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CLASSIFICATION

PROJECT EVALUATION SUMMARY (PES) – PART I

Report Symbol U-447

1. PROJECT TITLE	2. PROJECT NUMBER	3. MISSION/AID/W OFFICE
An Analysis of the Efficiency of Health Measures to Raise theProbability of Child Survival in Developing Countries. (Contract AID/ta-C-1358, Univ. of Michigan)	931-0260	DS/HEA

4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) 80-3

Terminal 10/30/80

☐ REGULAR EVALUATION ☒ SPECIAL EVALUATION

5. KEY PROJECT IMPLEMENTATION DATES			6. ESTIMATED PROJECT FUNDING		7. PERIOD COVERED BY EVALUATION	
A. First PRO-AG or Equivalent	B. Final Obligation Expected	C. Final Input Delivery	A. Total	$ 188,548	From (month/yr.)	6/76
FY 76	FY ____	FY 79	B. U.S.	$ 188,548	To (month/yr.)	8/79
					Date of Evaluation Review	October 1979

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PID, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
- Model strongly supported by RAC (Research Advisory Committee) - Presentation given by principal investigator, Dr. Howard Barnum, to Regional Bureaus, PPC, Office of Nutrition and Office of Population. (See attached summary report.) - Regional Bureaus queried on future application of the Model. There has been no response. - It is recommended that the Model be made available to the Health Development Planning/Training Project, when it is operational, for use as a teaching mechanism by the selected U.S. and developing country institutions.		

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS

- ☐ Project Paper
- ☐ Financial Plan
- ☐ Logical Framework
- ☐ Project Agreement
- ☐ Implementation Plan e.g., CPI Network
- ☐ PIO/T
- ☐ PIO/C
- ☐ PIO/P
- ☐ Other (Specify) _____
- ☐ Other (Specify) _____

10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT

- A. ☐ Continue Project Without Change
- B. ☐ Change Project Design and/or ☐ Change Implementation Plan
- C. ☐ Discontinue Project

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)

DS/HEA:Irving Taylor, Manager
DS/PO:M.Rechcigl

12. Mission/AID/W Office Director Approval

Signature

Typed Name: DS/HEA:J.Alden

Date: 10/30/80

AID 1330-15 (3-78)

Project No: 931-0260

Contractor: U. of Michigan

Contract No: AID/ta-C-1358

Summary of the Review by the Research Advisory Committee (RAC) of the Project "An Analysis of the Efficiency of Health Measures to Raise the Probability of Child Survival in Developing Countries". October 1979

Introduction:

From time to time, AID's Research Advisory Committee (RAC) undertakes a review of selected completed research projects. At the 67th RAC meeting in October 1979, the RAC reviewed this project. The full comments of the subcommittee which reviewed the projects are attached; a summary follows.

Brief Description of the Project:

The project's primary goal was to develop an analytical model that would provide policy makers with a framework to facilitate the efficient allocation of scarce resources to programs aimed at reducing the rates of infant and toddler mortality in LDCs. A non-linear programming model that allows the selection of optimum combinations of health interventions subject to a set of resource constraints was constructed.

Brief Summary of RAC Review:

The RAC subcommittee found that the project had accomplished its objectives. The model that was developed was sufficiently sound to illustrate the basic relationships for a rational choice of a system of interventions. When tested on empirical data, the model reproduced mortality data very well. However, it does not provide a "recipe" for an optimum set of health interventions for particular communities, but it was found to have the potential for application but would have to be tailored to some extent to each local community or country in which it was used.

The model was not without its limitations. Data for the parameters could be collected from straight forward surveys, with one exception. Estimates for impacts of various interventions on mortality are collected using a modified Delphi technique, which, because of short-cuts in its application, was considered the weakest link in the model. Other limitations of the research results are the rather complex computer program that is required and the highly technical nature of the final report. The RAC subcommittee cautioned that for the model to be useful, the users would need to invest some time in understanding its basic logic. However, once used correctly, a principal value of the model would be an increased appreciation of a more logical and systematic structure for thinking about health intervention decisions.

Potential Uses of the Results:

AID has several programs for which the model developed from this research project might be useful. The Food for Peace Programs in some countries are concerned with choosing the optimum health-nutrition intervention under given resource constraints. In addition, any missions with a maternal child health program may find the structure of the model helpful in thinking through the health problem to be solved in a systematic manner. Programs in nutrition, disease control, or immunization with a child health component could find the model useful.

