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EVALUATION OF PAHO/WHO PROGRAMS
OF ASSISTANCE TO THE GOVERNMENTS

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EVALUATION OF PAHO/WHO PROGRAMS
OF ASSISTANCE TO THE GOVERNMENTSI. Introduction

The purpose of this paper is to give the Executive Committee an account of the activities of the Organization in the field of evaluation in recent years and to recommend certain courses of action for the future.

Evaluation is an indispensable tool in the management of the projects in which the Organization is collaborating with Member Governments. It is a term which has a wide range of meanings from the simplest type of appraisal to the most elaborate. It may contemplate questions of priority, of effectiveness, or of efficiency, or it may consider the question of what proportion of a problem the project intends to tackle. It may involve the most objective collection and analysis of statistical data; on the other hand, it may involve only the most subjective appraisal of accomplishment. An Organization like ours may suggest to Governments the adoption of a procedure which is applicable to all projects or of more intensive study of one or more selected projects, employing for this purpose techniques that are specially applicable to such projects.

In this paper we do not propose to describe in detail certain important activities of the Organization which, though they constitute essential elements in its system of evaluation, are inapplicable to all the projects. Examples of such activities are the developments in computer science and the special evaluative exercises in malaria, nutrition, water supplies, smallpox eradication, Aedes aegypti eradication, and fellowships. Nor shall we refer to the Organization's assistance to Governments in the development of national health plans and epidemiological and statistical services or to the fact that this assistance facilitates the evaluation of national health programs. On the other hand, we refer to certain of these subjects when we discuss the possibility of cost-benefit and cost-effectiveness analysis in Part VI of this paper.

Our activities have been guided by policies formulated by the Governing Bodies. In September 1964 the Directing Council in its XV Meeting passed Resolution XIII, which requested the Director "to continue the evaluation of the Organization's program, to extend it to all country projects in which the Organization cooperates, and to make a continuous review of project activities in all stages of their development." A similar resolution (XXVI), passed at the XIX Meeting in 1969, referred also to the participation of national staff.

At the end of 1967 a Department of Evaluation, which a few years earlier had had a brief separate existence, was re-created at the Washington Office to pay special attention to this aspect of the Organization's work.

II. Formulation of the Procedure

Among the various alternatives available, we selected a relatively simple procedure designed to assess project "effectiveness," that is to say, to measure the accomplishment of predetermined objectives. This procedure consists of five stages:

- (1) Preparation of a Basic Document;
- (2) Formulation of annual targets;
- (3) Maintenance of a record of activities carried out;
- (4) Preparation of an annual Evaluation Sheet; and
- (5) Analysis and utilization of the results.

The Basic Document is prepared, as a rule, only once in the lifetime of a project but is in constant use. It consists of four columns. The first column contains a brief description of the problem giving rise to the project, together with a more detailed definition of the baseline situation. The second column describes the purpose and objectives of the project. In order to permit subsequent evaluation, the objectives have to be adequately defined, especially in terms of time and coverage. In the third column are placed the most significant activities leading to the accomplishment of that objective. In the fourth column is listed, for each objective and each activity and correspondingly numbered, an indicator which is project-oriented, reliable, easy to apply, and inexpensive.

The targets of activities for the calendar year are, of course, formulated early in the year and are carefully selected in the light of the duration of the project, its original objectives, and accomplishments to date.

The Evaluation Sheet, which is prepared at the end of the year, consists of five columns. The first column is for the purpose and objectives. In the second column are recorded (in figures) the targets of activities for the year. The third column contains (in figures) the activities carried out in relation to each target. In the fourth column are noted the percentages of accomplishment of the targets of activities for the period. The fifth column mentions factors that facilitated or impeded the progress of the project and also the cumulative percentage of accomplishment of objectives. The last page of the form is not divided into columns but is designed to provide a general appraisal of results and of the impact of the project in its specific field, in the health sector in general, and in the socioeconomic sphere when possible.

The analysis and utilization of the results of the evaluation will be dealt with in Parts III and IV of this paper.

III. Application of the Procedure

Since the formulation of the procedure, there have been four main features of work of the Organization: first, a vigorous effort to apply the evaluation procedure to all the projects; second, the utilization of the results of evaluation; third, the incorporation of the evaluation procedure in the Quadrennial Projection of the cooperative activities of the Organization; and, and finally, the intensive orientation of the staff in all aspects of the work.

