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# PRELIMINARY DESIGN OF A PROGRAM OF RESEARCH FOR THE DEVELOPMENT OF HEALTH SERVICES

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## I. INTRODUCTION

The IV Meeting of Ministers of Health of the Americas in 1977, the Thirtieth World Health Assembly in 1977, the International Conference on Primary Health Care at Alma Ata in 1978, the XX Pan American Sanitary Conference in 1978, the WHO Document on Science and Technology for the Promotion of Health in Developing Countries, presented at Vienna in August 1979, all stated that one of the most important goals of the Member Governments of WHO was the attainment by all peoples of the world by the year 2000 of a level of health that would permit them to lead socially and economically productive lives.

The Alma Ata report on Primary Health Care, the WHO document on the Formulation of Strategies for Attaining Health for All by Year 2000, and the report on Science and Technology in the Promotion of Health, of the Vienna Meeting, present highly useful recommendations for the formulation of policies and preparation of strategies and plans of action at both the national and the regional and global levels. The committees on medical research of WHO and PAHO have worked out bases and presented recommendations for concrete plans of action for the coming years, which will have to be put into practice at the earliest possible opportunity if we are to hope to attain the goal of health for all by the year 2000.

This document presents a proposal for a "Program of Research for the Development of Health Services" in the Region of the Americas.

## II. BASIC PRINCIPLES

The Program rests on the following basic principles:

1. The ultimate purpose or goal of the program is to contribute to the development and reinforcement of health services in the countries of the Region so that they will be able to apply the strategies and implement the plans of action recommended in the documents cited in part I (Introduction) of this document.

2. The general objectives of the Program are to help extend the coverage, lower the costs and enhance the effectiveness and efficiency of health services.

3. The research that the Program is designed to support and the projects, strategies and actions which it is expected to implement, will be for action-oriented based on the practical needs of the health services of the different countries. To the extent possible, simple epidemiological methods will be used and practical systems analysis methods applied.

4. The programs and projects to be supported will have to make use of the

ordinary structures and facilities of the health services. Pilot projects that are difficult to replicate will be avoided.

5. Even in the stage of designing the research it will be kept in mind that, given the ultimate goal of the Program (see paragraph 1), a way will have to be found to introduce into each project techniques for disseminating the results or benefit to other parts of the country and other countries of the Region.

6. One of the principal objectives of the Program will be to develop the applied research capabilities of the health services as a strategy for rationalizing the administration of those services. So far, research has contributed little to the development of health services in Latin America.

7. A priority goal of the Program will be to extend and rationalize the primary care process, in which the Declaration of Alma Ata will be borne in mind, which specifies that primary care embraces at least the following activities.

   a) Education on health problems and the methods of preventing and controlling them;

   b) Promotion of food supply and proper nutrition;

   c) An adequate supply of safe water and basic sanitation;

   d) Maternal and child health care, including family planning;

   e) Immunization against the major infectious diseases;

   f) The prevention and control of the principal local endemic diseases;

   g) Appropriate treatment of common diseases and injuries;

   h) The provision of essential drugs.

8. The Program will take account of the importance of self-determination and self-reliance of individuals, communities and countries in health matters. Without prejudice to the general responsibility of the Governments, measures will be taken to enlist the free and conscious participation of the community. This participation is not merely desirable, but, indeed, a social, economic and technical necessity.

9. The Program will bear in mind that primary care is part of the national health system, and will help establish the requisite inter-relationships between the primary and the secondary and tertiary levels. It must also respond to the need to develop the assured support of other sectors, such as those of education, agriculture, animal production, food, hydraulic resources, environmental protection, housing, employment generation, and communications.

## III. PLAN OF ACTION

It is proposed to launch the Program in January 1981 and to carry it

out over a period of six years in three stages of two years each, at the end of which an evaluation will be performed and adjustments made as are found to be indicated.

It was provided that the Program would be preceded by a preparatory stage, which began in June 1979 at the end of the XVIII Meeting of the Advisory Committee on Medical Research (ACMR) of PAHO and will end in December 1980. During this preparatory stage, a series of actions have been and will be taken to further the objectives of the Program, though they involve only the regular funds of the Organization. During the same period, work will be started toward the acquisition of information of use in improving the structure of the Program. Among the former actions, we may include:

1. The interdivisional preparation of protocols with exploratory operations research models in the following areas:

   a) Drug administration in health centers and hospitals;

   b) Administration of materials, sterilization facilites and infection control at health centers and hospitals;

   c) Appropriate technology for the maintenance of health centers and hospitals.

   These protocols will be offered to interested countries in which conditions for conducting the research are appropriate, and will serve as an exploratory devise for the identification of specific problems that could be studied in functioning service units. These protocols are designed to bring out these problems with the fullest possible documentation on the basis of case studies and at a low, affordable cost.

2. A Regional Seminar on Operations Research in Health was held in Washington, D.C., from 13 to 15 November 1979. This Seminar was attended by distinguished operations research specialists of the United States and Latin America and by health ministries and other health institutions familiar with the problems they are concerned with. The report on this Seminar will be presented by Mr. Ortiz, a technical officer in the Division of Human Resources and Research at PAHO Headquarters.

3. Under the research grant program, which provides financing for health services research (HSR) and for the training of research workers, a grant has been awarded to the Human Resources Department of the Ministry of Health of Chile for research to diagnose the needs for the training of managerial personnel for the national health service system.

4. Technical cooperation was rendered to Barbados in the following areas:

   a) The identification of problem areas and subjects of operations research in the development of the new national health service system;

   b) The design of a graphic model of the present drug requisitioning and distribution system;

c) Flowcharts for the new drug requisitioning system;

d) A sensitivity analysis model for estimating the number of general practitioners required in the new health service system;

e) Framing the terms of reference for a consultant in the analysis of health service systems.

5. Cooperation was rendered to Nicaragua in the simplification of an evaluation model previously designed for the patient referral system in maternal and child health services in the Managua area.

7. The PAHO-Kellogg Health Administration Education Program provides for research in health services as an instrument for its implementation which has accordingly been included in the four fundamental areas:

Economics and Finance

Operations Research

Epidemiology and Community Medicine

Organizational Behavior.

8. This Program also provides for grants in support of research that may be pursued toward student theses, for a total of US$140,000 distributed over four years.

9. In the IV Subregional Meeting on National Health Research Policy, a special chapter on In-Service Research was included as an incentive to those present at the Meeting, who were high-level representatives of the Ministries of Health of Argentina, Chile, Paraguay and Uruguay, to use these instruments.

10. BIREME has a stock of 16,000 microfilms containing information on HSR, which will be put in order and selected for publication and distribution under that establishment's selective information program.

11. A directory, by specialties, is being compiled of consultants who may be called upon to advise HSR researchers in the Region.

12. The Division of Human Resources and Research of PAHO recently added an office of Statistical Methods, which offers technical cooperation in the design and statistical analysis required in HRS, and is at the disposal of researchers in the Region.

13. A consultant of the Division of Human Resources and the staff of PAHO's Field Office at El Paso are participating in the planning of the work for the study on "Economic Analysis of Utilization of the Health Resources available in the Area of the United States-Mexico Border," to be described by Dr. Rosenthal to this meeting.

The work of preparing the Program and the Financing for it will be as follows:

1. A short-term consultant was hired and came to Washington last March for an exchange of views with members of PAHO's Internal Advisory Group with a view to planning the work of formulating the Program. This consultant and the coordinator of the Sub-committee on Health Services of the ACMR will together visit a number of countries in the Region interested in HSR to identify researchers and research teams and collect information on objectives, the country's priorities, methods, and funding. All this information will help to guide the design of the Program and to decide on future activities. The mission will go to Brazil, Colombia, Costa Rica, Mexico and Peru.

