea what the solution might be); and
3. Greatest probability (of finding solutions quickly).

Assuming a group will set the priorities, a very simple technique is to ask the members to rate or rank each problem on these criteria. Other simple techniques that could be used, such as the Delphi and the Q-Sort, are described in the PRICOR monograph, Operations Research Methods: A General Approach in Primary Health Care.

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**CHAPTER III**  
**DESIGNING AN OPERATIONS RESEARCH PROJECT**  
**IN COMMUNITY FINANCING**

## CHAPTER III. DESIGNING AN OPERATIONS RESEARCH PROJECT IN COMMUNITY FINANCING

PRICOR defines operations research as a systematic, problemsolving process for use in planning, consisting of three phases: problem analysis, development of solutions, and testing of those solutions. This chapter describes that process briefly, with examples of ways this approach can be applied to operational problems in community financing of primary health care (PHC). Summaries of PRICOR-funded projects in community financing can be found in the appendix. The PRICOR monograph, Operations Research Methods: A General Approach in Primary Health Care, by Stewart Blumenfeld, provides a more detailed description of operations research methods.

Operations research can make management decisionmaking easier and more rational. It can reduce reliance on costly trial-and-error approaches through the use of systematic procedures for selecting the "best" course of action. PRICOR staff and advisers have developed a practical operations research approach that incorporates the essential features of traditional operations research yet remains flexible enough to be applied to the significant operational problems identified in the preceding chapter. The general operations research approach is summarized in figure 3-1.

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Figure 3-1.--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, and collect needed data.
3. Set priorities and select the problems for study.

### PHASE II: SOLUTION DEVELOPMENT (for each operational problem)

1. Specify the objective for the solution to each problem.
2. Identify the controllable (decision) variables and uncontrollable factors (constraints and facilitating factors) 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 sensitivity analysis of each solution.

### PHASE III: SOLUTION TESTING AND EVALUATION

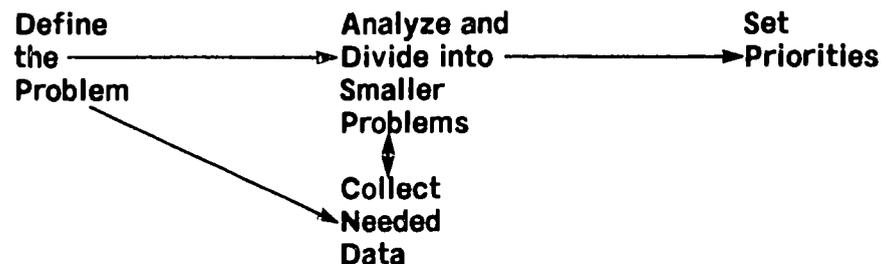
1. Design a test of the solution(s).
  2. Conduct the test and collect needed data.
  3. Evaluate and modify/adjust the solution(s).
  4. Merge the resulting information.
- 

The steps in this process are described briefly in the following sections and are illustrated with an example from a PRICOR-supported operations research project. As operations research is an iterative process, the steps are not necessarily sequential, and depending on the nature of the study, some may be repeated several times and others may not be undertaken at all.

## PHASE I: PROBLEM ANALYSIS

The steps in this phase are illustrated in figure 3-2 and described below.

**Figure 3-2.--Steps in Problem Analysis**



### Step 1. Define the Problem

Problem analysis usually begins with the identification of a discrepancy between what should be, and what is, occurring. For example, villagers should be supporting their health workers, but they are not; essential drugs should be available in the rural areas, but they are not. Information identifying a problem could come from observations, evaluation reports, discussions with program managers, and other sources.

**Example:** For several years, the Ministry of Public Health of a South American country has been unable to provide basic health services to its rural and urban poor. The country is deeply in debt, and the Ministry has an extremely limited operating budget. Faced with the prospect that this situation may continue indefinitely, a number of rural and urban cooperatives have decided to develop and test "self-financing" primary health care systems, with help from the local USAID Mission. No studies have been undertaken, however, that would enable the local decisionmakers, in this case the board of directors of this new project, to select or construct the "best" financing strategy for them. PRICOR is supporting a research project to help the cooperatives develop and test the "best" self-financing system.

### Step 2. Analyze the Problem, Divide It Into Smaller Operational Problems, and Collect Needed Data

Problem analysis often begins with a systematic description of the problem to define such things as its scope, magnitude, seriousness, characteristics, and probable causes. Some problems, such as "What can the community finance?" are too big to study all at once. They need to be broken down into more manageable problems, such as those listed in chapter II (the objectives of community financing, the participating population, services and commodities to be financed, etc.)

One way to proceed in problem analysis is to describe how community financing should work, thinking of it as a system of related parts. The system may be ongoing or one that is being designed. Figure 2-2, in chapter II presented a general, graphic representation of a community financing system. The model shows that the system's contribution to PHC goals depends not only on the smooth functioning of its parts (pricing,

revenue collection, control, etc.), but also on other factors in the environment (seasonality of income, health care provided by private practitioners, costs of pharmaceuticals, etc.). The general community financing system can be described in this graphic manner, and each of its component parts, or subsystems, analyzed to identify significant operational issues or problems.

For example, how should prices be set; who should be in charge of collecting fees; what approaches should be used to raise revenues? Sometimes several components can be grouped for analysis; for example, management and control, and sometimes--as is often the case with pricing--several different analyses may be required in one component.