Between 1968-70 a series of meetings was held with the staff - at the Central Office, in the Zones, and in the countries - to promote the utilization of the process of evaluation as a working tool at all levels of operation, and the selection of appropriate technical criteria for project evaluation in the various specialized fields of work.

In 1969 the incorporation of the evaluation procedure in the preparation of the Quadrennial Projection firmly established continuous project evaluation as indispensable for determining the extension or termination of projects and for deciding upon changes in the program and budget. We have to recognize that, although this principle is being applied on an ever-increasing scale in the Organization, there is still considerable need for improvement.

The criteria adopted in the past two years for the appraisal of evaluation documents arriving at the Central Office were as follows:

- (1) Whether there was an adequate definition of the baseline situation;
- (2) Whether the interrelationships among the various entities (problem, purpose, objectives, activities) were clearly established;
- (3) Whether the objectives were clearly defined;
- (4) Whether the indices selected were suitable;
- (5) Whether the annual targets were appropriate in relation to the duration of the project and its objectives;
- (6) In general, whether the documents were prepared in such a way as to facilitate the measurement of attainment of objectives;

- (7) Whether there was an adequate description of the impact of the project in its own field, on public health, and, when appropriate, in the socioeconomic sphere; and
- (8) The general impression conveyed by the documents of the extent to which the evaluation procedure was applied.

There has now been significant progress towards the goal of making evaluation a tool in constant use in the management of the projects in which the Organization is cooperating with the Governments. Of the 455 country projects in operation, 85 per cent reported in 1970 as compared with 65 per cent two years earlier. Among reporting projects, the percentage that applied the procedure adequately was 73 compared with 43 in 1968. The staff responsible for country projects, without exception, received from the Department of Evaluation an appraisal of the adequacy of the evaluation documents. It was decided that, in the future, the Director and his principal assistants would, on their visits to the field, pay particular attention to the status and utilization of the documents. The results of the work in the Region as a whole were the subject of staff meetings, especially called, in Washington and in the field.

In addition to this systematic project evaluation, certain fields were explored in greater depth. In close collaboration with the appropriate specialists, evaluation guides were prepared in the fields of nutrition, health education, and foot-and-mouth disease, and in the form in which they already existed for malaria and smallpox.

In implementation of Resolution XXVI of the Directing Council, of October 1969, special attention was given to the participation of national staff in the preparation of the basic documents, annual activity targets, and evaluation sheets. Their role is covered in a special section which has been added to the agreements signed between the Governments and the Organization. In that section, the method to be followed is specifically set out to enable government representatives and the international agency providing assistance to periodically evaluate the project and suggest the changes advisable. It is evident that the evaluation of programs and projects will approach perfection only when all project staff, whether national or international, take an active part in the process and procedure of evaluation.

IV. Benefits to the Governments

The chief advantage of a systematic approach to evaluation, such as the one described in this paper, is that it provides the health administration with a rational basis for changing policies and priorities and thus for reallocating resources. There are other advantages to such an approach. It furnishes knowledge about the effectiveness of effort in achieving objectives. It gives detailed information as to the exact parts of a project that

may be ineffective. With regard to the health situation and the health activities, it provides data that are objective, valid, and reliable. In short, it is indispensable to good management in the health sector.

V. Utilization by Governments and the Organization

The utilization of the evaluation documents is of fundamental importance. They are part of a continuous process. If they are not used, they become merely a useless academic exercise. Mention should be made of some important aspects of the utilization of the results of evaluation by staff of various categories:

- (1) Project staff carefully analyze the results and make the necessary adjustments in the annual targets or in the objectives or both. They make sure that the Project Summary prepared at the end of the year for the Annual Report of the Director fully reflects the evaluation process and indicates in figures the degree of accomplishment of targets and of objectives.
- (2) Country Representatives, who have overall responsibility for project operation, use the results of evaluation to reorient the projects, proposing their extension or termination as appropriate.
- (3) Under the guidance of the Zone Chief, the Zone Advisers, who normally exercise technical supervision of the country projects, take an active part in the application of the procedure, carry out a technical analysis of the evaluation documents at each stage, and invariably make comments to the country project staff, sending copies of their comments to the appropriate technical department and to the Department of Evaluation.
- (4) Each Zone Chief has the special responsibility of maintaining a list of the projects in the area under his jurisdiction, with the name of the local staff member responsible for the project and the name of the Zone Adviser (or Washington official) responsible for supervision and comment.
- (5) The Chiefs of Technical Branches are responsible for ensuring that the evaluation documents contain the appropriate technical information, that model basic documents, including the appropriate indicators, are provided to field staff, that project staff members receive comments on the evaluation documents when there is no corresponding Zone Adviser, that AMRO project staff invariably receive such comments from the appropriate Regional Adviser, and that the procedure and the appropriate project evaluation documents are included in the orientation of new technical staff, whether employed on a short- or long-term basis.

- (6) The Department of Evaluation reports to the Director at the end of each year the extent to which the procedure has been applied in each project, in each country, in each Zone, and in each field of work.

VI. Proposals for Future Activities

Parts I to V of this paper have given an account of the formulation, application, and utilization of a procedure for project evaluation. Now it is proposed to discuss measures for strengthening evaluation in the work of the Organization and applying certain new techniques. This part of the paper will be subdivided into two main sections. Section A will discuss evaluation activities in general. Section B will deal with the application of cost-benefit and cost-effectiveness analysis to project evaluation in PAHO/WHO.

A. Evaluation Activities

The following topics will be considered:

1. Strengthening the Application of Objective Evaluation;
2. Better Integration of the Planning and Evaluation Efforts;
3. "Planning Accuracy;"
4. The Problem of Determining the Extent to which Apparent Project Effects are Due to the Project Rather Than to External Causes;
5. The Question of Side Effects of a Project; and
6. The Evaluation Content of the Annual Report of the Director.

1. Strengthening the Application of Project Evaluation

This subject will be discussed under the following subheadings:

- (a) Revision of Working Paper (1968)*: Objectives and Activities;
- (b) Measuring Resources;
- (c) Application of Evaluation Findings to Program Improvement;
- (d) Revision of Policy Guides;
- (e) Intercountry and Regional Projects; and
- (f) Short-term Consultants and Temporary Advisers.

* CD19/21 (Eng.), page 43

(a) Revision of Working Paper (1968): Objectives and Activities

From the outset, one of the problems in the application of the procedure to country projects has been the difficulty of differentiating between (i) activities, and (ii) purposes and objectives. Conceptually, the distinction is clear. Purposes and objectives refer to desired states in persons or the environment, while activities refer to actions taken by project staff aimed at attaining objectives and purposes. It is possible that some of the confusion stems from the use of two different outcome terms - purpose and objective, where purpose is one end point on a continuum and objectives are all other points on that continuum. In order to remove this ambiguity, consideration is being given to the introduction of the terms ultimate objective, program objective, and sub-objective.

It is proposed to revise the Working Paper on Evaluation of 1968 to clarify these and similar matters. For example, training of staff is clearly an activity the aim of which is that the staff possess certain knowledge, attitudes, or skills. The revised edition of the Paper will also develop more fully the concept of "final activity," explaining how it is the last entry in a continuum of activities, just as purpose or ultimate objective is the last entry in a continuum of objectives.

(b) Measuring Resources

At this stage of the development of the procedure, it was decided to ignore for the time being the question of resources allocation and to confine ourselves to the problem of project effectiveness.

The time appears to be ripe to introduce the item of resource utilization as a means of ascertaining the costs associated with various levels of attainment of objectives. Since the final section of this paper deals particularly with cost and cost-benefit analysis, it is only necessary to indicate here that, while measurement of the attainment of objectives should have first priority, the usefulness of such data must be tempered by a knowledge of the cost of attaining objectives.

(c) Application of Evaluation Findings to Program Improvement

There is need to strengthen not only evaluation by international staff but also its utilization by national personnel. The latter subject was specifically referred to in Resolution XXVI passed at the XIX Meeting of the Directing Council in September 1969. There is evident need for a further stimulus to the participation of the national staff in the evaluation process and procedure and to ensure that our records of each project clearly show the extent of this participation.

The mere inspection of an evaluation sheet by technical staff could lead to useful discussion of the appropriateness of objectives selected for a particular time period; consultation with the particular country in

question might show more emphasis was being placed on low priority items than on high priority items. In addition, evaluation findings should form part of the basis for improvements in program planning for a subsequent period of time.