2. In the months from June to December 1980, more detailed descriptions will be provided of the general purposes, the specific objectives, and some of the plans of action to be implemented. To this end it is expected to visit in the next three months at least three of the five countries in which actions are to be initiated in the first stage (1981-82). The recommendations of PAHO's Advisory Committee on Medical Research and the opinions and suggestions of its Internal Advisory Committee on Health Research will be taken into account.

3. Before any work or project is begun in each country, there are some very important steps to be completed, among which are:

   a) The chosen countries must have well-defined national health policies (priorities, goals, strategies and plans of action) and have undertaken to extend the coverage of their health services;

   b) The Governments and participating institutions must have made a policy commitment to work on the Program;

   c) Efforts must be made for the development of the institutions and staff who would be working on the Program, for which seminars, short courses, consultancy visits, distributions of documents, etc., are recommended;

   d) At the same time, decision-making groups and institutions (health ministries, social security institutes, science councils and academies, national planning bureaus, related ministries, etc.) must be prompted to take an interest and participate in, and to support, the Program and its projects. In this way, it is hoped to promote acceptance of the Program and its projects and the national dissemination of the results.

4. In the Meeting of WHO's Subcommittee on Health Services Research at Manila in April 1980 a report on this Program was presented.

5. A meeting with representatives of the Hipólito Unanue Agreement (Bolivia, Colombia, Ecuador, Peru and Venezuela) will be scheduled for August of September 1980, and to it will be invited, for each country, two high-level administrators of the ministries of health and of social security, and two researchers with experience in primary care. Another meeting for Area V (Brazil) will be arranged for the

end of the year. The main purpose of these meetings (as we recommended at the Meeting of WHO's Subcommittee on Health Services Research at Alexandria) will be:

a) To define the objectives and significance of research for the development of health services;

b) To acquire a better understanding of the objectives and of the methods and operations to be used in research of this kind;

c) To define areas and types of research projects that can contribute to attainment of the goal of "health for all by the year 2000";

d) To suggest epidemiological, systems analysis, social science and other approaches to be taken into account in drawing up projects;

e) To present examples of health services research and their results;

f) To launch a discussion of strategies and plans of action for the dissemination of results in a multinational regional program;

g) To identify needed cooperation from outside, such as advisory services, travel grants, the furnishing of documents, etc.

6. The opportunity offered by the XVII Meeting of the Global ACMR (12-17 October) and of its Subcommittee on Health Services Research should be taken to support extensively on the progress of the Program and to request technical and financial assistance from WHO.

7. In October 1980 a two-week Regional seminar will be offered on health services research for ten participants at the level of directors of health, and of health research and planning. Three foreign teachers and local staff will be hired for the purpose. The site chosen for this seminar is Cali, Colombia, where several research programs are in progress which can serve as models for demonstrations to the participants. The purpose of the seminar will be to motivate high-ranking officials of health and education ministries and directors of social security institutes, academies of science, national science and technology councils, planning ministries, etc. and to build in them an awareness of the need for this kind of research, and of its importance for contributing to the solution of the Region's health problems and for contributing to the social and economic development of the citizenry. During the seminar special attention will be given to strategies and plans of action in primary care, community participation, and the importance of multi-institutional and multisectoral participation in the programs and projects.

8. A study will be made of the activities and programs that can most efficiently contribute to development of the capabilities of the countries and the various national institutions to conduct effectively programs and projects for the development of health.

9. Part of the foregoing study must be an analysis of the projects now in progress in some countries for the improvement of their services. A critical analysis of these projects and of their results (evaluative

research) can yield information very useful to the Program proposed in this document.

10. Some short courses in health services research will be conducted to enhance the capabilities of the countries and institutions in the Region, with the participation of some other Regional programs, such as the Program of Training in Health Services Administration (PROADSA).

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# FINAL REPORT OF THE REGIONAL SEMINAR

# ON OPERATIONS RESEARCH IN HEALTH

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INTRODUCTION

1. Welcome

Dr. Jose Roberto Ferreira welcomed the participants and special guests to the seminar on behalf of the Director of the Pan American Health Organization. He noted that PAHO/WHO was interested in promoting research activities as a means of determining the health status of people and improving their living conditions. Health services research emphasized support for activities aimed at improving and extending the coverage of those services. He also said that specialists in many disciplines had to participate in health services research, in view of the unique nature of each problem.

Dr. Ferreira stated that the multidisciplinary approach to health services research also required the participation of different sectors of the administration and institutions training researchers by widely differing methods. A good example of this was a number of industrial engineering and systems schools which in the past had never touched health problems, but were now taking on activities that were fully applicable to health services research.

Dr. Ferreira also noted that so-called operations research was without doubt one of the major lines of health services research. Its systematic and analytical approach had enabled the development of methods that made fullest use of resources and thereby helped to maximize the efficiency and effectiveness of their use. Finally, Dr. Ferreira discussed a number of decisions of the PAHO/WHO Governing Bodies that had resulted in a regional health services research program. This program had been submitted to the Advisory Committee on Medical Research for consideration. It recommended holding meetings to promote collaboration among producers and users of health services research, in order to decide on how and where to make best use of these methods.

2. Organization and structure of the seminar

Mr. Jorge Ortiz described briefly the start and the early development of operations research in health services as a part of the academic programs of industrial engineering and systems schools at Latin American universities. Some of this research had been done with financial support from the PAHO Research Grant Program.

Mr. Ortiz said that to determine how common health services operations research in industrial engineering and systems programs was, a survey of 35 industrial engineering programs had been conducted in 1975. The survey had found that eight programs had one or more activities involving health services research.

The basic purpose of this seminar had been to draw the interest of the personnel of academic programs in industrial and systems engineering and the executives of institutions in the health sector to health services research. Specifically, the seminar was aimed at generating an awareness of prospective applications for operations research in the health sector and setting up exchanges of research experiences among the different countries in the Western Hemisphere. This would be of practical value not only for the findings of this research but also for the human and methodological problems encountered in it. The hope was that the problem areas identified in health services by participants from the health sector would be pondered and analyzed to determine the extent to which it would be feasible to use the systems approach and the methods of operations research.

A rundown was given of the agenda, which in the first session called for nine topics on the philosophy, history, methods and applications of operations research in health. Five presentations on experiences of operations research in Latin American health services were made in the second session, and, in the third session, six presentations on problems areas of institutional and program administration which could be subject of operations research in health. A document was presented containing the general bases for a regional health services research (HSR) program . The fourth session included a visit to the National Center for Health Services Research of the United States, where the Director and his staff exchanged ideas with the participants about the development of HSR in the United States. In the fifth session, devoted to a general discussion based on the different ideas that had come up in earlier sesssions and the experience of the several participants, recommendations for different aspects of the promotion and conduct of operations research on health services in Latin America and the Caribbean were presented and discussed.

Session I: Update on operations research and systems analysis in the health field

1. The systems approach

Dr. Harry E. Emlet, Jr. explained that a systems approach to health began with recognition of three impacts of health as objectives of the health care system: absence of disease; existence of full function, physical, mental and social; and conscious possession of a full sense of well-being. It then proceeded with deliberate systematic identification of the present and future alternative ways of achieving the objectives; analysis and selection of the preferred alternative(s); operational implementation of the preferred alternative; conduct of the appropriate research and development (R&D) toward achievement of the future alternative; continual evaluation of the results of the R&D; and based of this evaluation, reassessment of the preferred alternatives and the related design of the health system.