Researchers need to collect and analyze data to describe the operational problems accurately. Since data collection can be costly and time consuming, analysts should examine existing data first and then draw up a list of the remaining data that need to be collected. Many researchers collect data for problem analysis and solution development at the same time. The data may come from a variety of sources, including PHC records, statistical reports on household expenditures, observations of health-seeking behavior, surveys of service utilization, and case studies of financing schemes.

**Example:** A research team is organized and develops a work plan for collecting needed data for problem analysis. Some of the data will also be used for other purposes: to identify constraints on possible solutions (e.g., seasonality of household income), ranges of values for certain decision variables (how much people are willing to pay for PHC services), and for baseline measurement of the effectiveness of the new financing scheme.

The data for this phase are collected through a household survey of health service needs and expenditures on health, interviews with key informants (village leaders, traditional healers, pharmacists, for example), analysis of available data on income and costs of goods, and case studies of the few self-financing operations that have been undertaken in the region. Using this information, an overall description of the current health financing "system" is prepared, which identifies the operational problems that need to be solved. These include deciding which PHC services will be financed by the community, which financing methods to use, how much to charge for commodities and services, and how to manage the funds.

### Step 3. Set Priorities and Select the Problems for Study

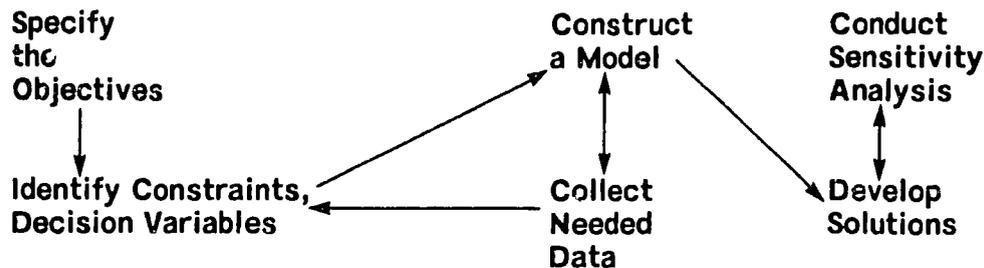
Sometimes a number of problems will emerge from the analysis. Obviously, they cannot all be studied at once; priorities need to be set. The analyst can do this in a number of ways. One is to identify those problems that are expected to have the greatest effect and study them first. Another is to identify the logical sequence of decisions. For example, before deciding on pricing and fees, decisionmakers must establish which services to provide. Decisionmakers should help determine which of the operational problems should be studied and in what order.

**Example:** Consultation with the project's board of directors leads to the conclusion that three interrelated problems need to be addressed. They are: determining which services to include in the benefits packages to be offered to each cooperative; determining the cost of each service package; and determining the pricing or financing structure for each service package. The second problem is seen as a subset of the pricing problem, since costs must be covered by revenues. Thus, the two priority problems selected for analysis are the service package and its pricing. Since the packages may vary among the cooperatives, separate analyses will be required for each cooperative.

## PHASE II: SOLUTION DEVELOPMENT

The steps in developing a solution for each operational problem are illustrated in figure 3-3 and described below.

Figure 3-3.--Steps in Solution Development



### Step 1. Specify the Objective for the Solution to Each Problem

To begin the solution process, the analyst must specify the characteristics of the desired solution in terms as quantitative as is feasible. A general objective for community financing might be "to raise enough resources to provide essential PHC services and commodities to all members of the community." If the operational problem is one of payment and revenue collection, an objective might be stated as: to define a seasonal schedule for revenue collection that generates enough revenue to cover annual costs. If the operational problem has been defined as one of training community health workers to manage a revolving fund, the objective might be: to define a strategy for training (number) health workers to perform (tasks) by (date). Objectives in operations research are usually of two types: 1) those that retain things of value (input minimization, e.g., minimize cost); and 2) those that obtain things of value (output maximization, e.g., maximize coverage). One cannot attempt to achieve both objectives at the same time (i.e., one cannot concurrently achieve highest output and lowest input).

For example, one might set as the objective for the solution to a malaria problem: select the best mix of malaria control activities that will maximize the reduction in the prevalence of malaria in children under 10 years of age. In operations research terminology, such a statement of the characteristics of solution is called the objective of the solution.

**Example:** The research team, in consultation with the board of directors, agrees on an overall objective for the cooperative financing schemes, which is expressed as

$$TE = TC$$

where: TE = Total expenditures by households within the community on health services provided through the co-op health system, and

TC = Total cost of providing these services through the co-op health system.

With regard to the specific operational problems, the board takes the position that "the ultimate decision on what array of services and financing mechanisms will be implemented will be made by each co-op membership"; however, the range of options are to be developed from the study. Thus, the objectives are stated as follows:

1. **Service Package.** To develop a service package that meets the primary health care needs of the target population, is acceptable to that population, and will not require financial contributions above current levels of health care expenditures.
2. **Financing.** To develop a financing scheme that will generate funds sufficient to cover total systems costs, including resupply costs; distribute the burden equitably across the community; foster utilization of appropriate services; provide incentives for utilization of preventive PHC services; and have a flexible payment schedule to allow for seasonal variations in income.

#### Step 2. Identify the Uncontrollable Factors (Constraints and Facilitating Factors) and Controllable (Decision) Variables of Each Problem

The performance of a program can be represented by a simple equation:

$$P = f(C, U)$$

which means that performance (P) is a function (f) of a set of controllable (C) variables and uncontrollable (U) variables. Such an equation is sometimes called the objective function. Often, the objective for the solution is to maximize the (P) of this objective function.

