HEALTH DELIVERY SYSTEMS IN DEVELOPING COUNTRIES

A Committee Report to IIASA by the Participants in an Informal Meeting, Laxenburg, Austria, July 2 - 5, 1979

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FOREWORD

During the past two years, the HSS Area at IIASA has been engaged in research on urbanization and development in developing countries. An important future component of this research is to be the study of the demand for services, such as health. Although health care research has been a central part of HSS activities since the establishment of the Area, it has only addressed problems in the developed world. The possibility of extending that research to consider the problems of health delivery in low-income countries, experiencing rapid rates of urbanization, led to the informal meeting of experts described in this report.

The meeting was organized by Professor Bruce Johnston of Stanford University, USA, with the assistance of Professor Evgenii Shigan of the Ministry of Health in the USSR. Dr. Philip Aspden of the UK was the rapporteur for the meeting and Professor R.M. Maru served as rapporteur for drafting groups chaired by Professor Carl Taylor and Dr. Ashish Bose.

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Chairman
Human Settlements and
Services Area

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I. Introduction

This small, informal meeting which was organized by the Human Settlements and Services Area brought together an interdisciplinary group which included nine invited scientists and a few members of IIASA's scientific staff to examine issues related to the design and implementation of health systems affordable by low-income countries. The twofold objectives of the meeting were to advance understanding of the priority needs for research that will be of value to governments undertaking such programs and to make recommendations concerning the type of activities, if any, that IIASA should undertake in this area. A list of participants is attached in Appendix I.

The meeting was able to give particular attention to India's recent experience in undertaking a Rural Health Scheme and Community Health Worker Program which were initiated in October, 1977. Presentations by Dr. Ashish Bose, Director of the Demographic Research Centre at the University of Delhi, and Professor R.M. Maru, Coordinator of the Family Planning and Health Unit at the Indian Institute of Management, Ahmedabad, drew upon the research that they have been pursuing as part of the on-going evaluation of these programs. In addition, Professor Carl Taylor of Johns Hopkins University in the U.S.A., and Professor V.K. Tatochenko from the Institute of Pediatrics of the Academy of Medical Sciences in

Moscow have had extensive experience working with health programs in India, and their presentations were also of particular relevance to health problems and activities in India.

Following discussion based on the findings of some of the evaluation studies carried out in India and of the strengths and weaknesses of the Rural Health Scheme and Community Health Worker Program, the group considered more general issues. This began with an examination of the interrelationships between health delivery systems and other socio-economic components of rural development. This was followed by two presentations that considered the priority components of an integrated health program, where integrated was taken to mean not only personal health care but also nutrition and other preventive and promotive activities such as family planning.

More specific aspects of health delivery systems were then considered, starting with the selection, training, and supervision of health field workers. Attention was then given to ways of ensuring that the common emphasis on the curative aspects of health does not lead to the neglect of relatively inexpensive preventive and promotive activities which can make a significant contribution to the reduction of mortality and morbidity. Finally, the important issues related to stimulating community participation in integrated programs of health, nutrition, and family planning were considered.

Having discussed health delivery systems in largely descriptive terms, the meeting turned to its main objectives of identifying priority areas of research and suggesting possible research topics for IIASA. A list of the topics dealt with by the ten discussion openers is attached as Appendix II.

In addition to Roger Levien's introduction to IIASA, Andrei Rogers, Chairman of the Human Settlements and Services Area, presented an overview of the activities of that Area and Evgenii Shigan, Task Leader, described IIASA's related work in Modeling Health Care Systems.

II. IIASA's Stengths and Interests Pertinent to Research on Health Care Systems in Developing Countries

There is considerable recognition of the fact that applied systems analysis can make a useful contribution to the design and management of national health systems because health depends on a multitude of factors and requires interdisciplinary and intersectoral collaboration. Two of the participants--Tatochenko and Golladay--were involved in the preparation of the Report of a WHO Expert Committee, *Application of Systems Analysis to Health Management* (Geneva, 1976). Much of the discussion during the present meeting emphasized the importance of a systems approach in undertaking research and analysis related to health systems in developing countries. Because of their severe resource constraints, defining goals and objectives, setting priorities, and determining an appropriate balance and time sequencing of the activities to be included are crucial to the success of integrated health programs. The constraints imposed by limited financial resources and by the lack of trained manpower are, of course, especially acute in the low-income developing countries with per capita GNP of $250 or less. In virtually all of these low-income countries, which account for approximately one-third of the world's population, the rural population still accounts for some 70 to 80 percent of the total population. Because the population,

including the population of working age, is growing rapidly in these countries, this dominance of agriculture in their population and labor force will persist for several decades at least, which further underscores the importance of health delivery systems capable of achieving wide coverage of rural as well as urban areas.