Systematic design of the health system as an organization of resources, to provide for the necessary and appropriate interventions in the individual's life and environment, was a complex process. The process required deliberately and explicitly answering a rather large number of key questions that now were frequently answered only implicitly and by default. If successfully answered, care was made available and accessible to the persons needing it, in form, content, quality, and costs that made it acceptable to consumer, provider, and third-party payer alike, and that yielded a reasonable likelihood of the consumer realizing the promised benefits.

Some of the alternatives highlighted by a systems approach to health, such as prevention through control of the environment, fell outside of what was now considered the primary purview of health care; and yet they might represent the most powerful and cost-effective way of influencing certain aspects of health. Other alternatives involved educating the consumer and bringing him into a role in caring for his or her health that went well beyond what health care providers were now prepared to do or accept and might well entail enlisting the direct involvement of the public and private school systems.

Still other alternatives, such as those related to achieving and maintaining a full sense of well-being, required the health care provider to assume responsibility for an area he was untrained or ill-trained to understand and address and that he tended to regard as involving largely "personal problems" of minor significance in comparison with disease and clearly indentifiable loss of function. Addressing this category of system concern might require significantly revising the content of medical education and the criteria for selection of its recipients or, alternatively, the development of an entirely new kind of health care provider, the educational framework to educate and train him or her, and the organizational setting in which he or she was to function. Yet another direction was conceptualization, exploration, and development of entirely new paths, such as genetic engineering, which might hold the key to a breakthrough in some chronic health problems similar to what antibiotics had provided for infectious disease.

If the systems approach was seriously adopted, these outside-the-normal-scope-of-health-care areas were not simply noted and dismissed, but were deliberately addressed; and if shown to be sufficiently significant, were implemented in a manner appropriate to their stage and role in the overall system.

After Dr. Emlet's presentation, several comments were made about the criteria for selection of the indicators of effectiveness. The point was made that these indicators had to emerge from work in conjunction with the users, that is, the physicians and administrative personnel who were faced with the problem and would have to take the final decisions on it.

## 2. Operations research and the management of health services

Dr. William Pierskalla explained that the management of health services could often benefit from the application of knowledge from operations research. The most effective application involved the systematic integration (usually by constructing models) of resources to arrive at decisions involving better health care delivery.

Operations research had been most successful working on intrainstitutional problems such as scheduling of health personnel, facilities, patients, and services; constructing computer-aided diagnostic systems, information systems, and transport systems; and the planning of staffing levels and facility design and layout.

Operations research had also been successful in interinstitutional level planning, location, design and staffing of large health care delivery systems. Finally at the most macro level, operations research had been used for determining health status, manpower, and facilities needs and allocation at a national level.

However, operations research could not be applied without the integrated knowledge from many other disciplines.

In this respect, the operations researcher would have to gain sufficient knowledge to communicate effectively with the medical, nursing, technical and administrative staff facing the operating problems.

To illustrate the use of operations research in the solution of health services problems, three examples were discussed. The first was the scheduling of nurses in acute case institutions. This scheduling problem in large hospitals took large amounts of nursing time and resulted in many schedules disliked by the nurses on duty. An operations research model of this problem eliminated 90 per cent of the nursing time devoted to this task and produced schedules of much greater satisfaction to the nurses.

The second example was concerned with finding the optimal sequence of examinations to discover noncontagious disease in a large population. This sequence would have to meet budgetary, personnel and facilities constraints.

On a more macro level, the third example was concerned with how to design and operate a regional system of blood banks. The use of operations research in this case allowed the systematic quantitative evaluation of different regional structures and the location of regional centers as well as the allocation of hospitals to these regional centers in the least costly manner.

Following Dr.Pierskala's presentation, it was remarked that models and mathematical techniques were a valuable aid in analyzing some health service problems. As a result, it was recommendable that these models and techniques be publicized and used, wherever possible.

3. Methods for evaluating health programs

Dr. Joseph de la Puente said that the purpose of his paper was to discuss some examples of strategies that could be used to evaluate health programs. At first, he explained the advantages and disadvantages of using national statistics such as mortality and morbidity rates. In the United States these statistics came from official documents and national surveys. He then talked about the development and use of different types of health indices and gave three examples of program evaluation in greater depth. Each one of these example programs needed a different strategy for its evaluation because the problem was always different. Those programs would be kidney transplant, prevention of death from cervical cancer and diagnosis of breast cancer by mammography. Although the programs and the strategies for their evaluation were different, the basic principles remained the same. Designing a successful evaluation called for a thorough understanding of the details of the program, the advice of persons who would take decisions and act in accordance with the results, the devising of practical, relevant and reliable measures to carry out the evaluation, and a prior decision on what would be done with the results.

For an in-depth discussions of his presentation in all its parts, and to enable the participants to apply points useful to them in the future, the following supplements had been prepared which he described briefly:

1. Examples of measures to evaluate health services from the national standpoint in the Unites Sates.

2. Development of health indices in the United States.

3. Evaluation of programs for the acquisition of organs for kindney transplant.

4. Evaluation of programs to prevent death and disability from cervical cancer.

5. Evaluation of mammography services to lower false-positive rates.

4. Operations research in the location of health facilities

Dr. E. C. Revelle discussed models for the location of health service facilities in the same order as they evolved historically.

The basic concepts underlying the models were: (1) a Time Standard and (2) Coverage, as measured by the number of people within the distance (Time) Standard. The models included and were derived from basic models, and these models were, in brief:

(1) Siting a limited number of facilities so as to minimize the average travel time of all users;

(2) Siting the minimum number of facilities so that all points of demand had a facility within the time or distance standard.

(3) Siting a limited number of facilities so that the maximum population would find service within the standard.

These models could be extended to include (1) multiple objectives, e.g. covering both rural and urban populations; (2) locating several types of services, both of which were needed in combination for coverage; (3) locating both the services and the facilities which would house them; (4) locating a hierarchy of interacting facilities.

A data base of the shortest time between places and the population of those places was needed to begin application of these models but constituted valuable information for many purposes.

In the wake of Dr. Revelle's presentation, several comments were made to the effect that the models used were relatively simple because basically they were developed by using time as the standard for the evaluation of alternatives.

The models make it possible to guarantee some levels of coverage but did not allow for the behavior of the users in the selection of health facilities.

In using models it was important to analyze carefully such aspects as technological changes in transport systems and in population distribution, and conditions for access to the health facilities.

5. Cost-effectiveness appraisal in health services research

Dr. William A. Reinke stated that adequate coverage of health services for traditionally underserved populations had become the focus of attention in primary health care and associated health services research. Innovative delivery systems based upon redifined work role were examined for success in balancing resources against service needs of defined target populations. Issues of effectiveness, efficiency, equity, and cost were paramount in these investigations.

In principle, the issues would be embodied within a linear programming framework designed to achieve optimal cost-effectiveness in the face of resource constraints. Generally, however, the linear programming framework per se was impractical because of multiple program objectives, lack of precision in establishing cause/effect relationships, and inability of health care system managers to control fully the inputs and effects. Nevertheless, the model provided a useful systems framework for comprehensive assessment of innovations descriptively, but quantitatively, through functional analysis.

Costs had to be ascertained and allocated functionally in the interests of replicability. At the cost analysis stage, it was important to distinguish between cost per capita and cost per client. Innovative programs were typically more costly than existing services reaching a small fraction of the target population. Improvements in coverage, however, were likely to exceed cost increments, thereby resulting in reduced costs per unit of service.

Assessment of program effectiveness, and the ratio of effectiveness to cost (i.e., efficiency) was complicated by the multiplicity of dissimilar impacts generated. The paper discussed various methods of aggregating effects to produce overall performance indices and cost-effectiveness rations. Strictly economic methods and measures of utility were not likely to be adequate, and the paper illustrated use of the Delphi technique for incorporating community preferences and other non-economic considerations into the analysis.