The controllable variables are also called decision variables. The decision variables are those that are under the decisionmakers' control and for which they must set a "best" value. For example, they may have to decide on the best price to set for ORT salt packets, the frequency of collection of fees, and the best persons to manage the community financing system. All of the decision variables for which values have to be set must be identified.

One important type of uncontrollable variable is the constraints that analysts must take into account when developing a solution. Constraints limit the range of choice and, for that reason, should be identified. For example, government regulations may prohibit the sale of certain drugs except through pharmacies.

Uncontrollable factors that are positive can be called facilitating factors; they favor certain choices. For example, if most community members are willing to pay for health services, this is a facilitating factor. Constraints and facilitating factors have values, or magnitudes, and analysts must also determine these. For example, how much are community members willing to pay for PHC services?

A simple illustration of how the controllable and uncontrollable variables are related to one another follows. In pricing commercial ORS, a constraint may be that sales have to cover manufacturing costs. Objectives may include: 1) to maximize the proportion of severe diarrhea cases in which ORS is used; and 2) to generate enough profit from sales of ORS to finance other desired PHC services. One of the decision variables, then, is the sales price. The value would be the specific price (e.g., 2 pesos) that is set. An optimal solution, therefore, would be the value that best meets the objectives, given the

constraints; that is, the price of ORS (value for the decision variable) that maximizes use of ORS in severe cases of diarrhea (objective) given the constraint that sales have to cover manufacturing costs.

**Example:** From the data collected in phase I, a number of constraints are identified and quantified. These include several economic constraints. For example, drug prices have increased 100 percent in the past year and are likely to rise as much in the next 2 years; household income is highly seasonal among small farmers in the rural areas, with almost 60 percent of annual income derived immediately after the harvest in October; income is more evenly distributed among the work force in the urban areas; and the government just announced a 57-percent increase in salaries of workers. The principal decision variables include: the PHC services provided to each co-op; the drugs and other commodities provided; the revenue mobilization mechanism (fees, contributions, annual assessments); and the prices or charges to set.

### Step 3. Select and Construct an Appropriate Model for Solving Each Problem

Operations research uses a wide range of data analysis procedures to arrive at solutions to problems, but its distinctive feature is the development of solutions through the use of models. Models are representations of reality expressed in symbols that may be graphic (maps, diagrams, flowcharts) or mathematical (a cost-effectiveness equation, a supply-demand equation, a linear program).

In operations research, the analyst selects or develops a model that fits the problem being studied and then uses it to find the best, or optimal, solution to the problem. The model allows the analyst to enter different values for the controllable variables, so as to find the best solution given the constraints. For example, an analyst might use a supply-demand curve to identify the price for ORS that would result in the highest sales while producing enough revenue to cover the cost of the salts.

This process of modeling is far more rapid than conducting field experiments, and far less expensive as well. These are its principal advantages; but there are limitations, too. Models only approximate reality, and thus they must be constructed carefully, because an inappropriate or unrealistic model will necessarily produce unrealistic results. Complex mathematical models usually require specialists and computers. However, a number of simple techniques are useful, including flowcharts, decision trees, and matrices. These and other relevant models are described in the PRICOR monograph on operations research methods.

**Example:** The research team selects two different models. The first is a heuristic model. The team develops a PHC service package by using a chart that lists the health needs of the community and the severity of each need. (See table 3-1.) The researchers use the economic data collected in phase I to calculate the cost of the PHC service to meet each of these needs. Through a structured group process involving co-op leaders, community health workers, village leaders, public health service providers, and the research team, they rank the needs and corresponding services in order of priority. Then, they calculate the total cost of desired combinations of services ("service packages") and select a tentative package.

The second model is an economic one, designed to determine the amount of money that could be generated by different financing mechanisms. Analysts study the phase I data, key informant interviews, and case studies to develop a discrete list of the alternative mechanisms. Among the most feasible alternatives are fees for services, a monthly membership fee, and an annual membership fee. Table 3-2 illustrates the use of this model.

Table 3-1.--Heuristic Model for Setting Health Service Priorities

This chart is used with community members to identify health needs and to set priorities for training of health workers. It could be modified to set priorities among health services. Through group discussions, the community members reach consensus on the various health needs, using simple crosses to indicate importance (e.g., + not very common; +++++ extremely common). The health needs (or services) that have the highest scores would make up the service package for that community.

PROBLEM	HOW COMMON	HOW SERIOUS	PEOPLE'S CONCERN	HOW MUCH IT AFFECTS OTHER HEALTH PROBLEMS	POSSIBILITY FOR TEACHING PREVENTION OR TREATMENT	HOW MUCH CHW COULD DO ABOUT IT IF TAUGHT	IMPORTANCE TO BE GIVEN IN COURSE
Diarrhea	++++	++++	+++	++	++++	++++	21
Malnutrition	++++	+++	++	++++	++++	++++	21
Worms	++++	+	++++	++	++++	++++	20
Cough							
Common Cold	++++	+	++++	+	++	++	14
Pneumonia	++	+++	++	++	+++	++++	16
Tuberculosis	++	++++	+++	+++	++++	++++	20
Skin Diseases	+++	+	+++	+	+++	++++	15
Stomach ache	+++	++	+++	+	++	+++	14
Tooth problems	+++	+	+	+++	+++	++++	15
Fever	+++	++	+++	+++	+++	++++	19
Drunkennes	++	+++	++++	++++	+	+	15
Pregnancy & Birth	++	++	++	++++	+++	++++	17
Heart Attack	+	++	++	+	++	+	9
Epilepsy	+	++	+	+	++	+	8
Bottle Feeding	+++	+++	+	++++	++++	+++	18
Tetanus	+	++++	+++	+	++++	++	15
Headache	+++	+	+	+	++	+	9
Misuse of medicine	++++	+++	0	+++	++++	++	16
Land tenure	++++	++++	++++	++++	++++	+	16
Accidents	++	+++	+++	+	+++	+	21
Vaginal Problems	+++	+	++	+	+++	+++	16
Measles	++	++++	++	+++	+++	+++	14
Whooping Cough	++	+++	+++	++	+++	+++	17
							16