With respect to the problem of obtaining maximum use of evaluation by Central Office staff, it is proposed to set up immediately in each technical department in Washington, in addition to the existing record of the application of the procedure to individual projects, a continuous record of the accomplishment and impact of each project, and for this purpose to classify the projects according to whether overall accomplishment is satisfactory, unsatisfactory, or doubtful.

(d) Revision of Policy Guides

The Policy Guides are to be rewritten by technical advisers in Washington with a view to furnishing field staff with better guidance on the technical components of project evaluation, e.g., the definition in the specific field of the problem, objectives, activities, indicators, and impact.

(e) Intercountry and Regional Projects

Until recently, we have been concentrating our efforts on the evaluation of the country projects. The percentage of intercountry and regional projects to which the procedure has been applied is smaller. It is considered that the time has come when an effort of equal intensity should be brought to bear upon these projects. The same evaluation procedure is being adapted to this end.

(f) Short-term Consultants and Temporary Advisers

Since we are now employing nearly one thousand short-term consultants and temporary advisers each year, it is important that they be as fully instructed in the evaluative approach as our permanent staff, and we propose in the future to include special guidance on the evaluation procedure in the existing written instructions for short-term consultants. In the future, it will be the responsibility of the appropriate regional technical adviser to supplement the written instructions with specific orientation when a short-term consultant visits the Central Office for briefing.

2. Better Integration of the Planning and Evaluation Efforts

A basic difficulty lies in the fact that the planning and evaluation activities in the Organization are administratively separate. This independent organization of two components of the administrative process, which are in fact inextricably linked, may work to the disadvantage of both

planners and evaluators. Evaluation is continuous. It enters into the planning process from the moment of formulation of a project. Consideration will be given to the possibility of developing a combined unit on planning and evaluation with specialists in both areas working side by side.

3. "Planning Accuracy"

In the application of the recently-developed concept of "planning accuracy," two separate estimates of conditions at a point in time or during a period of time are made: one is made at the time of planning and is of the form described in the problem statement; the second is made at the time of evaluation as described in 4.6 on page 5 of the Working Paper on Evaluation (1968). The extent to which these two estimates coincide is the measure of "planning accuracy."

It can be seen why interpretation of project effectiveness should be tempered by findings of planning accuracy. Suppose it were predicted at planning time that by 1975, if unchecked, infant mortality would be 60 per 1,000 in Norte and an objective were set that it be no higher than 40 per 1,000. (The 22 per 1,000 reduction from the 1967 level of 82 per 1,000 is predicted to result from economic development independent of health services.) In 1975, evaluation studies find a rate of 50 per 1,000, but also estimate the rate would actually have been 70 per 1,000 without the project. It can be seen the project did accomplish as much reduction as planned - 20 per 1,000 - but did not hit the point target planned. The problem is one of planning accuracy rather than project effectiveness. Such a finding has different implications for future planning than would a finding that performance of planned activity did not have the predicted results.

4. The Problem of Determining the Extent to Which Apparent Project Effects Are Due to the Project Rather Than to External Causes

In the past, we have given primary attention to the degree of attainment of objectives, but have not stressed means of determining whether any observed change was due to the project rather than to other social changes. We will in the future give greater attention to this problem. Two major methods will be considered. One is the use of comparison groups, preferably on a true experimental basis, but also using naturally existing groups. The second is the use of statistical time series analysis, including the use of multivariate techniques such as multiple-regression analysis. The use of these techniques will be discussed in greater detail in future working papers.

5. The Question of Side Effects of a Project

Every project may have secondary effects not included in its predetermined objectives. Sometimes these may be beneficial; sometimes they may be harmful. In assessing the net worth of a project, it is important to take into account the unintended side effects which are created. The last

page of the Evaluation Sheet contains a section which refers to impact upon aspects of the social and economic welfare of the population other than those specified in the objectives and purpose. This section will, in the future, be given special consideration, and more specific instructions and guidelines given for assessing important side effects. This would give a more complete picture of the total impact of the project.

6. Evaluation Content of the Annual Report of the Director

To an increasing extent, the project summaries in our Annual Report contain quantitative data on the achievements of the projects in relation to their annual targets. We propose to strengthen this effort further in order that the Report may show with increasing specificity the effectiveness and efficiency of each project.