Realistically, health service researchers considered alternative means of achieving multiple objectives. Particular alternatives were likely to favor certain results while producing less satisfactory outcomes relative to other objectives. What was sought, therefore, was an alternative which yielded nearly optimal results over the entire range of objectives contemplated. This was likely to be an integrated mix of services with synergistic effects or operating economies. The paper concluded with a summary of experience from such a situation in India.

6. Opportunities for systems analysis and management of sickness campaign programs

Dr. Truett L. Smith pointed out that because of the continuing threat of diseases to the world, it was still necessary to improve the management of programs for combating them. Systems analysis could be a useful instrument for such management. The function of a disease control system could be defined as a response to the pathologies of the community which helped to reduce or minimize morbidity, mortality and other indices of the state of health. Systems analysis consisted in the application of quantitative methods to the solution of the problems faced by the health authorities. In disease control, systems analysis was particularly applicable to three types of problems: (1) unreliability of the information to which statistical methods are to be applied; (2) a multiplicity of incompatible goals, which can be resolved by applying decision-analysis techniques; and (3) a dynamic environment, which calls for the application of dynamic control procedures. By way of example, two specific problems could be cited in those solutions systems analysis would be increasingly necessary. These were the growing volume of disorganized epidemiological data and the need to enlist the participation of skeptical public in disease control programs.

Following Dr. Smith's statement, it was commented that in addressing the problem of uncertainty and the quality of data, the effort should focus on the data collection process, for processing errors could be corrected, but not those made in collecting the data.

7. The use of operations research in hospitals

According to Dr. John P. Young, the growth of operations research in hospitals could be said to have occurred in essentially three phases, and had been motivated by the passage of the Hill-Burton Act in 1946. This act had provided government funds for hospital construction, and had simultaneously provided additional funds for research in facilities development and utilization. The first phase in the growth of operations research, from 1950-1956, had been characterized by the use of industrial engineering techniques to solve hospital operating problems, with primary focus on work measurement and methods improvement. The second phase, from 1956-1972, had concentrated on administrative problems involving the prediction of demands for care and management decision-making in the allocation of services and resources. The third phase, from 1972 to today, had seen a shift in emphasis to larger health delivery systems and health policy issues, with focus on manpower, technology, quality and costs. An important example of the use of operations research in hospitals was the work involving the assessment of in-patient needs and the effective allocation of nursing staff in response to predicted needs. The work on patient assessment and classification, and nurse staffing, had been extended from acute-care hospitals to nursing homes and mental hospitals, and patient classification systems were now being mandated for all hospitals in the U.S. by 1980 by the Joint Commission on Accreditation of Hospitals.

Following Dr. Young's statement, favorable comments were made about his recommendation that health services research should initially emphasize the use of industrial engineering techniques to improve the operation of services.

Also, studies should be made of patient and personnel flow, plant distribution, improvement of working methods, the prediction of medical, paramedical and auxiliary personnel requirements, assessment of the impact of an increase in the demand for supporting services and, in general, the use of simple models.

8. Systems analysis applied to the organization of an information system on outpatient care

Dr. Richard K. C. Hsieh said that systems analysis was a way to approach decision-making in management. This approach evoked order as opposed to chaos. It implied a search for logical solutions as against a haphazard attack on problems. It involved an overall view that rose above partial aspects. The procedure had been described by many authors. Briefly, its basic stages were: (1) the clear definition of objectives; (2) the identification of possible ways of attaining those objectives; (3) choosing the best solution or combination of solutions; and (4) application of the solution selected.

Dr. Hsieh said that during the past four and one-half years, the public health hospital services of the United States had been developing and implementing an outpatient care data system (OCDS). This service was a network of eight hospitals and 27 dispensaries with a capacity to see 1.8 million outpatients and accommodate 30,000 hospitalizations per year.

The OCDS had the following purposes: (1) to obtain selected data for improving the patient treatment function; (2) to obtain selected data for the improvement of clinical management and the administrative functions of the system; and (3) the preparation of profile reports considered necessary for the monitoring and critical analysis functions.

For these limited objectives to be attained, there must be a consensus on the minimal information or data requirements of the OCDS.

To determine these minimal data requirements, a far-reaching analysis of national studies on outpatient care and a study of local and internal needs were made. A matrix was prepared to determine the basic data or critically important information that were obtainable from the public health services. After two years of experiments, trials and discussions, the minimal data and specific reports to be supplied by the OCDS were determined.

According to a preliminary study made during this phase, more than 70% of the total cost of operating a computerized OCDS would be incurred for personnel, that is, for the time spent by staff on the collection of the basic data and on preparing the computer programs. Instead of a total cost model, a predictive model was made that would focus the analysis on the cost of the data processing staff.

On the other hand, it was not easy to express quantitatively the value or the benefits of the information. It was subjectively decided, therefore, that any other configuration proposed would have to meet at least certain specific criteria, which were validity, feasibility, accuracy, completeness and timeliness.

Once it had been determined which configurations met or exceeded those minimum criterial, the least expensive solution would yield the highest cost-benefit ratio.

Evaluating any technique for the delivery of health services was a difficult task but a necessary one.

Electronic data processing was a source of concern in many countries because of its implications for the confidentiality of medical information. The objective of the OCDS was to furnish to the public health hospital service, when needed, data on a minimum set of items (not previously available) on patient treatment and clinical management.

Only authorized personnel had access to those basic data and to the processing equipment. Control was obtained by a security and risk system designed to make the operator aware of his responsibility.

Probably the most innovative contribution of the OCDS to patient care was the addition to the clinical chart of some data that many physicians of the public health hospital system wanted, but had been unable to obtain. Noteworthy in this regard was the patient file index, which provided a profile of groups of patients with similar clinical problems and treatments.

However no system, no matter how simple and economical, can survive without the support of users and the authorities. The OCDS owed its very existence primarily to the efforts of many physicians, dentists and other health personnel.

In concluding, Dr. Hsieh stated that his presentation had two simple objectives. The first was to show the practical application of systems analysis to the establishment of an information system in a large organization delivering medical care services to specific populations. The second was to report on the progress of a project involving the application of computer technology to outpatient care.

The application of systems analysis was a rational way of executing projects but did not guarantee satisfactory results. The data processing technique used by the OCDS was obsolete from the start, but its main purpose was to improve the quality of care with the available resources and not to use the latest technology.

9. Operations research in health services--historical perspectives

Dr. Charles D. Flagle said that from its beginning in the 1950s operations research in health had had a dual relationship; one at the clinical and institutional level, one at state and federal level. A review of early research revealed that in many instances the initial relationship had been established at the clinical level. However, the operational problems had often had national implications and the general applicability of the work had justified national support.

One class of problems that had followed this path were those of staffing and supply of hospital nursing units. The effective use of scarce nursing resources had motivated, both hospitals and governments, to seek improved form of organization and support of inpatient care.

Similarly, problems in outpatient clinics had brought on concern for primary care at institutional and societal levels, and we had seem much nationally supported research in clinical settings.

While historical circumstance had strongly influenced this often difficult dual relationship, it could be seen as beneficial in the long run for the researcher and the implementation of his findings.

When Dr. Flagle concluded, several comments were made to the effect that health services research should be aimed at solving the actual problems of the services. The fact that services research had been done by students to meet a requirement for a graduate degree had frequently led to over emphasis on the use of sophisticated mathematical models.

It was also said that in the future, in connection with the developing countries, research in primary care would be greatly stressed. This would require the formation of multidisciplinary groups that would have to address problems in a comprehensive way and would need good coordination and continuity. These groups would work on such problems as nutrition, housing, education, etc.

