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A HEALTH DEVELOPMENT MODEL APPLICATION

TO RURAL JAVA

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APPLICATION TO RURAL JAVA

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ABSTRACT

Decision-making in the public sector often lacks clear, relevant information on which to plan and allocate resources. The approach presented here is an example of a simulation model for guiding decisions among alternative programs for rural health development.

This model explored the effects of various combinations of health programs on the health status of the population. Decision rules, estimated values of variables, and relationships among variables (such as attack rate per age group for specific diseases or utilization rate per age group for specific types of health care delivery) are presented.

The specifications of the model simulate the conditions in rural Java, Indonesia, in terms of the expected costs and effects of alternative programs. The alternatives considered were various combinations of health centers, subhealth centers, village health workers, and public health promotional programs of sanitation, nutrition and immunization. Estimated relationships of the utilization and effectiveness of these health programs were used to calculate the impact on morbidity and mortality which might be expected under alternative combinations of health programs at specific budget allotments.

A model such as this can be made more useful as the variables become increasingly reliable. Sensitivity analysis was used to identify the specified model relationships and the input estimates where reduction of uncertainty is needed. If an input estimate is varied within a reasonable range and the rank order among the alternative strategic decisions changes, then greater certainty is needed for that variable.

The ranking of programs was determined by the level of budget available, the criteria for determining health status, and the inputs into the specification of the programs. Under a combination of mortality and disability criteria, program alternatives were delineated within a narrow range for decision-making. Village health workers and immunization appear more effective in lowering mortality rates and sanitation more effective in lowering morbidity rates.

The sensitivity of model outcomes to input estimates were tested. The rankings of alternatives were most sensitive to cost and effectiveness estimates whereas changes in attack rates and utilization rates had much less influence. From these results, research priorities for the refinement and expansion of the model lie in the areas of cost analysis and program-specific effectiveness studies. Beyond the refinement of this model further developments lie in the incorporation of cultural and behavioral impacts on health status and the effects of change over time.

FOREWORD

This report discusses one phase of a continuing research activity concerned with the derivation and application of quantitative relationships between expenditures and health effects in developing countries. The project received its initial stimulation in conversations with Barbara Herz and Maureen Lewis of the Bureau of Program and Policy Coordination of USAID, who emphasized the need for knowing such relationships in the formulation of an international health policy for the United States.

On the basis of these conversations and preliminary research undertaken at the University of Michigan, collaborative arrangements for refinement of concepts and field surveys have been developed with researchers in a number of third-world countries. While these activities were being designed, it was thought useful to organize tentative data and report on an illustrative application, relative to some health program options of the Republic of Indonesia. This application was designed to communicate some of the methods, problems, and uses of a quantitative model at an early state of the research process.

We would like to thank Indonesian colleagues for their substantial advice in the preparation of many of the estimates used in the illustration. These colleagues include Dr. R. Henry Pardoko, Director of the Center for Health Services Research and Development in Surabaya, Dr. Soeharto Wirjowidagdo, Director of Community Health Service, Ministry of Health, Dr. Berlian Siagian, National Institute of Research and Development, Dr. Bambang Winardi, Communicable Disease Control Officer, East Java Office of Health, and Dr. Karneni, Chief Health Officer and Dr. Aman Wahyudi, Assistant Chief Health Officer of Kabupaten Tulungagung.

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I. INTRODUCTION

When governments of developing countries, and agencies which aid development, proceeded with decisions regarding policies and allocation of resources in the health sector, they have generally had little assistance from quantitative information. Even in developed countries, data about the *effects* on health of alternative courses of action are controversial at best. In developing countries, reporting of morbidity and mortality are incomplete, uncertain, and frequently biased because collection of reports has been primarily from urban areas and hospitals, and these do not represent the whole population. This report describes a method for taking what *is* known about the health sector - indicators of health status, types of service utilization, foreseeable resource allocations - and placing these quantities into a systematic framework as a tool for planning.

Problems with Vital Statistics

Government officials who must choose health policies and allocate resources to combat diseases know how misleading the officially reported statistics can be.[1] Dr. W. Charles Cockburn surveyed high level health officials in 1973, asking them what they *perceived* to be the leading health problems of their countries. He then matched their perceptions against the published mortality patterns of their countries.[2] For the developing countries the lists did not match at all. In nearly every

region of the world the reported causes of death seem to indicate that as few as three or four of the top ten killers are communicable diseases. Yet the lists compiled by health officials who were polled tell quite a different story; nearly every disease mentioned is a communicable disease. The published reports seem to be an artifact of the data collection system: those who die in hospitals get reported.