Source: D. Werner and B. Bower, Helping Health Workers Learn, pp. 3-17.

**Table 3-2.--Economic Model for Establishing Membership Fees**

The overall objective for the self-financing scheme is that total revenues generated equal total costs of providing health services. This is expressed as

$$TR = TC$$

where TR is total revenue and TC is total cost. The economist will compute the cost of providing services at various levels. In this example, the levels are low demand, medium demand, and high demand. The formula for computing these costs is shown below.

Level of Demand for Services	Total Costs (Pesos)			=	Total costs
	Cost of Services + Provided	Cost of Drugs + Provided	Fixed Costs		
Low	45,000	55,000	150,000		250,000
Medium	95,000	110,000	150,000		355,000
High	125,000	180,000	150,000		455,000

Next, the economist will compute the annual fee that must be set to generate the revenues needed at each level of service. In this example, various fees are tried out and multiplied by the number of members paying such fees and the probability of collecting the fees.

Annual Fee	Total Revenues (Pesos)			=	Total Revenues
	x	Number of Members	x		
100		2,400		.95	228,000
200		2,000		.80	320,000
400		1,800		.75	540,000
800		600		.75	360,000
1,000		500		.75	375,000

By comparing the two tables, the economist finds that the optimum fee for a high level of demand is between 200 and 400 pesos. Further calculations for different fees in that range would lead to the identification of the optimum fee.

#### Step 4. Collect Required Data

Each model has certain data requirements. If some of the needed data are not in hand, they would have to be collected. As in phase I, data could come from a variety of sources, depending on the needs.

**Example:** The data collected in phase I are adequate for most of the analytic needs, but because the economic situation in the country is so precarious, the research team studies the latest inflation and cost data and updates the economic data.

#### Step 5. Use the Model To Develop the Optimal Solution(s) for Each Problem

At this point, the relevant data on the constraints, facilitating factors, and decision variables are put into the model in place of the abstract symbols. By using different (but always realistic) values, the analyst can develop and evaluate several possible solutions. The one that best meets the objectives given the constraints is the "optimal" solution. For example, using the model, the researcher can change the price for ORS to see the effect of different prices on utilization. The optimal solution would be the price that will maximize utilization of ORS by mothers and children given the constraint; for example, that the price not exceed 2 pesos per packet.

**Example:** The research team visits each cooperative and presents the chart of health needs and services. The communities select several service packages, which the team then analyzes in terms of their costs. It then computes the optimum fees for the three financing alternatives: individual service fees, monthly membership fees, and an annual membership fee. The team discovers that monthly membership fees are unlikely to produce adequate revenue, and it eliminates this alternative.

#### Step 6. Conduct Sensitivity Analysis of Each Solution

The solutions that emerge from the procedures described above should be subject to "reality" testing to insure that they are reasonable, politically and culturally acceptable, and compatible with solutions developed for other operational problems (e.g., remuneration of community health workers). Sensitivity analysis allows the analyst to see how the results might change if the objectives, decision variables, or constraints were changed, for example, by 5 or 10 percent. (Note that this is a "paper" exercise, not an actual field test of the solution. After indicated adjustments, the researcher should be ready to recommend the "best" solution to the decisionmaker.)

**Example:** The research team checks the tentative results with the board of directors, who believe that both the service fees and the annual fee would be acceptable. The economist recomputes the fee levels using higher estimates for inflation and drug costs. It is clear that neither financing scheme will work if inflation exceeds 50 percent in the next year, unless there is a corresponding increase in income or some services are dropped. The board agrees to go ahead regardless of this uncertainty and decides to present this information to the cooperatives and let them decide which scheme to select.

### PHASE III: SOLUTION TESTING AND EVALUATION

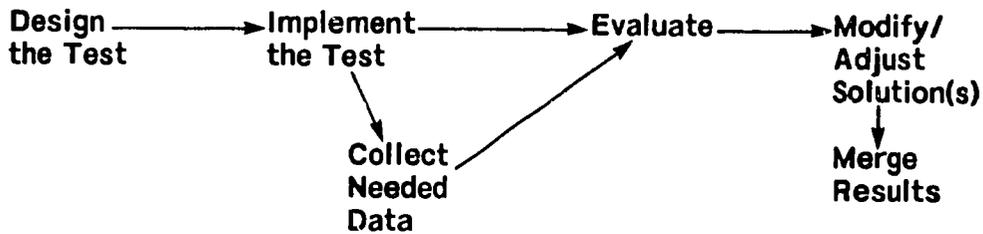
The steps in this phase are illustrated in figure 3-4 and described below.