In the developed countries the emphasis would be on the evaluation of traditional systems, in order to establish whether they were really solving the health problems of the population.

Operations research was not only applicable to health services research. Other problems should be taken up that were more important and whose solutions could greatly benefit our society.

Session II. Some Latin American experiences in operations research in health services

1. Mexico

Dr. Gonzalo Mitre said that about ten years ago, the Industrial Engineering Department of the Monterrey Technological Institute had started its first applications of industrial engineering and operations research in the field of health services.

Dr. Mitre then said that with the collaboration of the Mexican Social Security Institute (IMSS) of the city of Monterrey and funding from the PAHO Research Grant Program, a practical school was set up in 1972 in premises of the Social Security Institute. At this school, professors and students did work in a clinic, a hospital and the head offices of the IMSS.

Since that year, this health services research had been pursued periodically in the IMSS where more than 20 projects had been completed.

The applications had been diverse, for example, in the siting of new hospitals, storeroom control, the design of information systems at a clinic, a dynamic model of the social security system in a city, and the diagnosis of operations in a private hospital

In general, these projects had sought to find practical solutions and, in many cases the solutions had been implemented.

The work team had consisted of the researcher, physicians, administrators and students, the latter from the Monterrey Technological Institute. Later, said Dr. Mitre a course had been given on application of operations research applications in health systems as part of the program toward the master's degree in operations research.

Upon the conclusion of Dr. Mitre's presentation, it was commented that the problem of industrial engineers' salaries seemed to be widespread in the countries of Latin America.

It was agreed that the purpose of services research was to solve problems and not to find problems suited to the technicians.

2. Peru

Dr. Augusto Mellado Mendez described the following applications of operations research to health:

Case I: Simulation model of the general medicine outpatient ward at Central Hospital No. 1 of the Peruvian social security system.

- Devised in 1976 as one of the first attempts to apply simulation models to the problem of outpatient congestion.

- The aim was to cut patient waiting time to a minimum. Data were collected and a model was constructed on a GPSS/360. Two policies were tested and favorable results were obtained for one of them.

Case II: Proposal for the design and implementation of an information system for Central Hospital No. 2 of the Peruvian social security system.

In 1977 it was proposed that a study be done toward the design of an information system (hardware and software) for Central Hospital No. 2. The system would cover the areas of administration, medicine and higher management. Minicomputers and packages of specialized programs where to be used. A number of applications were identified. A doctors' strike and the economic situation in Peru made it necessary to drop the project.

Case III: Inventory control system for hospital storeroom.

An inventory control system for a hospital storeroom was developed for the Hospital Regional Board, Birmingham, England in 1969. This was for a system of hospitals consisting of five large and two small hospitals and a number of clinics. Two types of items were considered:

(a) Food supplies, exclusive of fresh meat, vegetables and milk, and fresh foods in general.

(b) Miscellaneous items such as cleaning equipment.

The stock consisted of 400 items. Two models were designed. One was a model of lowest-cost lots with re-order level and safety margin, and the other of a simple lowest-cost lots for low-demand items.

When Dr. Mellado Mendez concluded his presentation, it was commented that interdisciplinary work was now becoming a reality in the health field.

There was also reference to the importance of implementing information systems in a gradual fashion. On the whole, it was felt that services research should make simple proposals that resulted in specific applications and not complex proposals that could not be applied in the short or middle run.

3. Chile

Mr. Victor L. Perez, an engineer, spoke on some applications of the different techniques and methods of the systems approach in health and on the results obtained. To increase the effectiveness of such applications,

he cited a conceptual model that interrelated the variables involved in the design of organizational systems, in this case, administration and administrative information systems. This model made clear the relationship between the design and the resolutions of operations research models and the design of organizational decision-making processes (supported by administrative information systems). Finally, he described some aspects of the application of this conceptual model to the design of a system for the formulation, execution, and evaluation of a health program.

4. Costa Rica

Mr. Carlos M. Quesada, also an engineer, pointed out that the School of Industrial Engineering of the University of Costa Rica had been carrying on research in health since 1973. This research covers applications of operations research techniques, general systems theory and industrial engineering in the field of hospital administration. This work was being done by professors and students of the School of Industrial Engineering.

This research was being done was because of the interest of the director of the National Children's Hospital and the introduction of a new form of instruction, external education, which was intended to raise the graduate to a high level of professional maturity.

The theoretical framework of this research was based particularly on general systems theory, a new application of the scientific method. More particularly, the systems studied by industrial engineering could be called systems of organization that generated goods and services. They included human, energy, and information components, all of them interrelated. Their general purpose was efficiency.

The methodology followed included the following steps:

1. Definition of the system
2. Formulation of its objectives
3. Analysis of the system
4. Diagnosis
5. Proposal of alternatives
6. Design
7. Implementation of the resulting system
8. Control and evaluation
9. Redefinition of the problem.

The object of the study in health institutions were the systems of organization for the delivery of health services. The elements of these systems were:

(a) Human, including physicians, patients, and paramedical and auxiliary personnel. One important point was that professional practice itself was not an object of the study and could not be so in any way.

(b) Materials, that is, the physical components that performed services for health establishments.

(c) Informational, meaning all communications among the human elements and making decision making possible. The relationships were particular to each of the subsystems. The objective could be subdivided into the following:

-Quality of the health service
-Care delivery capacity
-Efficiency in processes

The work of industrial engineering was aimed essentially at boosting efficiency. This, in turn, would result in an increased capacity to provide health care, which, if not swamped by demand, would enhance the quality of the service, which, in the end, was still an improvement.

The first work was done by the School of Industrial Engineering, Faculty of Engineering, University of Costa Rica in four areas selected to meet the needs of the institution (National Children's Hospital):

1. Compounding of formulas
2. Diet planning
3. Emergencies
4. Outpatient care

This first work eventuated in the first publication of results, which later gave rise to the First Seminar on Operations Research in Health, held in San José in December 1974.

The second stage of the research was started in 1975 and went forward in other health establishments, as well as the National Children's Hospital.

The results obtained in the first studies done at the National Children's Hospital opened up the health sector. Today work has been done in several health establishments in Costa Rica.

The School of Industrial Engineering has been doing research in the health sector for six years, and now understands a little more the significance and importance of the health services of Costa Rica.

Following Mr. Quesada's discussion it was commented that it would be advisable to consider forming national or regional groups to conduct research in health services. This would make it easier for small hospitals to benefit from the services of professionals whom they could not retain on a permanent basis.

It was felt that a rapprochement between operations researchers and national groups doing services research should result in a wider dissemination and a greater impact of operations research.

5. Colombia

Dr. Carlos Perez pointed out that to improve the health of our population one had to improve the operation of the health services. In other words, better use had to be made of the available resources by expanding the coverage of the services and improving their quality. There was much that operations research could contribute to this process. Fundamentally, operations research was a rationalization of the decision-making process, preferably by quantifying the advantages of each alternative for the objectives of the organization. It was felt, however, that the main thing was the method and not the use of models or specific techniques. In solving problems, operations research should use all available knowledge, which meant that multidisplinary groups had to be assembled whose members could contribute their individual knowledge to the study of individual situations.

Dr. Perez stated that a variety of problems had been encountered in the course of research and consultancies in the health sector in Cali. No effort had been made to determine their cause for it was sometimes difficult to tell the problem from its cause. Dr. Perez preferred to list the problems and to comment briefly and illustratively on them.

Traditionally, research and consultancies to health services had been carried out by professors and students of medicine and nursing and always with external financing or as part of the teaching process. This had led health service administrators not to provide for the financing of consultancies, either for the remuneration of the professionals performing them or for the computer time and other services associated with them.