B. Application of Cost-Benefit and Cost-Effectiveness Analysis to Project Evaluation

Thus far, the Organization's project evaluation efforts have been confined largely to the proper description of project-relevant health problems, project objectives and activities, and determination of the extent to which the defined activities are actually carried out and the objectives attained. This system of evaluation has great value for purposes of managerial planning and control. It leaves to informal judgment, however, determination of whether the solution of a health problem is worth the cost incurred. Also, in planning projects, the procedure does not constitute a systematic method for determining which mix of activities would provide the least-cost solution to a given problem.

Cost-benefit analysis is a method for determining whether or not a project is worthwhile, the best time to undertake a project, or which of several alternative projects is the most desirable. The method is analogous to an accounting procedure and consists of determining the costs of undertaking a well-defined project, establishing a comparable measure of the benefits of the project, and comparing costs with benefits. It is usually necessary to allow for indirect costs and benefits and for the fact that various costs and benefits obtain at different points in time.

A related and more general technique, cost-effectiveness analysis, is a method for determining the least costly means of achieving a given set of benefits or, alternatively, the means for attaining the highest possible level of benefits, given cost and certain project limitations. Thus, cost-benefit analysis compares the costs of any given project with its benefits, while cost-effectiveness analysis provides a means for determining optimal project design.

As a tool for practical decision-making, cost-benefit analysis first came into prominence in the United States of America around the turn of the century. The general areas in which cost-benefit analysis has found

application include water projects (irrigation, flood control, hydroelectric power), transportation projects (roads, railroads, inland waterways), land usage, education, and health.

Application of cost-benefit analysis to the health field, at least as a hypothetical exercise, apparently predates its use in all other areas. In 1667, Sir William Petty estimated the cost of transporting people out of London and caring for them for three months so as to increase the probability of their surviving the plague by an assumed amount, and related it to an estimate of the monetary value of their survival. In recent times, cost-benefit analyses or closely related studies have been undertaken in a wide variety of health fields, including tuberculosis, syphilis, cancer, heart disease, and kidney disease.

Cost-effectiveness analysis evolved largely out of the field of engineering economy, in which methods were developed for determining the optimal design of industrial plants on the bases of given potential monetary costs and benefits under conditions of assumed certainty. Following World War II, methods for handling values not directly expressed in monetary terms and uncertainty with respect to costs or benefits were borrowed from the field of operations research; the method, thus modified, was applied to the design of systems, forming the basis of what came to be known as cost-effectiveness analysis. It has found its widest application in the fields of national defense and space exploration.

Before discussing particular problems in the measurement of costs and benefits and in the application of the technique in the health field, some general limitations should be recognized. First, the measurement of costs and benefits inevitably involves value judgments. This is particularly evident when the activities of a program alter the distribution of socioeconomic well-being to a significant extent. Measurement of the costs and benefits of social intervention is thus predicated upon some theory of collective, or governmental, decision-making, a subject in which there has been considerable work by economists, political scientists, and philosophers, but which offers few helpful practical principles.

Second, application of the analysis must be made within a particular legal, political, social, and cultural context. It is possible, for example, that projects indicated to be worthwhile cannot be undertaken because agencies or governments are unable to command the resources necessary to insure their fulfillment. Also, the political authorities must, in many cases, be willing to take a very long-range view. For example, the major benefits of a water fluoridation program may occur long after the costs commence, and perhaps after current governmental leaders have retired.

Finally - a technical point - if the activity is so substantial in terms of a national or regional economy that the whole constellation of relative prices is considerably altered by it, a different form of analysis is called for.

We now turn to a discussion of more detailed aspects of cost-benefit, cost-effectiveness analysis, and its application to the health field. The principles developed can be readily adapted to any particular type of economic planning. In the sections below we shall consider (1) the measurement of costs, including the time discount rate; (2) the measurement of benefits; and (3) possible application of the cost-benefit, cost-effectiveness method to projects in which the Organization is collaborating with the Governments.

1. Measurement of Costs

Measurement of the costs of a project is generally much easier than measurement of the benefits. In most cases the market values of the commodities or services utilized will provide a reasonably good measure of their costs. There are, however, a number of potentially important exceptions to this.