#### Step 1. Design a Test of the Solution(s)

Once the decisionmakers select the solutions they prefer, an actual test or trial may be required to validate the solution(s). The test may be of one or several possible

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Figure 3-4.--Steps in Solution Testing and Evaluation



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solutions, and it may be designed in one of several ways: as an evaluation study with controls, as a pilot or demonstration project to test feasibility, or as a modification in program operations to be evaluated and adjusted over time. For example, ORS packets may be sold at different prices to evaluate the effects of pricing on sales. Different financing mechanisms (annual fees and service fees) might be tried out in different communities. Whatever the form of the field test, however, it has to be designed carefully to insure that the findings will be accurate and applicable to other communities in the region or country.

**Example:** Each cooperative selects its own service package and financing scheme. Two adopt straight service fees and one an annual membership fee for a 2-year trial period. The research team designs a field test with three uninvolved communities that had been included in the baseline survey serving as controls. They plan a post-test using the same household survey undertaken for the baseline data collection.

#### Step 2. Conduct the Test and Collect Needed Data

The tests are then implemented according to the evaluation protocol. Data on actual performance, including revenue generated, services utilized, population covered, and other key indicators are collected to evaluate the solutions.

**Example:** The research team conducts the field test in three communities. They analyze quarterly statistical reports to monitor the financing schemes' operations. They conduct a brief evaluation after a period of operation and recommend some changes in the service packages and fee structure. At the end of the project period, they conduct a followup household survey and analyze and present the results to the board of directors and cooperative leaders.

#### Step 3. Evaluate and Modify/Adjust the Solution(s)

On the basis of the findings from the test, the theoretical solutions are modified or adjusted. If the modifications are significant, further testing is required.

**Example:** The research team's analysis of the evaluation results indicates that the annual membership fee is the most productive of the two schemes, but that the fee should be changed to a sliding scale to make the services more available to low-income members. The board of directors accepts the recommendations, as do the cooperatives.

#### Step 4. Merge the Resulting Information

Sometimes several changes in the system are made at the same time. If this happens, the researcher must "put the system back together" to assess the effect of changes made in one part of the system on the rest of the system. For example, would a change in the fee structure bring in more money, and would that require a change in the management and control mechanisms? The analyst must merge the various changes to insure that the system as a whole will continue to function productively.

**Example:** During the second year of the test, analysts undertake several short operations research projects on problems that emerge, including provision of drugs, supervision of health workers, and management of funds. The analysts incorporate the results of these studies into the ongoing test and note the effects on the system. The final report includes recommendations for adjustments to each of those areas that will lead to improved performance of the system overall.

#### A FINAL NOTE

Certain problems do not lend themselves to following the above steps in exactly the order described. For example, analysts may need to collect data before selecting an analytical model. The steps and methods may overlap, or a number of steps might be repeated. Analysts may also research a number of operational problems simultaneously. Thus, these steps should be seen as a general guide to the process of operations research and should be employed with flexibility.

APPENDIX

SUMMARIES OF PRICOR-SUPPORTED STUDIES IN COMMUNITY FINANCING  
OF PRIMARY HEALTH CARE

## APPENDIX: SUMMARIES OF PRICOR-SUPPORTED STUDIES IN COMMUNITY FINANCING OF PRIMARY HEALTH CARE

This appendix summarizes a number of studies that PRICOR has funded and illustrates several ways that operations research can be used to study problems of community financing of primary health care.

### HONDURAS: A Study of Financing Alternatives for Basic Health Services

The Ministry of Public Health and Social Assistance, with technical assistance from Management Sciences for Health, is undertaking a 24-month study to develop and test community financing alternatives to complement Ministry-provided services.

The first phase of the study involved collection of data from a variety of sources to analyze the problem thoroughly and to identify possible financing alternatives. As of this writing, those appear to be: 1) consultation charges by health personnel, including the community health worker, the physician, and the auxiliary nurse; 2) selling medicines in health centers; and 3) soliciting contributions of labor, materials, and land.

The second phase of the study will examine each of these alternatives to assess their potential costs, effects, and relative cost-effectiveness. For each financing alternative, the costs and coverage estimates will be compared to determine which alternatives will produce the greatest coverage for a given cost.

In the final phase of the study, one or more of the financing alternatives will be field tested in two health areas of the country for approximately 6 months. After the results of the test are analyzed, adjustments will be made in the financing schemes prior to implementation nationwide.

For more information on this project, contact Dr. Yanuario Garcia, Direccion General de Salud, Ministerio de Salud Publica y Asistencia Social, Tegucigalpa, Honduras, C. A., or Dr. A. Frederick Hartman, Management Sciences for Health, Apartado Postal No. 7, Colonia Kennedy, Tegucigalpa, Honduras, C.A.

### BRAZIL: Community Financing of Primary Health Care Services

Residents of favelas (slums) in Rio de Janeiro have limited access to basic health services. The Centro de Pesquisas de Assistencia Integrada a Mulher e a Crianca (CPAïMC) has been providing maternal and child health and family planning services to some of these marginal urban communities for the past 5 years. The purpose of this research project is to expand PHC coverage to these communities through community financing. The immediate objective of the study is to find ways to finance services that could be delivered at mini-posts and health units.

The study will take place over a 21-month period. In the first phase, problem analysis, the researchers identified 18 possible ways communities could participate in the financing of primary health care.

In the second phase, the researchers will again use group processing techniques (brainstorming, Nominal Group Technique, Delphi) and interaction matrices to identify the best community financing approach for each favela. The "best" solutions should be those schemes that have the greatest chance of being successful given the constraints. These potential solutions will then be subject to "reality testing" by presenting them to community leaders, Ministry of Health officials, CPAïMC decisionmakers, and others for review and critique.