This meant that consultancies and services research were largely dependent on external assistance, which was usually of limited duration and for specific purposes. This in turn contributed greatly to the difficulty of inducing young professionals, mainly engineers, to accept careers in the health field, when industry could offer better work stability and higher salaries.

Another important point was the poor career prospects for other non-medical professionals in the sector. It was hard to convince a hospital director that an industrial engineer or programmer analyst should sometimes be paid more than medical professionals as market conditions required. The loser in this problem was the organization, which was, thus, able to hire only idealists, or else recent graduates, who remained long enough to acquire experience and, at a time when they should start making their real contribution to the institution, usually moved on to better jobs in the industrial sector.

The teacher had similar problems for, at the salaries paid in the Colombia Public University, highly qualified professionals usually had to divide their time between teaching and consultancies, and this largely prevented the university professor from devoting himself fully in either teaching or research and consultancies, to his preferred field.

Considerable difficulties also arose in support areas such as computers, libraries, reference services, etc.

A few proposals could be briefly presented that would help improve professional career prospects in the health sector. As a first measure it was essential to encourage operations research work in the sector. This was to be done by establishing national and international societies that would encourage professionals in these fields to enter the health sector and would work to improve the pay and standing of persons employed in that activity.

This proposal included the establishment of ways of publicizing activities in the area, by publishing journals and holding periodic seminars to disseminate the work and encourage exchanges of experience.

Under this proposal, permanently financed centers of operations research in health could be set up to service as links among professionals for the performance of this work. These centers could also be used for the education and exchanges of professionals. It was also necessary to promote the establishment of documentation centers to assist in the work of exchanges, dissemination and translation of materials connected with our work.

Following Dr. Perez's presentation, several comments were made to the effect that the basic purpose of services research was to improve the administration of the services. The systems approach emphasized that the way to improve administration was to rationalize decision-making processes, and it was specifically recommended that rationalization process be accomplished by applying the scientific method to his administration problems.

Session III. Priority areas of operations research in health

1. Peru

Dr. Manuel del Rio described the health status of the Peruvian people as unsatisfactory. The risks of illness and death were high in that country and were those of a developing society with a low standard of living. One of the causes of this high mortality was diseases that could be averted or reduced by the application of known health techniques. Health resources were scarce and badly distributed, their output and productivity were low and their manpower inadequately trained. Health planning was based on the available resources and not on the real needs of the population. This health situation was the context for the presentation.

The problem areas proposed were vital statistics, the production of health services, nutrition and health technology, all of which could benefit from operations research.

In vital statistics, underreporting in birth and death records had been high, and imposed constraints on the health planning process.

The production of medical visits and hospital discharges at public health establishments had declined relative to the adult population over the last five years, primarily because of lower demand.

Deficiency, malnutrition, either alone or in combination with infectious diseases, hindered the structural changes needed for development. In Peru about one of two children under six years of age was undernourished. The physical and mental deterioration of almost half the Peruvian population in this age group because of malnutrition was an unacceptable social problem.

The lack of appropriate technology in health because of external and internal restrictions was another reason for the failure to satisfy the basic needs of the broad Peruvian masses and for the increasing cost of health services and for their failure to reach more than a minority of the population.

On concluding this presentation, objectives were proposed for the problem areas of nutrition and technology in health.

2. Costa Rica

Dr. Oscar Fallas discussed a number of problem areas in the administration of the Costa Rican Social Security Fund (CCSS) and possible applications of operations research.

He said that the CCSS, the leading institution in the country's health sector, was required by law to give medical care to the entire population (2.3 million). This commitment had made it necessary for the CCSS to take over the administration of the country's entire hospital infrastructure in a very short time.

In 1973 the operating budget for the illness and maternity system amounted to only 19% of what it was in 1978. During that same period, the number of employees rose from 6,499 to 18,300, that of medical consultations from 3,062,225 to 5,008,046, and that of hospital discharges from 92,908 to 226,678.

This surging growth was blamed for many of the economic and operational difficulties besetting the institution at this time. There were problems in the gathering and processing of statistical and accounting information, a lack of adequate planning, and a shortage of proper evaluation and control machinery for determining more accurately the actual coverage, densities, yields, costs, etc.

The following areas were discussed as possible objects of operations research: (1) care services (a) development of evaluation models; (b) the use of health services; (c) the design and evaluation of medical care models; (2) information systems; (3) finances; (4) human resources.

3. Cuba

Ms. Maria Cristina Fernandez gave a brief account of the levels of medical care operating in the Cuban national health system, which were primary, secondary, and tertiary medical care.

She talked about matters relating to operations research in health services which are part of the program of specialization in health administration of the Instituto de Desarrollo de la Salud, and to the health services research being done by the students under this program as their work toward the diploma.

She analyzed the possibilities of applying operations research to the problems of primary medical care, and of problem areas that could addressed through operations research in the hospital, the basic secondary medical care unit.

She described a number of operations research projects in the Cuban health sector that had been completed and others that were in progress. In these projects the following techniques were applied: the survey, factorial analysis, the testing of hypotheses, Markov chains, querring theory, statistical quality control, sampling of work, multiple regression analysis, scientific organization of work, flow diagrams, computation, etc.

4. Chile

Mr. Mario Inostroza discussed the following aspects of the Chilean health system:

a. Traditionally most of the structure was in the national health service, which covered about 70% of the population.

   This health service weighed very heavily in the decision-making process, and had policy-making, regulatory planning and administrative functions in relation to almost all the resources allotted to the health sector.

   These functions had generated a complex bureaucracy, which had made the service a highly centralized and administratively cumbersome structure.

   The Government authorities having agreed that it was necessary to enhance the effectiveness and efficiency of the resources allocated to the sector, far-reaching structural changes were made: 27 administratively independent health services were established which were subject to the Ministry of Health only in matters of policy, regulation, and the allocation of resources, and the evaluation of the attainment of the goals set by the Ministry.

   The Ministry of Health was organized at the national and at regional levels (the country had been divided into regions). The health services were controlled by the Executive Branch through the ministerial channels.

b. Because of these changes in the health system, the Ministry of Health decided to give priority attention to research into the roles and functions of the leadership of the components of each health service in

order to determine the education and training needed by the new health directors and executives. It also decided to study the supply of and demand for health services in order to identify administrative problem areas and find alternative ways of improving the quality and output of the services, increasing their productivity, making them more accessible to the user, and enhancing his satisfaction from them.

c. Together with the foregoing, support is being given to lines of research in biomedicine and administration required by health services for the determination of policies and strategies on health care for the diseases typical of an underdeveloped country, for which broad coverage is required and for those of a developed country, which attack a much smaller population but require care that is costlier and increasingly complex.

Research is also is going on in other matters that affect epidemiological policies and strategies, the yield and use of resources and how satisfied users and health personnel are with the health system. As concern the latter point, it is essential to determine the capacity of the health sector to make proper use of professional human resources. Once this capacity is known, it will be possible to make decisions that affect another sector which in this case might be education.

5.Mexico

Mr. Sergio Vazquez Cordova, an architect, spoke briefly on some conceptual aspects of operations research and their possible application to the health field. He also pointed out that the progress made by operations research in administration were applicable to planning and resource management in the analysis and design of organic structures and their functional relations and inter-communication, and in the design and operation of control systems.

He said that the production of health services in Mexico had assumed more or less industrial proportions, which made feasible the application of operations research in health. He referred particularly to vaccination programs, especially campaigns in which operations research could contribute decisively to the solution of problems of planning, the organization of resources, implementation of the program, and control of the process. He also said operations research should be applied to programs for the control of specific diseases and for epidemiological surveillance. Here, too, there were important questions to be answered in the areas of organization, fulfillment, communications and others.