The following steps may be appropriate for disseminating awareness of the research and its potential utility in child health programs:

1. The final report could be simplified to highlight the method and major funding and be widely distributed to AID missions and LDC institutions. This hopefully would generate some interest.

2. AID could review its portfolio of projects with the intention of selecting a fairly large project in a particularly resource short country (Tanzania MCH project for example) and apply the model to that program.

3. Based on this experience additional applications of the model might be incorporated into future A.I.D. health/nutrition programs.

The application of the model will not be accomplished easily or quickly. The RAC minutes indicate several areas where complications could arise. With experience, however, the model could become a highly useful tool in health planning projects.

Attachment: a/s

The File September 12, 1979

DS/HEA, Irving Taylor

Report of Presentation by Howard Barnum on Project No. AID/ta-C-1358, "Efficiency of Health Measures"

This project is now considered completed with the final report received in June of this year. Dr. Barnum made a presentation of this report on August 16, to a representation from the Regional Bureaus, PPC, and DSB.

The basic purpose of this Project was to ascertain the efficiency of health measures, in order to raise the probability of child survival in developing countries. A mathematical optimization model was designed with its application being to a specific locality, Cali, Colombia. However, the approach is to have general application to an analysis of cost effectiveness of alternative health programs. The other specific in this instance is that the model is designed to address a specific age group from 1 to 5. Using the technique, the models can be developed for any age group and population desired.

An effort was made to select diseases which would account at least 75% of childhood mortality and for which there are well know interventions.

The survey results indicate that promotional programs, water, sanitation, and nutritional interventions are expected to have the greatest impact on morbidity. Further, there are significant inter-disease causal effects between diarrhea and malnutrition.

As expected, the highest cost activities are in-patient care and institutional deliveries, with nutritional activities being moderately costly. The least costly activities per unit are health promotion, latrines, well baby clinics, and pre-natal iron supplements.

Simulations with the model using baseline intervention levels and subjective specification of impact perameters reflect a pattern of mortality by cause of death that corresponds to the patterns for comparable communities observed in the Pan American Health Organization study directed by Drs. Puffer and Serano. Significantly, the simulations revealed that a general feature of the model is the diminished marginal cost effectiveness of any given activity as the

level of other activities increases. Also, the reduction in child mortality with the optimum use of resources is dramatic at low resource levels and diminishes as resources become more abundant.

Dr. Barnum's presentation was well done and well received. The discussions which followed reflected interest on the part of the Regional Bureaus and PPC. A suggestion was made by Robert Meehan, Program Office, that this Report should be placed on the Research Advisory Council (RAC) agenda for the October meeting. The research people from DSB and the Regional Bureaus could be invited to this presentation.

Another possibility for the future use of this methodology is, through simplification, we could make the linear set of equations applicable for other population groups.

Another suggestion was that the Report be condensed for journal publications.

Bob Meehan and Dr. Mel Thorne both felt that the Report is too complex to distribute to the Field but that possibly a two to three page summary might be prepared. The highlights section of the Report might be applicable in this instance.

The action I will take at this point is to place a request for a presentation of this Report to be on the RAC agenda for October.

An Analysis of the Efficiency of Health Measures to Raise the Probability of Child Survival in Developing Countries - University of Michigan

Dr. Swanson chaired the Review Committee. Other members were Drs. Connell, Montgomery and Linder. Dr. Swanson summarized the Committee's comments.

I. PROJECT REVIEW REPORT

At the May 24-25. 1976 RAC meeting, a RAC subcommittee (Dr. Linder, chairman) reported on a research proposal dealing with an analysis of the effectiveness of various health intervention programs designed to reduce the rates of infant and toddler mortality in developing countries. The RAC was not asked for a recommended action, only for comment.

The purposes of the research proposal were as follows:

a) to provide policy makers with an analytical framework that will facilitate efforts to efficiently allocate scarce resources to programs aimed at reducing the rate of infant and toddler mortality;

b) to provide direct policy insights as to the relative cost-effectiveness of alternative policies in raising the probability of child survival; and

c) to assist A.I.D. in its efforts to promote LDC health programs which are efficiently focused on the most urgent health and medical problems.