IIASA's experience in developing an applied and interdisciplinary approach to systems analysis and in facilitating collaborative efforts by scientists and decisionmakers concerned with important and complex problems were considered to be highly relevant to efforts to advance understanding of the design and implementation of health systems in developing countries. Moreover, being a non-governmental organization spanning East and West, it is somewhat removed from certain types of political problems which handicap international organizations and national agencies responsible for bilateral technical assistance and aid programs. This, it was thought, might lead to a more objective assessment of problems and solutions. Further, because of its ability to attract able scientists representing a number of disciplines, it was suggested that IIASA might be able to contribute new ideas and innovative approaches to the study of health systems in developing countries.

The work currently being carried out at IIASA in connection with the task on Modeling Health Care Systems probably does not have a great deal of direct relevance to the problems that must be confronted in low-income developing countries. However, the progress that has been made in defining the components of a national health system and in understanding the interactions among

those components should facilitate the conceptualization and modeling of health delivery systems in less developed countries. The work that has been done in the Human Settlements and Services Area in modeling changes in population by age and by rural or urban location and the impact of those changes on the demand for health services appears to be directly relevant to problems in developing countries, particularly given the availability of a flexible computer program which has already been applied in IIASA's case study on Kenya.

Some of IIASA's past and current work aimed at improving the process of policy design and adaptive management also seem to have considerable relevance. The major research carried out by the IIASA team led by C.S. Holling of the Institute of Resource Ecology at the University of British Columbia has arrived at some very interesting conclusions about ways to improve the process of policy (systems) analysis in order to provide useful guidance for the effective and adaptive management of complex resource and environmental problems. It was suggested that some of the lessons derived from that study have wide relevance. In addition, Rolfe Tomlinson, Chairman of IIASA's Management and Technology Area reported briefly on current studies of problems of adaptive management and strategic monitoring directed at achieving better performance in the management of other types of complex systems.

In the introductory presentations and in subsequent discussion, Levien, Rogers, and Shigan noted a number of constraints on IIASA's capacity to take on additional activities. It was emphasized that as a relatively small organization there are severe limits on the range of research activities in which IIASA can be involved without

seriously diluting the quality of its work. It was stressed that IIASA should concentrate on important "global" or "universal" problems to which applied systems analysis, modeling activities, and an interdisciplinary approach can be expected to make a significant contribution. The problems associated with the short duration of most appointments at IIASA were also stressed. Because of those problems research projects should be of fairly short duration. There must be a possibility of using existing sources of information because field work and data gathering are not feasible. These constraints also underscore the need for collaborative arrangements with national research institutions.

It was further pointed out that the National Member Organizations which provide the core budgets for IIASA's program of work tend to have a very understandable preference for research projects that are of direct interest and value to all or most of the 17 developed countries which they represent. For that reason a decision by IIASA and its Council to undertake activities related to health delivery systems in developing countries would probably be contingent on the availability of supplementary financing to cover a major part of the budget for those activities.

III. Recommendations Concerning Research Topics to be Considered By IIASA

The discussion of resarch needs and priorities led to a comprehensive list of research topics. From a list of some 21 topics, the following five were chosen: (1) a modeling approach to the analysis of trade-offs among health interventions; (2) modeling the interactions between fertility and mortality; (3) an infant and child mortality model; (4) primary health care as a social system; and (5) adaptive management. The choice of those topics was

made on the basis of the group's judgments of research priorities and the comparative advantage of IIASA as a research institution. Various members of the group prepared the following statements giving a short description of the topics and the justification for recommending them for consideration by IIASA. There was considerable overlap of ideas inherent in the original list of topics, and the authors of the statements were encouraged to include ideas from unselected topics if thought relevant.

1. The Modeling Approach to the Analysis of Trade-offs Among Health Interventions

The priorities that should be attached to various health interventions have been the subject of considerable controversy. The importance of this controversy is being escalated by the competing international campaigns in water supply and primary health care which will strain national implementation capacity and exceed economic resources. Thus a clearer assessment of the cost-effectiveness and riskiness of alternative interventions under realistic conditions is urgently required.