In the case of curative care services, which usually absorbed the largest share of the resources for health, the needs were similar but the conditions different, so much as to necessitate other strategies for applying and accomplishing the purposes of operations research. On the one hand, the facilities personnel and operations of the social security agencies were highly standardized, which could mean that operations research would optimize the production of these services.

On the other hand, in public care establishments whether federal, state or municipal, production was not only not standardized, but to a considerable extent involved locally fashioned elements. Thus, in this case, the aim would be rather to standardize a minimum number of operations.

The speaker felt that manpower training and development programs could benefit from operations research directed at determining their content and effectiveness.

Finally, Mr. Cordova described possible problem areas in the administration of health services at which operations research in health services could be directed.

6. Colombia

Dr. Marco Tulio Galarza presented some of the projects of research in the delivery of health services now under way in the city of Cali, and mentioned proposals for future research.

Simplified surgery systems

The growing waiting lists for elective surgery had prompted a multidisciplinary group of Del Valle University (surgeons, anaesthesiologists, architect, engineers, an economist, a health worker, an educational psychologist, and a sociologist) to design and test new models of surgical care.

Systems theory was the theoretical framework for experiments with alternative solutions to the problems of patients requiring surgery that could maximize the utilization of existing resources.

The objectives were stated, the surgery models described and results reported.

The results of the project had been implemented at San Cristobal, Venezuela; the Social Security Institute at Cali; and the Santiago Renjifo Clinic, and the infrastructure of the Caßaveralejo and Joaquin Paz Borrero hospital centers was being prepared so that the care program could be started in Cali.

Computer assistance in the diagnosis of gallbladder disease

The Bayes theorem was being used to seek an alternative way to diagnose gallbladder disease from the signs and symptoms of patients, in order to reduce the high percentage of normal cholecystographs in the Radiology Department of the Del Valle University Hospital in Cali.

Regionalization and patient referral

Cali had been divided into four intermediate health units to facilitate administration and the care of patients. This decision meant that alternative procedures would have to be found in the following areas:

a. Programming of medium- and long-term investments
b. Studies of patient waiting time at the various levels of the system
c. Supplies and inventory
d. Emergency plans
e. Alternative laundry systems
f. Use of ambulances and communications
g. Food services
h. Central reagent supply and quality control of clinical laboratories
i. Costs
j. Measures of coverage, effectiveness and efficiency
k. Information systems

7. General basis for a general health services research program

Dr. Jorge Castellanos stated that the document entitled "Bases Generales para un Programa Regional en Investigacion de Servicios de Salud" brought out the characteristics, orientation, purposes and objectives of health services research in the context of the regional goals for health care, and presented a plan of action covering, essentially:

a. Promotional activities
b. Activities to strengthen and develop current actions
c. Activities in direct support of specific projects

The plan stressed the adoption of national policies for health services research, formulated strategies for supporting efforts in the countries to develop national capacities in this area, and proposed mechanisms for supporting the addition of research components to projects for the development of services with a view to increasing their coverage.

Some of the principal strategic approaches proposed for these actions were the organization of multidisplinary work teams to deal with specific aspects of health services research, encouragement of and support to instruction and training of national personnel in different fields of service research, with priority to managers and to the dissemination of studies done in the countries and emphasizing the use made of these studies both at the national level and in individual service units. Another proposal was the promotion and support of exchanges of experiences among countries and cooperation between them in joint efforts in areas of mutual interest that could benefit from intercountry studies.

It followed from the foregoing that, although this was a new area of work, support for this type of activity was essential because of how important its results could be for the proper development of services, so that the goals of "Health for All by the Year 2000" and extension of the coverage of health care might be achieved.

Session IV: General discussion and recommendations

A. Program of work

In a general meeting the group decided to appoint a subcommittee to prepare a program of work as a guide to the discussions and the framing of recommendations. This program of work was as follows:

1. Framework

1.1 The problems of health
1.2 General recommendations on the role of and activities in operations research in health in our countries.

2. Development of operations research

2.1 Methods
2.2 Manpower development (education, training and continuing education)
2.3 Basic information
2.4 Dissemination of methods, techniques, and practical results
2.5 Financial resources required
2.6 Relations between operations researchers in health and institutions

To cover the program of work presented in the little time available, it was decided to make up four working groups, each to discuss one of the following topics: (1) the conceptual framework; (2) the conduct of operations research in health; (3) mechanisms for the dissemination of information, and the promotion of operations research in health services; (4) funding for operations research in health and development of the relationship between researchers and institutions.

Each group presented its recommendations to the other participants for general discussions.

B. Conceptual framework

The participants in the Regional Seminar on Operations Research in Health agreed that the problems of health covered all aspects relating to:

- The state of health of the population as expressed in the risks of illness and death.

- The operations of existing health services to preserve the health of the general population.

- The functional and organizational structure of the health service system.

The participants were of the view that the current health situation in most developing countries was conditioned by the existing economic and social structures. The health service systems were experiencing difficulties caused by the indiscriminate use of technology, the rising cost of goods and services

in the health field, inflation, and progressively smaller annual appropriations and budgets. These factors helped keep unsatisfied the basic health needs of a great majority of the population.

The participants made the following recommendations for the use of operations research in health:

1. That it be directed to the satisfaction of national aspirations, especially in regard to social justice and self-determination.

2. That a distinction be made between the scope of operations research in industrialized countries and in developing countries, and also among the different regions of a country.

3. That operations research be an effective means for taking policy, technical and administrative decisions in the health service system.

4. That it receive support at the highest political level to enable it to contribute to the solution of the priority health problems in the framework of a comprehensive, multidisciplinary and multisectoral approach.

5. That it recognize the need to stress the critical areas in health, such as nutrition, food, health technology, coverage of health services, and education for health.

6. That it recognize the need to support the development of primary health care.

7. That it be used on a permanent basis to improve health service systems by making them more efficient and effective.

In addition, the physicians, engineers and other specialists attending the Seminar recognized the need for joint work among their specialties to implement these recommendations in their several countries.

C. Conduct of operations research in health

Under this topic, the participants discussed: (a) methods; and (b) manpower education and training.

a. Methods

The participants recommended the use of scientific method, which consisted of the following phases:

1. Identification of the problem
2. Definition of the system

- Objectives (indicators)
- Components
- Environment
- Resources (limitations)
- Administration

3. Construction of a model
4. Determination of alternatives
5. Evaluation and selection of alternatives
6. Sensitivity analysis of the solution
7. Implementation of the solution
8. Supervision and control of the solution
9. Final evaluation of the solutions's impact for attainment of objectives of the system

Thus operations research in health, based on the scientific method, would define analytical criteria for the evaluation and selection of alternatives, and would develop specific techniques and implementation procedures in the light of its own situation, and in this way make known in the countries the general methods for addressing the problems of the health services so that each country might take its own decisions on the basis of its own situation. The sequence of the basic method is outlined in the stippled panel of Figure 1.

Exchanges of research were recommended to aid in the adoption of methods.

b. Manpower education and training

The profiles of the knowledge required of the industrial and systems engineer, the public health physician, and the medical administrator were define in the setting of the current situation.

The proportions of information and training proposed were as illustrated in the profiles given in Figure 2.

The change in these profiles was to be brought about by seminars and workshops to disseminate systems theory and operations research, aspects of health and administration for managers, and education and training activities (courses, master's programs, advanced programs in operations research in health services, and continuing education) for technical personnel.