Among other items, the expected products included a final manuscript describing the linear programming model and evaluating the policy implications of its solution under alternative assumptions.

We now have the final report (dated June 1979) in hand and a R&C subcommittee (Drs. Connell, Linder, Montgomery, and Swanson) has been asked to evaluate the report in the framework of six questions.

Before responding to each of the six questions, the subcommittee wishes to record a generally favorable appraisal of the quality of the research conducted under the project. A difficult problem was approached with skill and imagination and, importantly, the project was completed according to schedule.

1. Did the project accomplish all of the goals set for it in the project paper? An analytical framework and some policy insights were provided and there exists a potential for this report to assist A.I.D. in planning more effective health programs.

2. Is the model that is described in the report technically and scientifically sound? The basic purpose of the model is to determine the combination and levels of various health interventions (32 in all) which minimize the mortality rate in three age groups (0-1 month, 1-12 months, and 12-60 months). The selection of the optimum combination (in the above sense) of health interventions is subject to a set of resource constraints including limits on total costs, total cost of supplies, physician time, registered nurse time, auxiliary nurse time, bed days available, and capacity of physical facilities. In the operation of the model, these constraints are systematically varied from low levels to higher levels and corresponding changes in the optimum combination of health interventions are observed. In the illustrative results presented, the health interventions

selected at low resource levels are those that should recieve emphasis in communities in which resources are scarce. The results for the low-resource solution include, for example, health promotion, water and sanitation, and well baby clinics. At high levels of resource constraints inpatient care replaces outpatient care and toilets replace public fountains and latrines in the optimum mix of interventions. Additional reductions in mortality rate incure successively higher additional costs as we move from low levels of health intervention resource availabilities to higher levels; the expected diminishing returns to health intervention expenses occurs.

In the propcsal presented in 1976, the procedure indicated that a linear programming optimization model would be used. As the project proceeded, it became apparent that a more complex non-linear optimization procedure would need to be adopted. Part of the reason for this shift may have been initial underestimation of the complexity of the impacts of the health intervention activities.

An important component of the model is that portion which describes the impact of the health interventions on morbidity and mortality in each of the three age groups. It was necessary to construct this component and to validate its operation before the optimization process described above could be performed.

In all modelling efforts, it is important to distinguish between the logical or conceptual aspects of the model structure and the empirical components or data used to make the model operational. Conceptually, the child mortality model appears to portray the important relationships

that are expected from prior experience. One of the most difficult and also important features to incorporate into the child mortality model were the various interactions among the eight disease categories, not only within an age group but also the lagged effects of a disease in a given age group on morbidity and mortality in subsequent age groups. The system of these linkages between intervention and morbidity and mortality needed to be developed before designing the questionnaire and going to the field to get estimates of the various parameters.

Sixteen health professionals were surveyed to provide estimates of the parameters related to usage, morbidity, mortality, and disease interactions. Ten of the respondents were from Columbia, the country in which the community analyzed is located. Respondents were asked for a range of parameter values within which they thought there was an 80 percent chance of containing the true value. Experimental or epidemiological data on a scale such as that required by this multiple-disease multiple-intervention model do not exist. Validation of the child mortality model was performed with available data from a previous study near Cali. That is, given the intervention pattern actually employed, the model reproduced the observed mortality rates reasonably well

It should be noted that there was considerable variation among respondents and that apparently the usual second and succeeding rounds of the Delphi technique were not followed. With this technique, the results of the first round are usually summarized and returned to respondents with a request to revise initial estimates if appropriate.

On succeeding rounds, those individuals whose responses lie outside of the groups "consensus range" are asked to supply arguments and counter-arguments may be given by others on the next round. This process may continue until a predetermined consensus range is reached. Apparently only initial responses were used in this study.

A word of caution is in order about a potential source of bias in the impact coefficients estimated by the 16 respondents. It has been noted that there is a natural human tendency to overestimate the importance or impact of activities to which we are professionally or otherwise committed. If this is a source of systematic bias in the estimated impact coeffecients then the aggregate cost-effectiveness of programs may be overestimated. However, it there is little or no difference in the degree of overestimation of the impact of each of the various health intervention activities, then the changes in the pattern of the optimum mix of activities as we move from a low-resource community to a high-resource community still provide a guide for establishing priorities.