The objective of this study would be to explore the principal options for improving health status using such interventions as immunization, maternal and child care, nutrition supplementation, health education, improved water supplies, sanitary disposal of wastes, and improvements in housing. It would depart from earlier efforts in two important respects. First, it would *not* rely upon historical data to support the view that public health interventions are of primal importance, but would recognize that significant developments in technology have occurred over the past three decades. Second, it would examine intervention in terms of final use rather

than provision of inputs (e.g., goods and services). Thus, for example, the sub-model for water quality would consider not only the quality of water at the source but also possibilities of contamination in distribution, home storage, or at time of consumption. Similarly, utilization and compliance behaviors for immunization, chemotherapy, etc., would be explicitly modeled. In assessing the cost-effectiveness of interventions or groups of interventions, one would explicitly consider such social factors as predisposition toward proper utilization, maintenance behaviors, continuity of operations, etc., and hence be able to evaluate risks as well as economic efficiency. The end product would be a mechanism for evaluating differing intervention strategies given initial conditions and resources and an assessment of outcomes that takes account of the "software" as well as the "hardware" aspects of alternative interventions.

Initial experiments with such a model should be based upon parameters estimated from existing empirical studies.

2. Influences on the Interactions Between Fertility and Mortality

One of the most important, but most complex, interactions underlying the whole question of integration of health, population policy, and nutrition is the two-way relationship between fertility and mortality. Declines in fertility are importantly associated with improving health among women and children. Conversely, declines in mortality can have multiple combinations of effects on fertility. It is simplistic to think of mortality and fertility separately since the balance between the two needs to be adapted to local conditions. The simplistic view that following a fall in

death rates there would be an almost automatic fall in birth rates is no longer accepted now that in-depth investigations have led to better understanding of the complex interactions that are involved. A revision of thinking about the "child survival hypothesis" is underway, and additional data are becoming available on ways in which the expectation of child death influences motivations concerning child spacing and family size. The effect of lactational amenorrhea on inter-pregnancy intervals has been clarified, and it is becoming possible to distinguish between replacement and insurance effects. An ideal problem for conceptualization and modeling is to try to clarify understanding of these interrelationships which are increasingly important for policy decisions and resource allocations in many developing countries.

These analyses obviously have to be carried out in the context of other important motivational variables such as: age, parity, age at marriage, literacy (especially of women), employment opportunities for women, and local cultural influences. Once the interactions between mortality and fertility are better understood it will then be possible to develop a larger model in which the effects of various policies on both mortality and fertility could be explored. For instance women's literacy, women's employment, and age at marriage are assumed to have powerful effects on fertility. The trade-offs between various interventions need to be explored. The social effects of a variable such as women's employment need to to be balanced in terms of possible negative effects on child mortality and exploitation of women. Finally, in this modeling it is important to evaluate the influence of the timing and sequence of interventions as well as the lag between them and the social effects produced. Sufficient data are available to start this process.

3. An Infant and Child Mortality Model

The Infant Mortality Rate (IMR) is one of the most important indicators of a population's health status. Many analyses have shown correlation between IMR and the most basic socio-economic, biological, and health services indicators. Thus IMR could be used as an indicator of the effectiveness of various interventions.

IMR has to be studied both differentially (in particular 0-1 month mortality deserves attention) and in connection with the Child Mortality Rate (CMR) for the 1-4 years age group since the latter seems to be an even better indicator of health status. In fact, while the difference in IMR between the extreme conditions may be 10-fold, for CMR it can reach 100-fold and even higher magnitudes. Moreover, CMR is considered to be the best indicator of the nutritional status of children. While decreases in IMR are always welcome they may be substantially offset by corresponding increases in CMR. So far, IMR and CMR have not been systematically studied together despite the indisputable benefit of developing a model based on these two indicators.

Construction of a model of infant and child mortality could allow studies of a variety of situations and interventions, both within and outside the health sector. Intersectoral variables (insofar as they affect human health) could be analyzed with the help of such a model much better than in most other models. Furthermore, it could become the nucleus of a more comprehensive health status model. The problem could be analyzed on the basis of data which could be easily collected. For example, data on the prevalence of specific preventable conditions and their age-specific case fatality rates would be required and these could be obtained from

national statistics. Collaboration with national centres (there are quite a number of them) would be essential, and one can foresee a number of potential users of the model. In fact, IMR is used as the most important indicator in technical cooperation between developing countries. IIASA involvement in this field might aim at:

- improvement of methods of verifying and rectifying infant and child mortality data
- utilization of this model as an indicator to test the effectiveness of the development of health services; the effects of specific interventions such as MCH (mother and child health), family planning, immunizations, health education, sanitation, nutrition, and education.
- assessment of the equity of Primary Health Centres in providing services to different population groups
- investigation of causative factors of infant and child mortality along with their sensitivity to some specific health interventions and to action in other sectors such as education
- linkage of infant-child mortality and morbidity models.