Once the community financing alternatives have been identified, they will be field tested over a 10-month period. A quasi-experimental design will be employed to measure the outputs of the alternatives (services provided, coverage, utilization, revenues raised) and their relative cost-effectiveness. Based on the results of the analysis, recommendations will be proposed by the research staff to improve the CF systems. These modifications will be introduced during the final month of the study.

For more information, contact Mr. Darci Dusilek or Ms. Karen J. Lassner, CPAIMC, Avenida Presidente Vargas 2863, 20210 Rio de Janeiro, Brazil.

#### BENIN: Community Financing Alternatives in Primary Health Care

The Clinic for Obstetrics and Gynecology of the Faculty of Health Sciences at the National University of Benin, with technical assistance from the Unitarian Universalist Service Committee, is assisting the people of the rural commune of Pahou in organizing a demonstration project for family health and community medicine. One of the objectives of the project is to establish a low-cost model for management of health care services "which will effectively and efficiently utilize local resources in the delivery of health care." Community leaders have agreed to finance drug and community health worker remuneration costs. This study addresses the question: what would be the most appropriate way for the community to finance these items?

Phase I of the study is a systematic analysis of the essential components of a financing scheme and the assessment of alternative schemes. The research team is working with the Pahou staff and village health communities to define a "matrix model" that will list the attributes of a successful financing scheme on one axis and possible financing alternatives on the other. By establishing quantitative relationships for each alternative on each attribute, it will be possible to identify the most promising financing schemes. So far, two principal schemes have been identified: prepayment and payment per episode of illness.

In phase II, the alternatives chosen by various communities will be tested. Periodic monitoring and evaluation will allow changes to be made as necessary to improve the operation of each CF alternative. A final evaluation will assess the effectiveness of each system.

For more information, contact Dr. Alihonou Eusebe, B.P. 1822, Cotonou, Benin, or Ms. Elizabeth Coit, Unitarian Universalist Service Committee, 78 Beacon St., Boston, MA 02108.

#### THAILAND: Community Financing of PHC Activities in Nutrition and Sanitation

This is a 19-month study of revolving funds in 40-50 villages in Northeast, Central, and Southern Thailand to analyze existing experience with community financing of nutrition surveillance, supplemental feeding, and household sanitation. In the first stage of the project, over 12,000 revolving funds were identified. A mail survey yielded data on over 4,600 of these funds. Followup case studies were scheduled for approximately 60 funds. The objectives are to: 1) describe existing viable models for community financing of these activities; 2) analyze equity considerations; and 3) explain variations. The ultimate goal is to develop model financing schemes, which will then be tested in 1984-85. The study is being conducted by the National Economic and Social Development Board, with technical assistance from a U.S. consultant.

For further information, contact Miss Orathip Tanskul, NESDB, Krung Kasem Rd., Bangkok 10100 Thailand, or Dr. Charles Myers, Harvard Institute for International Development, 1737 Cambridge St., Cambridge, MA 02138.

### BRAZIL: Financing of Community Water Supply

This is a retrospective investigation of projects initiated by the Fundacao Servicos de Saude Publica (FSESP), which started in 1942. A joint survey conducted by Johns Hopkins University and FSESP in 1960 serves as a baseline for the project. Data will be analyzed to identify factors that account for success and failure of financing schemes and to compare their cost-effectiveness. This information will then be used to develop alternative financing schemes that could be used in primary health care in Brazil.

For further information, contact Dr. Timothy Baker, School of Hygiene and Public Health, Johns Hopkins University, 615 North Wolfe St., Baltimore, MD 21205.

### SENEGAL: Community Financing of Primary Health Care

The Ministry of Health and various donor agencies believe that mobilization of community resources to pay for at least some PHC services is essential for the expansion of primary health care in Senegal. This 3-month study had three objectives: 1) determination of those factors associated with success in community financing of primary health care in Senegal in the past; 2) a critique of CF schemes proposed for phase two of the Sine Saloum project; and 3) development of an evaluation plan for the community financing component of the phase two project.

For more information, contact Dr. Clive Gray, Harvard Institute for International Development, 1737 Cambridge St., Cambridge, MA 02138.

### ZAIRE: Community Financing of Village Health Workers

This 20-month project seeks to examine the relative cost-effectiveness of the various PHC systems (government and private) in operation at the community level in Zaire, specifically as concerns the utilization of dispensary-level services. The study hopes to identify: 1) the most cost-effective financing strategies for sustaining the dispensary services; 2) the relationship between these strategies and the level of utilization; and 3) the applicability of these strategies in different regions of the country.

For more information, contact Dr. Lusamba Dikassa, Department of Public Health, School of Medicine, B.P. 128, Kinshasa XI, Zaire, or Dr. Frank Baer, Basic Rural Health Project, USAID/Kinshasha, Washington, DC 20523.

### PHILIPPINES: Testing of PHC Financing Schemes

This is an experimental test of community-based financing schemes in rural communities of Iloilo Province. Twelve barangays (villages) in the Panay Unified Services for Health (PUSH) project form the universe for the study. Barangay health workers will help communities develop community financing schemes. Approximately two to three schemes will be developed and tested in three barangays, with the remaining serving as control groups.