As a general principle, the costs attributed to a project should reflect social costs of production, that is, the value of resources in uses from which they must be released in order to produce more of the health service in question. There are a number of technical conditions under which market prices will not correctly reflect such values. Most prominent among these are:

- (1) Monopolistic elements or other imperfections in the markets;
- (2) Sales (excise) taxes and price or production controls;
- (3) Unemployment of resources; and
- (4) Changes in quantities large enough to affect prices. It may be important, also, to take into account expected changes in relative market prices.

Whether or not the above points are important enough to take into consideration is an economic judgment which should be made in each individual case. It should be noted, however, that while adjustments for the above factors are often made on a pragmatic basis, no truly definitive general theory for making them exists.

An important consideration concerning prices in the health field is that over short-term periods at least some quantities of inputs to a project or set of projects may be essentially fixed. This is particularly true of skilled personnel. In this case, resources utilized in one component part of a project may not be available to other parts of the project, or resources utilized in a given project may not be available to other projects. The values of the inputs and their proper allocation must then be determined simultaneously. The mathematical techniques of linear and nonlinear programming provide means for accomplishing this. It is desirable, from the standpoint

of economic efficiency, that the allocations be made on as broad a basis as possible: country-wide in preference to government department level and department-wide in preference to project level.

In conducting cost-benefit and cost-effectiveness studies, it is important to consider the times at which various costs and benefits obtain. The term "social time preference rate" is used to indicate the degree to which future costs and benefits are, or should be, valued less highly than present ones. Since costs are related to causes, and benefits to effects, the former will, on the average, precede the latter in time. The necessity of waiting for benefits, given the fact that future benefits are not valued as highly as present ones, may be properly considered as a cost of a program.

Ideally, the discount (or interest) rate in all sectors of an economy should (with due allowance for differences in risk) be set equal to the social time preference rate. This rate could then be applied to the time streams of goods and services foregone and provided by a project. In practice, prevailing interest and profit rates may differ substantially from the incremental social time preference rate, but they do provide an indication of the incremental social opportunity cost rate, which indicates the rate of return on foregone investments. It has been suggested that an average of market rates, adjusted for risk and tax effects and weighted in proportion to the sources of funds utilized by a project, be employed. In previous cost-benefit, cost-effectiveness studies, however, even this has not been done, the discount rate being set equal to some "reasonable" value.

2. Measurement of Benefits

Discussion of the benefits of health programs is facilitated by consideration of the stages in the course of a disease process at which intervention may be made. Action at the environmental level may be expected to save monetary costs of detection, diagnosis, and treatment as well as the less tangible costs associated with pain, disability, fear, anxiety, and possible early death. At the presymptomatic and symptomatic stages the amount of potential monetary savings would be reduced. Finally, at the clinical stage, intangible items may comprise the major portion of the benefits. The major point to be made is that, for the early stages, monetary savings provide a minimum estimate of project benefits. Since these are relatively easy to measure and since their discounted value may exceed project costs, the determination of worthwhile early-stage projects is made less difficult.

Benefit measures may be divided into tangible and intangible categories. Tangible benefits consist largely of the avoidable costs of disease detection, diagnosis, and treatment. These are relatively easy to measure, but the general principles delineated in the preceding section on cost measurement must be taken into account.

The less tangible benefits are those associated with the avoidance of pain, disability, fear, anxiety, and early mortality. Because of the relatively well-defined physical nature of the event, let us consider death first.

Early and even relatively recent attempts to determine the value of human life have focused largely on earning or production capacity. In the case of housewives, an imputed value of services was generally used. In many studies the value of the individual's own consumption of goods and services was subtracted so as to obtain a measure of the net economic benefit he provided to other members of his family and, through taxes and the like, to the rest of society.

The difficulty with such measurements is that they provide an underestimate of the total value of human life. This is the case because intangible elements of the value of life, both to the person himself and to those who care about him, are left out of the calculation. One way of ascertaining the value of an individual's life to himself, which is currently being investigated, is by essentially asking him what percentage of his expected future lifetime income he would be willing to pay to reduce by some small amount the probability of his dying within a year. Unfortunately, people find such questions very difficult to answer, and a rather wide range of values has emerged, depending upon the form in which the question was asked.