4. Primary Health Care as a Social System

The recognition that community health can be improved mainly through preventive and promotive work is not adequately reflected in existing health policies and programs, nor is it central to new programs like the Indian Community Health Worker Scheme. Insofar as the Community Health Worker (CHW) perceives his role as a functionary of the existing health structure and looks upon the Primary

Health Care doctor as his model, it is likely that curative work will dominate the preventive and promotive aspects of his work. The CHW will inevitably play down his duties as a public health worker. To remedy this situation, the alternatives are to pull the CHW out of the existing system and put him under a new system or radically restructure the Primary Health Centres. This in turn calls for the retraining of the entire staff of the Primary Health Centre in order to give the necessary orientation for preventive and promotive aspects of health work. This in part can be achieved by a system of distance teaching, but there are many other aspects to the restructuring of Primary Health Care which have to be considered. The financial, administrative, and management aspects need careful study. Above all, it must be clearly recognized that the success of primary health care programs will largely depend on effective community participation at all levels. The involvement of the community in the selection of the CHWs is only the first step and unless strategies are worked out for the effective continuing participation of the community in health work, a program like the CHW scheme will end up by becoming another appendage of the existing health structure devoid of any innovative or dynamic potential. Research on the manifold aspects of such restructuring of the primary health care system looking upon it as a social system is likely to be very rewarding both for policy formulation and implementation.

Another crucial aspect concerns ensuring that the benefits of primary health care do in fact reach the vulnerable and weakest sectors of the population. The equity aspect must be inbuilt in any system of primary health care. It is important to remember in

this context that the primary health care system cannot be considered in isolation from the total health system and the broader socioeconomic framework. In particular, the linkage of the primary health care system with the supportive and referral aspects of the health care system should be emphasized.

Finally, one must stress the importance of transition from the basic health service extension concept to the primary health care concept which includes the community as a part of the health system rather than considering it merely as a beneficiary outside the system. This in turn cannot be considered without looking into the overall political and socioeconomic structure and process. But insofar as primary health care will require sustained efforts for many years, a solid start can be made by dynamic modeling of the system keeping in mind the diverse factors and the regional diversities.

5. Adaptive Management

An important lesson that has emerged from a major research project at IIASA is the need to develop and improve techniques of "adaptive management" for coping with the complex problems that arise in managing a natural resource. Even though serious efforts are made through research and analysis to base policies on the best knowledge and understanding that is available, uncertainty cannot be eliminated and shortcomings and mistakes are inevitable. Hence, the realistic approach is to view the management of such problems as a continuing, adaptive process. This underscores the importance of learning from the successes and failures of others and of "strategic monitoring" of policy implementation in order to provide feedback and guidance for revising policies and programs in order to increase their effectiveness.

The uncertainty that must be confronted in the design and implementation of rural health schemes is especially great. Experience with such programs is still extremely limited. Health systems are inevitably complex because of the influence of numerous and interacting factors. Their effectiveness depends in part, for example, on interactions between activities carried out at different levels ranging from the village to the Primary Health Centre and district and regional hospitals, doctors, and administrators. Moreover, the uncertainty that characterizes the effectiveness of alternative activities--nutrition and health education, immunizations, improvements in water supply and environmental sanitation, dispensing of drugs, and family planning--is exceeded by the uncertainty that characterizes efforts to influence behavioral factors ranging from the effectiveness of community participation and the motivation and performance of CHWs to the attitudes and performance of doctors and paraprofessionals.

Discussions at this meeting have indicated that promising ideas have already emerged concerning possible modifications in the design of rural health systems that offer promise of significant improvements in performance. Examples include a system of payment for drugs distributed through the health system, modified procedures for recruiting CHWs that would drastically increase the proportion of women, the creation of village health committees, and the use of simple nutrition screening devices (such as mid-upper arm circumference measurements) to determine the extent of protein-energy malnutrition and to identify the infants and children in a village who are at risk.

By the nature of the problem, the major responsibility and the principal efforts to devise and implement more effective systems of adaptive management rests with national governments. It is believed, however, that collaboration between IIASA and India and perhaps two or three other developing countries that are engaged in efforts to achieve broad coverage in the delivery of health services to their rural populations could be of mutual benefit. IIASA has had considerable experience with procedures for achieving a constructive dialogue between scientists engaged in interdisciplinary analysis of complex systems and policymakers and managers with responsibility for the design and implementation of policies and programs. It has also had a good deal of experience in modeling the components of health and other complex systems and the interactions among those components. IIASA could perhaps also play a useful role in promoting wider dissemination of the more important lessons derived from successes and failures of individual countries in developing more effective approaches to the adaptive management of rural health systems. The nongovernmental status of IIASA may give it unique advantages as a safe and unofficial ground on which errors could be acknowledged and learning experiences frankly exchanged.