Another strategy would be to add the components of systems theory and operations research to the curricula of administrators and physicians, and those of operations research in health services into the curricula of industrial and systems engineering. It is recommended to bear in mind that the training is not intended as a makeshift to turn out pseudospecialists, but to generate an attitude on the basic approach and the use of a common language among the members of the multidisciplinary team for operations research in health.

**Figure 1**

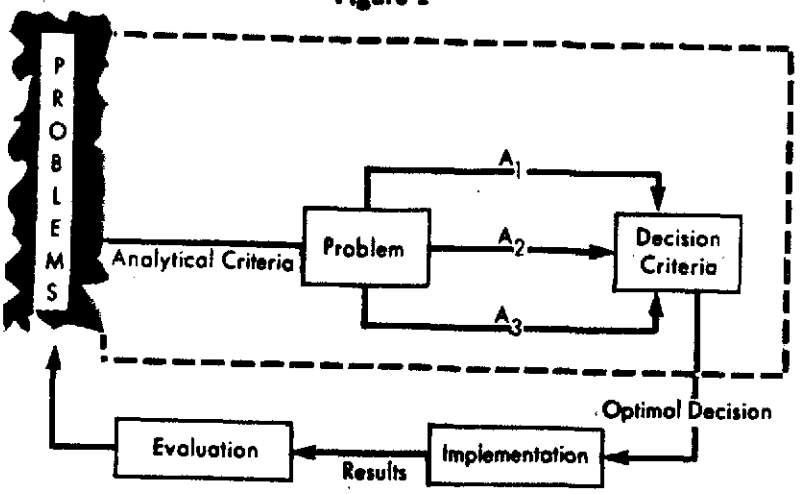
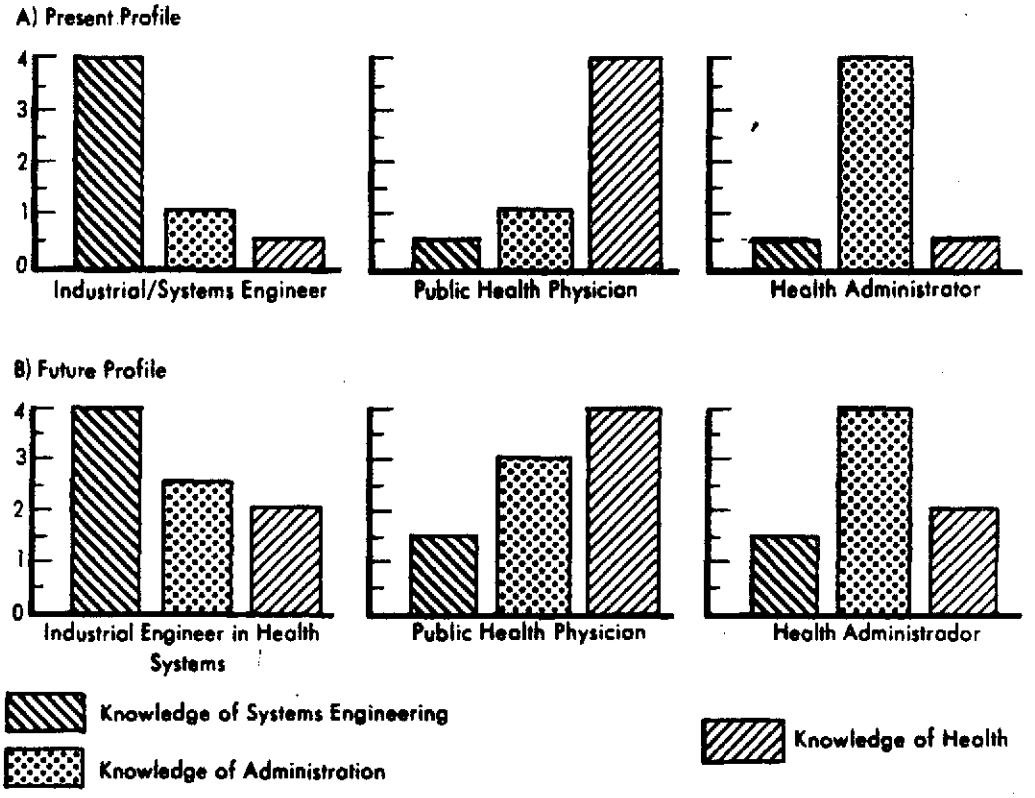



**Figure 2**



D. Mechanisms for the dissemination and promotion of research in health services

On this topic the participants in the Regional Seminar on Operations Research in Health made the following recommendations.

To the Pan American Health Organization

1. That an inventory be maintained of operations research in health systems and a catalog and information banks be set up.

2. That libraries containing information on health services be identified, and that they provide documentation and reproduction services.

3. That a directory of operations researchers in health systems be compiled.

4. That information be disseminated on sources of funding and grants.

5. That books and publications on operations research in health services be provided to libraries.

6. That the compilation of bibliographies and the reviewing of books on the subject be promoted.

7. That the dissemination of selected articles for researchers be promoted.

8. That it favor access to world data banks as an aid to the design of protocols and the conduct of research.

To professionals in health services research

1. That an association of professionals in operations research in health systems be established.

2. That established medical publications be used to disseminate the methods of research in health systems.

3. That regionalization of the circulation of journals be encouraged so as to extend their coverage and thereby more widely disseminate the literature on current services research.

4. That literature be prepared to help disseminate the methods and techniques of health services research:

   - A book of readings
   - Textbooks for specialists
   - Textbooks for administrators, nurses and physicians
   - Cases on services research

5. That health services research be promoted in undergraduate and graduate programs in industrial engineering by encouraging practical work at institutions and in the health system in general.

E. Funding for operations research in health and development of the relationship between health services researchers and institutions

In regard to the funds needed for operations research in health, the participants considered the following points:

1. The declaration of Alma Alta established the need to add services research component to health programs.

2. The research programs in the countries of the area had been conducted primarily for the development of sophisticated tertiary care technologies.

3. In the countries research programs were being carried on in health establishments and institutes of higher learning without any coordination between them.

4. Manpower training projects were being carried out with funding from international foundations.

5. Biomedical research was going forward to provide a basis for the planning of health services. This research was being financed either by health institutions or by research councils.

6. The Pan American Health Organization was allocating funds for the financing of health research programs.

7. Increasing the funds for research faced the same problems as increasing them for health services.

On the basis of the foregoing considerations, the participants made the following recommendations:

To the Pan American Health Organization

1. That it promote measures to improve the criteria for the allocation of funds to finance research projects of priority for the development of primary health care systems.

2. That it recommend to the international lending institutions, when allocated, loans to require studies done by the methods of health research as part of the justification of requests for loans.

To the countries

1. That they promote the formulation of policies on health research.

2. That they made services research a component of their health programs.

3. That they promote the enactment of legal provisions to formalize the existence of funds for health research at major establishments.

4. That they promote policies to shift resources from research in tertiary care to research in primary care.

5. That encouragement be given to the formation of teams between institutions of health and of higher learning to coordinate health research programs.

6. That a manpower training programs financed with international funds be given priority to programs for the training of human resources for research in the health field.

7. That the programs of research councils be steered toward operations research in health.

In regard to the relationship between operations researchers in health and administrators and politicians, the participants, considering that high level officials were unaware of the merits, contributions and results of operations research in health for the understanding and solution of health problems, made the following recommendations:

To the Pan American Health Organization

1. That high level meetings be held to build awareness in secretaries and ministers of health.

To the countries

1. That middle-level meetings be held to build an awareness in high level administrative officers.

2. That the training of operations research professionals in the behavioral sciences be upgraded.

3. That the results and accomplishments of operations research in health be made use of to promote this research among high level officials.

4. That every situation and opportunity be used to promote operations research in health services.