The second component of the value of life is that which an individual has to those who personally care about him, above and beyond his material contribution to their welfare. Here, as in other areas, it may be possible to use court-determined compensation in the case of death, provided such compensation includes an amount for mental suffering.

The value of reducing disability consists of (a) relatively tangible and (b) intangible components. The relatively tangible components can be evaluated rather directly by determining work-loss rates of both a temporary and permanent nature, as is now being done in the current study in Paraguay of the socioeconomic impact of malaria.

It should not be overlooked, in applying these techniques in the health sector, that fear and anxiety are real entities and their avoidance may comprise a major part of benefits in programs such as rabies control.

We come next to the social cost of an individual's death or disability. Variations in social cost may occur because a person is paid at a rate higher or lower than his marginal contribution to society or because he pays in taxes or charitable contributions more or less than he receives in benefits.

Another social factor to be taken into account, of particular relevance to the Organization's programs, is the indirect effect of a project on economic development. In this connection the concept of human capital

and its relation to education must be considered. A longer prospective working life will increase the average rate of return on investments in education and thus increase incentives for individuals to become well educated. It will also, of course, increase the rate of return on government investments in education. The increase in human capital in the form of an educated citizenry may be expected to enhance economic growth. Public health programs may also sometimes have important economic effects by opening land and other natural resources for utilization.

Effects on the total size and age distribution of the population are also important. If a large proportion of the population is of working age, per capita income will, of course, be higher.

Finally, the social benefits of programs, particularly those directed toward the reduction of communicable diseases, may exceed the sum of the benefits previously mentioned. To take an extreme case, a sudden, large-scale epidemic may disrupt the entire economic, social, and cultural characteristics of a region.

Establishment of the probabilities and potential sizes of epidemics and other infrequently occurring events poses a difficult problem. The Delphi method* provides a way of using and possibly improving upon expert judgment, by subjecting individual experts to each other's criticism, while preserving anonymity.

3. Possible Application to Specific Projects

It is not to be expected that cost-benefit or cost-effectiveness analysis will be of value in examining all of the Organization's present or proposed projects. Given the present state of development of these techniques, intuitive expert judgment may be more precise than any detailed calculation, particularly if such judgment is based upon accumulated experience in similar situations. Two general guides may be used in determining the projects to which cost-benefit and cost-effectiveness analysis should be applied. First, it would appear desirable to apply the analysis to those projects for which costs and benefits are readily measurable. Second, it would appear best to apply the analysis to those projects for which the answers are urgently desired.

Some indicators of the measurability of costs and benefits are supplied by the following criteria (expressed in terms of benefit measures):

(a) Tangibility

Tangible benefits are more readily measurable than intangible benefits. For example, it is much easier to measure the costs of an avoided hospital stay than the value of a life saved.

* Helmer, Olaf, Social Technology (New York: Basic Books, 1966)

(b) Assignability

Benefits which can only arise from a single project activity are easier to measure than those which can arise from a variety of other causes.

(c) Specificity

It is desirable that few rather than many benefit measures exist. For example, the wide variety of benefits attributable to nutrition projects may make benefit measurement difficult.

(d) Certainty

It is desirable that the benefits be relatively certain in the sense that reliable evidence can be obtained on their probable values.

We now turn to specific Organization projects and areas of interest which appear to be suitable for cost-benefit and cost-effectiveness analysis:

(a) Water Fluoridation

There is a considerable amount of evidence, well documented, that fluoridation of water supplies reduces the incidence of dental caries. Other less well-established physical benefits include reduction in the severity of caries, reduction in caries-induced malocclusion and periodontal disease, and reduction in nutritional and other general health problems.

In translating these physical benefits into monetary terms, one may first take account of the potential reduction in the cost of the present level of tooth extraction and filling. This provides a lower limit to the benefits of a water fluoridation program which may then be discounted and compared with its costs. Some account may then also be taken of the associated physical factors and the accompanying reduction of pain, discomfort, and other intangible items such as the sense of well-being associated with improved oral health.