The discussion of this topic emphasized that the concept of "adaptive management" refers to a process or methodology. Therefore, a IIASA project on "adaptive management of rural health systems" would have to be linked closely with the proposed research on specific aspects of the health system such as topic 4 on "primary health care as a social system". It was also suggested that efforts could usefully be directed to developing more sensitive and

diagnostic performance indicators (such as better data on infant and child mortality) which focus on timely modifications of health programs, rather than comprehensively characterizing, criticizing, or justifying results.

IV. Alternative Organizational Mechanisms and Possibilities for Collaboration

The group identified the following three mechanisms for facilitating or organizing research activities.

(1) Conferences. It was recognized that at the minimum IIASA could play a catalytic role by bringing together research workers from various countries to discuss and share research findings in this field. (Dr. Bose expressed the hope that a seminar or conference of that nature might be held in India in collaboration with IIASA.) Consideration might also be given to organizing a conference that would bring together scientists engaged in research on health problems in developing countries and decisionmakers responsible for the fomulation of policy and the management of health programs in countries that are confronting similar problems.

(2) Collaborative research. IIASA could collaborate with national and international organizations in carrying out specific studies. While the collaborating institutions can undertake field research, IIASA could provide leadership in evolving methodologies and a forum for conceptual thinking and for final analysis of data.

(3) Research team at IIASA. The most intensive type of involvement would be through forming a research team at IIASA which would work on one or two research projects.

Although the above-mentioned institutional arrangements are listed in increasing order of intensity of IIASA's involvement, they do not necessarily have to be exclusive categories. In fact, it would be advantageous to develop a mix of the above to achieve maximum impact.

Efforts should also be made to develop collaborative relationships with other international organizations, specifically WHO, the World Bank, FAO, UNFPA, and UNICEF.

The group recommends establishment of a IIASA Steering Committee for Research on Health Systems in Developing Countries composed of scientists from several relevant disciplines and representatives of international organizations. Such a Committee could periodically review research plans and provide continuing guidance to IIASA and an opportunity for periodic exchange of ideas and research findings.

The group felt that the discussions on the Indian rural health scheme during the present meeting had focused attention on the considerable potential for significant research in India and for fruitful collaboration between scientists in India and in other countries. Therefore, it is recommended that IIASA's efforts at the initial stage might usefully be directed towards establishing collaboration with scientists undertaking studies in India through arrangements with national bodies such as the Indian Medical Research Council and the Indian Council of Social Science Research and with local organizations.

V. Manpower and Funding Potentials

It was recommended that consideration be given to the possibility of creating a IIASA research team consisting of a policy analyst with special competence in modeling and the systems approach, a health specialist with experience in one or more less developed countries, and a management specialist with competence in organizational design.

Members of the group mentioned the U.N. Fund for Population Activities (UNFPA), the World Bank, and WHO as possible sources of supplementary funding of IIASA activities related to health delivery systems in developing countries. One member of the group expressed concern that the requirements of funding agencies should not be permitted to prevent IIASA from adopting a fresh and innovative approach to research in this problem area. It was also noted that a willingness on IIASA's part to invest some of its own resources would enhance the prospects for obtaining supplementary funding.

APPENDIX I

Meeting on Health Delivery Systems in Developing Countries

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APPENDIX II

Meeting on Health Delivery Systems in Developing Countries

TOPICS AND DISCUSSION OPENERS

1. India's Experience with the Rural Health Scheme (RHS) and Community Health Worker (CHW) Program.

   Research and Evaluation Activities: *A. Bose*

   Strengths and Weaknesses of India's RHS and CHW Program: *R. Maru*

2. A Systems View of the Interrelationships Between a Health Delivery System and Other Components of Rural Development: *B. Johnston*

3. The Feasible Range of Activities for Multipurpose Workers (paramedical field staff) and Village-Level CHWs: *C. Taylor*

4. Priority Components in an Integrated Health Program: *D. Morley*

5. Strategies for Training, Supervision, and Technical Support of Field Staff and CHWs: *C. Taylor*

6. Ensuring an Emphasis on Preventive and Promotive Activities: *V. Tatochenko*

7. Community Participation in Health, Nutrition, and Family Planning Programs: *E. Liisberg*

8. Criteria for Determining Research Priorities: *F. Golladay*

9. Research Needs Related to the Promotion, Design, and Financing of Rural Health Programs: *B. Kleczkowski*

10. Research Strategies: Exploiting Existing Knowledge, Field Studies, Comparative Studies: *T. Sundaresan*