In summary, it is our judgment that the model is sufficiently sound to illustrate the basic relationships and considerations for the rational choice of a system of interventions. It does not provide a "recipe" for an optimum set of health interventions for a particular community in Columbia or elsewhere, but it does have an application potential.

3. Is the level of sophistication of the model appropriate for application to health planning in developing countries?

Because it deals with a complex problem, the model needs to be

reasonably complex to be able to portray the relationships as they exist in an LDC community. Two elements are important in assessing level of sophistication. The model must not be so detailed that there is no expectation of getting the needed parameter estimates. This model apparently was simple enough to insure at least moderate success in conveying to the respondents the need for required parameter estimates. The second aspect of sophistication deals with computer requirements. Computer programs for non-linear optimization are not as common as those, for example, for linear programming and one might expect some difficulty in obtaining solutions with the computer capabilities found in many of the LDCs.

4. Will the model require extensive modification for each new application?

Although the general structure of the model could remain intact, some of the parameters would need to be modified. The range of health intervention activities considered may depend on the location of the decision-makers within the various ministries or agencies. Clearly, the resource constraints would need to reflect the new situation. The same holds true for the resources required for a one-unit level of each intervention activity. These data should not be difficult to obtain in a new location. The most difficult data problem is in that part of the model dealing with the impacts of interventions on mortality. However, it is likely that these impacts have sufficient generality to at least use the data from this study as a starting point in a new locality.

One rather obvious application in a new locality is the comparison of a solution using the present health intervention programs with a

solution of the optimum set of health intervention activities. This could be a starting point for a consideration of changes to move toward an improved program. This application would, of course, also involve some tailoring of the model to the local community.

5. Are the data requirements for the model greater than would be available in developing countries?

None of the data requirements are likely to be met by consulting secondary sources in developing countries or, for that matter, in developed countries. However, except for the data on the impacts of the various interventions on mortality, the data for resource constraints, intervention resource requirements, and costs could be collected with reasonably straight-forward surveys. Hopefully, the intervention impact coefficients from the present study could be used as initial values in other applications.

6. Are there any precautions that the Agency should take in using the model or recommending its use to health planners in developing countries?

This effort should be viewed as only the beginning of a perpetual research process and should be used or recommended only in that context. We note that the original project statement implied steps regarding the evaluation and utilization of this research. This phase of the project was apparently not completed or not reported.

A bona fide"application" of this model to influence health intervention programs requires that the users (health-intervention decision-makers) have confidence in the model and/or the model developers. This

requires some investment in time in studying users manuals and other reports which need to be much less technical than the final report reviewed by the subcommittee. Participation of the user in model construction from the beginning is a procedure which would increase the likelihood of actual model application. With close joint participation of the decision-maker and the modeller, one of the principal values of the modelling is likely to be an increased appreciation of a more logical and systematic structure for thinking about health intervention decisions. Expectations for use of the model should not include adoption of the quantitative results of "optimum" health intervention activities without modification. The need for the user to understand the basic logic of the model and the nature of the data base should not be underestimated.

II. SUBCOMMITTEE COMMENTS

Dr. Connell observed that the project had accomplished the majority of its goals and resulted in a model that is both technically sound and supported by conventional wisdom. The model developed is appropriate for LDCs and could be transferred to other countries without extensive modification. The availability of data for the model however, would vary considerably from country to country. In summary the study seems to be well thought out and carefully performed. It will be interesting to hear what plans AID has for utilizing information coming from this study.

Dr. Montgomery said he was generally pleased with the project results but felt the use of the Delphi technique was a weak point. He expressed pleasure with the "unusually skillful" analysis of the interactive effects

of both the diseases and interventions, including the interaction between preventive and curative programs. The methods developed should lead to improved planning.

Dr. Linder stated his impression of the project was positive, and that the direction of the research was correct. He felt that this project was the beginning of a long process of research and that the questions raised would be pursued by AID. He expressed reservations about results obtained using the Delphi technique.

III. GENERAL DISCUSSION

Mr. Taylor, AID, complemented the committee on their thorough review. He indicated AID was still considering how to apply the results of the project. He then introduced Dr. Barnum, principal investigator on the project.

Dr. Barnum, principal investigator, said that he was gratified to hear the committee's many positive comments. He agreed that the portion of the study utilizing the Delphi technique was the weakest. This, he said, was in part a matter of funding.

IV. ACTION

None required.