(b) Cervical Cancer Detection

Detection of cervical cancer using the Papanicolaou smear test provides both potential benefits and costs associated with (i) true positives, (ii) true negatives, (iii) false positives, and (iv) false negatives. In the case of true positives which are definitively diagnosed and treated, the benefits consist of the reduced cost of relatively simple treatment, the reduction in morbidity and mental suffering associated with late cancer, and the prevention of early death. For true negatives, the benefit consists of reduction in anxiety. False positives result at least in a temporary cost of anxiety and the cost of unnecessary diagnostic procedures. False negatives may conceivably delay consultation and treatment until the disease is far advanced.

Given the costs and benefits associated with each of these states and the technological constraints of the test, an optimal ratio of false positives to false negatives can be determined in terms of characteristics of exfoliated cells. There is also the related problem of determining the optimal frequency of tests for various populations at risk, in that the precursors of invasive cancer, namely, dysplasia and carcinoma in situ, can be detected between three and ten years before the occurrence of invasive disease.

Attention should also be given to the possibility of increasing the benefit-cost ratio by limiting the screening program to high-risk segments of the population.

(c) Tuberculosis Screening

Analysis of pulmonary tuberculosis and other screening programs may be carried out in much the same manner, except that in the case of communicable diseases there is the added benefit of preventing possible spread of the disease.

However, in the case of tuberculosis, there is the possibility of analyzing a rather wide variety of methods of prevention and early detection. In general, the skin sensitivity tests provide the best available method of detecting early infection in an unvaccinated population. X-ray evidence of tubercular lesions provides the possibility of detecting pre-symptomatic tuberculosis at a somewhat later stage. The bacteriological tests generally provide identification only after the communicable stage has been reached. The problem of variable development of the disease and spontaneous remission is considerable.

(d) Rabies Control

The rabies control programs provide an interesting example in that a number of methods or alternative activities are available. These include capture and destruction of stray dogs, vaccination of dogs, and prompt reporting and treatment of potential human cases. The benefits derived include reduction of human treatments and deaths, reduction of dog bites, and reduction of fear and anxiety.

Although the more tangible benefits may outweigh the costs, the intangible benefit of generalized anxiety reduction is likely to prove very important, thus posing a measurement problem.

(e) Intensive Care Units

Benefits from the introduction of intensive care units are likely to be almost entirely of an intangible nature. Evidence does exist, however, that patients treated in intensive coronary care units have survival rates which are considerably higher than those treated in conventional hospital facilities. Evaluation of the direct benefits of these programs thus depends largely on determining the value of prolonging human life.

In connection with the recent project to introduce intensive care units into Latin American hospitals, there is also the problem of determining the value of the project to the people of the Hemisphere in terms of the expected potential spread of this innovation.

(f) Nutrition

The protein-calorie nutrition diseases, kwashiorkor and nutritional marasmus and their variants, pose considerable health threats to infants and young children. Here again, there are a variety of control measures available: (i) food supplementation, (ii) nutrition health education, and (iii) comprehensive immunization programs. The benefits consist largely of lowering mortality and morbidity rates and in an improved level of health and physical and mental ability throughout life for the survivors. Moreover, the effect of improved nutrition on infectious disease morbidity and mortality is of great importance. In fact, two-way causations exist, as between gastroenteritis and malnutrition.

The complicated nature of the problem suggests that a well designed experiment with alternative methods of control would be most worthwhile. The results of such an experiment could be generalized to other similar areas of application.

(g) Aedes aegypti Eradication

Proposed eradication of the Aedes aegypti mosquito constitutes one of the most difficult, but potentially most rewarding, areas for cost-benefit and cost-effectiveness analysis.

Since the principal Aedes aegypti-borne diseases, yellow fever and dengue, are communicable and tend to occur in epidemics, the problem of determining the probable size and frequency pattern of these epidemics must be faced. Moreover, the probability of occurrence of dengue hemorrhagic fever should be determined. In this connection, the Delphi technique, employing the services of expert entomologists and epidemiologists, may be useful.

4. Conclusion

To sum up, we have reviewed the principal features of cost-benefit and cost-effectiveness analysis and their limitations, the way in which the costs of a health project may be measured, and the difficulties of measuring benefits. We have considered the possible application of these techniques to the projects in which the Organization is collaborating with Member Governments. We have seen some of the criteria that would have to be adopted in the selection of projects to which to apply these techniques. In general, we conclude that, taking account of these criteria, we should now consider the selection of one or more specific fields for a study in the appropriate depth. We must obtain beforehand a careful estimate of the cost of such a study.

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