The focus of the study is the process of developing and implementing the schemes, operational performance of the schemes, and their outcomes in terms of changes in service utilization, health-seeking behavior and health expenditures. The research is being conducted over a 24-month period by staff from the University of the Philippines in the Visayas, with help from a number of Filipino consultants.

For further information, contact Dr. Trinidad Osteria, University of the Philippines - Visayas, Iloilo City, Panay, Philippines.

### DOMINICA: Implementing a Revolving Drug Scheme

The availability and financing of essential drugs is seen by the Ministry of Health as the major obstacle to the expansion of primary health care in Dominica. After considering a number of alternatives, the Ministry of Health decided that implementation of a revolving drug fund (RDF) would be the best way to assure drug availability and to finance a large part of the PHC program. This study addresses the question: How does one develop the best RDF and solve the operational problems associated with its implementation? During the first phase of the study, the research team conducted a systematic analysis of the components of an RDF for Dominica. The next step is to identify operational problems and then, using appropriate methods, analyze and consider alternative solutions to these problems. The RDF will be tested first in the Roseau district, during which the alternative solutions can be assessed. The RDF will then be implemented in stages throughout the rest of the country. The Ministry of Health is being assisted in this 18-month study by consultants from Management Sciences for Health.

For further information, contact Dr. Desmond O.N. McIntyre, Health Services Coordinator, Ministry of Health, Roseau, Dominica, West Indies, or Mr. Peter Cross, Management Sciences for Health, 165 Allandale Rd., Boston, MA 02130.

### BOLIVIA: Community Financing of PHC Through Cooperatives

This 2-year project proposes to develop and test self-financing schemes that can be operated by rural and urban cooperatives in Santa Cruz. In phase I, village health promoters will collect data on health problems, service needs, and expenditures on health. This information will be used to help village health committees select PHC service packages and the means to pay for them.

In phase II, the schemes will be implemented and monitored. Adjustments in the financing schemes will be made to encourage replications in other cooperatives in Bolivia. USAID/Bolivia will finance the development of the schemes, and PRICOR funds will be used for the research components.

The project is being conducted by Fundacion Integral de Desarrollo (FIDES) with technical assistance from an epidemiologist and a health economist. For further information, contact Mr. Martin Miller or Mr. Jaime Bravo, FIDES, Casilla 1911, Santa Cruz, Bolivia.

### LIBERIA: Planning and Evaluating Financing Schemes in Kolahun District

This 18-month study will be conducted by staff of Phebe Hospital in a rural district of Liberia. The objective is to determine how the community itself can finance all or part of the cost of PHC services to assure that these essential services can be sustained. A baseline survey will be conducted to identify health and service needs, potential providers and target populations, and willingness and ability to pay for services.

The financing alternatives listed in the APHA monograph will be examined using a system definition matrix. Those that appear to meet the objectives, given the existing constraints, will be assessed by local community leaders following a Delphi procedure. The best alternative will then be field tested over a 12-month period.

For more information, contact Dr. Andrew Cole, Christian Health Association of Liberia, P.O. Box 1046, Monrovia, Liberia.

## SUGGESTED READINGS

Many of the references used to prepare this paper are not readily available. The following is a brief list of relevant articles and books on community financing that are generally available.

### Financing

Wayne Stinson, Community Financing of Primary Health Care, American Public Health Association, International Health Programs Monograph Series 1, No. 4, 1015 Fifteenth St., N.W., Washington, DC 20005, 1982.

World Health Organization, "Cost and Financing of Primary Health Care (PHC) at the Community Level," Geneva: WHO/PHC/80.1, March, 1980.

Dieter K. Zschock, Health Care Financing in Developing Countries, American Public Health Association, International Health Programs Monograph Series, No. 1, Washington, DC, 1979.

### Operations Research

Stewart Blumenfeld, Operations Research Methods: A General Approach in Primary Health Care, Methodology Paper No. 1, PRICOR, 5530 Wisconsin Ave., Chevy Chase, MD 20815, 1985.

Peter Delp, et al., Systems Tools for Project Planning, International Development Institute, Indiana University, Bloomington, IN, 1977.

F. Grundy, and William A. Reinke, Health Practice Research and Formalized Managerial Methods, Public Health Papers No. 51, Geneva: WHO 1973 (also available in French and Spanish).

## GLOSSARY

This glossary was compiled to aid the reader in understanding the meaning given to certain terms used by PRICOR.

**ALTERNATIVE:** An opportunity for choice between two or more solutions, one of which--but not more than one--may be chosen.

**COMMUNITY:** A group of people having common organization or interest or living in the same place under the same laws.

**COMMUNITY FINANCING OF PHC:** The mobilization of resources by a community to support, in full or in part, basic preventive and curative health services for its members.

**COMMUNITY HEALTH WORKER:** A person indigenous to the community who provides basic preventive and curative health services to members of the community. Also called village health workers. These include promoters, community health auxiliaries, health agents, health guides, health visitors, among others.

**COMMUNITY ORGANIZATION FOR PHC:** The processes or structures for achieving community participation in primary health care.

**COMMUNITY PARTICIPATION:** The involvement of community members in the planning or implementation of community activities.

**COMPONENT:** A part of a system.

**CONSTRAINT:** A requirement or restriction on a system that reduces the freedom of decision.

**CONTROLLABLE FACTORS:** (See decision variables.)

**COST-EFFECTIVENESS:** A technique for comparing the costs and the effectiveness of alternative ways of achieving the same objective.

**CRITERION:** A characteristic, rule, or test by which an object or event is judged.

**DECISION:** The act or process of choosing among alternatives.

**DECISION VARIABLE:** A variable in a decision problem that can be controlled by the decisionmaker.

**DEMAND:** The type and quantity of service or commodity wanted or requested.

**DEPENDENT VARIABLE:** The variable being predicted or explained (the "effect" in a cause-effect relationship).

**EFFECTIVENESS:** The degree to which program or system objectives are achieved. Usually, outcomes are compared to some standard, such as the objectives that were set originally. For example, the program reached 90 percent of its target.

**EFFECTS:** The changes in knowledge, attitudes, and behavior (practices) among individuals, families, or communities as a result of a program, project, or activity.

**EFFICIENCY:** The achievement of objectives without wasting resources; the relationship of output to input. For example, in two programs that use the same amount of resources, program A, which screens 10 mothers/day, is more efficient than program B, which screens 5 mothers/day.

**EVALUATION:** A judgment of worth. In practice, a process for making judgments about selected objects, processes, or programs by comparing them to specific value standards (e.g., objectives) for the purpose of deciding among alternatives.

**FACILITATING FACTOR:** An uncontrollable factor that favors certain choices (e.g., people's willingness to pay for primary health care).

**GOAL:** A desired impact. In primary health care, a state of health that is desired or expected to be achieved through an activity, project, or program; for example, to reduce infant mortality.

**IMPACT:** A change in the status (e.g., health, standard of living) of individuals, families, or communities as a result of a program, project, or activity. For example, a reduction in infant mortality by 15 percent.

**INDEPENDENT VARIABLE:** A variable that is used for predicting or explaining other (dependent) variables (the "cause" in a cause-effect relationship).

**INDICATOR:** An observable phenomenon that is substituted for a less observable phenomenon (e.g., weight according to age in a child as an indicator of health/nutritional status).

**INPUT:** The types and quantities of resources (labor, money, material, etc.) used in a program, project, or activity; sometimes called effort.

**INTERVENTION:** In health, an activity aimed at modifying a train of events so as to produce a more desirable outcome. For example, measles vaccination is an immunologic intervention between virus and host.

**MATRIX:** A mathematical or graphical representation in two dimensions of the relationship between a number of variables.

**MEASURE:** A number assigned to an object or event. Measures can be expressed as counts (45 visits), rates (10 visits/day), proportions ( $\frac{45 \text{ primary health care total visits}}{380 \text{ total visits}} = .118$ ), percentages (12 percent of the visits made) or ratios ( $\frac{45 \text{ visits}}{4 \text{ CHWs}} = 11.25$ ).

**MODEL:** A simplified representation of the real world. In operations research, models are usually graphic (maps, diagrams, flowcharts) or mathematical (formulas, equations).

**OBJECTIVE:** An effect that is desired or expected to be achieved by an activity, project, or program (e.g., to increase the use of growth charts by 50 percent).

**OBJECTIVE FUNCTION:** A statement or equation which expresses the relationship between the actions that a decisionmaker may take and the outcome of those actions or between the decision variable and the objective of the solution.

**OBJECTIVE OF THE SOLUTION:** A statement of the characteristics of an acceptable solution, usually expressed in quantified terms; for example, maximize the number of children that can be immunized with a particular program budget.

**OPERATIONAL PROBLEM:** A specific question, issue, or dysfunction in an operating system that limits the attainment of system objectives. It is a problem within the operating system as opposed to an environmental, health, or other nonsystem problem.

**OPERATIONS (or OPERATIONAL) RESEARCH (OR):** The application of science to the solution of managerial and administrative problems; a systematic, problemsolving process consisting of three phases: problem analysis, development of solutions, and testing of those solutions.

**OPTIMIZE:** To operate a system so that the system criterion is at its optimum value. For example, to minimize costs or maximize utilization.

**OPTIMUM:** The best, or more favorable, value that can be achieved given the constraints.

**OPTION:** An opportunity for choice between two or more courses of action.

**OUTCOME:** The results of a program or activity, usually its effects or impact, but may also include outputs.

**OUTPUT:** The types and quantities of goods and services produced by an activity, project, or program. For example, 750 packages of oral rehydration salts distributed.

**PRIMARY HEALTH CARE:** A strategy for making basic health services universally accessible to the world's population.

**PROBLEM:** (See operational problem.)

**PROCEDURE:** A series of predetermined tasks or actions to carry out an operation, such as a physical examination.

**PROCESS:** A linked series of actions or operations that are directed to a specific purpose, such as a health education session.

**PROGRAM:** A set of organized activities designed to reach a goal.

**SENSITIVITY ANALYSIS:** An analysis that shows how a solution is affected by changes in one or more of the variables that influence it.

**SUBSYSTEM:** A system within a larger system.

**SYSTEM:** A set of discrete, but interdependent, components designed to achieve a set of goals.

**SYSTEMATIC ANALYSIS:** Analysis carried out following orderly procedures.

**SYSTEMIC ANALYSIS:** The identification of the components that make up a system and an assessment of their interrelationships.

**SYSTEMS ANALYSIS:** A generic term to cover the application of a wide spectrum of methods (including OR) to problems or entities that are conceptualized or modeled in the form of systems.

**UNCONTROLLABLE FACTORS:** Factors that are not under the control of the decisionmaker.

**VALUE:** Estimated or assessed worth; in OR, the number assigned to a decision variable, such as the price set for ORS packages.

**VARIABLES:** The factors of a decision problem whose value may change.