Coverage of populations is a related problem. Mortality registration data available from the World Health Organization covers less than ten percent of Africa or Asia.[3] Results from attempts to estimate the remaining unreported deaths by the use of sample surveys still yield an incomplete picture.[4] Beyond mortality data are the details on cause of death. The medical certification of cause of death is lacking in most less developed countries, or is only available for deaths which occurred in hospitals.

Collection of cause of death information is difficult, costly, and often perceived to be of restricted utility by local health workers. These data are difficult to obtain because diagnosis may be unreliable, or multiple or unspecific causes may be common. They are costly because it is necessary to cover a large population base in order to generate information for age-specific fatality rates by cause. Finally, cause of death information is likely to be seen as of low importance by those who plan strategies for intervention to improve health status because such strategies are only occasionally disease-specific; also because in developing countries the underlying cause of death, e.g., malnutrition, may be more significant than specific disease patterns for program development.

Indicators of Effectiveness

The health effects of various programs aimed at improving health in developing countries are also uncertain. An expert panel convened by the World Bank to advise on the measurement of the health benefits of investments in water supply concluded that "health benefits... have not been quantified to permit the derivation of reliable formulas which can be used to predict the public health effects of water supply projects coming before the bank."[5] With regard to nutrition interventions, a study for the United Nations noted "Our knowledge of the effectiveness of various types of nutrition programs is severely limited by inadequacies in both the quantity and quality of existing studies."[6] Research results in field studies on the effectiveness of medical and nutrition interventions are usually flawed by inadequate sample sizes, and lack of formal controls. Where controls are established, the populations often differ in what may have been crucial characteristics.[7] A committee of the National Academy of Sciences reviewed experimental integrated health service projects and concluded "... that it is by no means certain that they will be either effective enough or low enough in cost to be worth replicating."[8]

The difficulties of tracing the health changes due to specific intervention stragegies are compounded by the interactive effects of problems and interventions; for example, malnutrition interacts with infection and general socio-economic condition interacts with health care programs toward variation in health status.

Bringing Components Together: Modelling

In the presence of these difficulties, what can be done to sort out better policies from worse policies - to help in the determination of preferred policies? Some would declare that political attractiveness is the only criterion possible. Others would take an educated guess, survey the indications at successive stages of implementation, and decide periodically whether to continue an attempted strategy. Sometimes policies are shaped by an underlying principle such as equity - attempting to distribute services to reach equalization across geographic areas or population subgroups. The complexities of measuring and the interaction of health with other sectors lead sometimes to "ideal" programs being devised without sufficient consideration of available resources or the relative merits of alternatives to "the ideal".

By carefully defining factors which could be expected to influence health, a complex problem can be examined in comprehensible steps. By examining relationships among the various components of the health sector, systematic processes can be identified and developed into predictive hypotheses; these are then subject to verification or alteration on the basis of emerging new information. In effect, the setting of components into a systematic framework, called a model, is a statement of theory about underlying processes. Major advantages of functional models over trial-and-error for planning are:

1) a model provides an orderly way for empirical findings and expert judgments from many sources to be usefully combined.

2) a model provides a means of calculating quantitative consequences of postulated relationships; these can be checked against experience and refined over time.

3) the relationships which are set into the model as assumptions and decision rules can be altered to explore what would be expected given different conditions.

4) the model defines a computer program simulating real-world conditions, and with this method of "experimentation," various policy changes can be tested quickly, without the risk or cost of actual implementation.

Now that the advantages of models and computer applications have been hailed, it is imperative to emphasize the caution with which policy makers should approach computer output. Some health skepticism is needed before any model is used in planning public service programs. Basic questions should include:

1) Do the results of the model's operation provide information about the specific questions raised at the outset? (Unless they do, the simulation may have made the problems worse!)

2) Do the numbers entered, the relationships assumed, and the decision rules make sense intuitively to knowledgeable officials? (If there is erroneous input, the output will surely be invalid.)

3) Has sensitivity analysis been used to show the range through which estimates might be expected to vary before there would be change in the rankings of preferred programs? (Formal acknowledgement of the uncertainty of the model helps to keep improving it. Where a decision rests on a ranked order of alternative programs, the decision maker needs to know how sensitive that order is to changes in the variables used to developed the ranked order.)

4) Does the policy maker communicate with the designers of the model so that model capacity can be changed or expanded in response to new information or new policy alternatives? (Simulations are only as useful as their users create them to be; they should be continuously redesigned without becoming too redundant or too complex for useful application.)

One approach to analyzing relationships between health status and medical services, sanitation, nutrition, economic levels, and social indicators uses data at high levels of aggregation such as national statistics. A second approach seeks to model the functional relationships affecting health status into small steps, tailored to specific localities; this permits the utilization of existing studies, field surveys, and expert judgment.

The highly aggregated data approach has been the basis of some of our

work; using published statistics on indicators of national levels of health, we have used multiple regression analysis to determine correlates of life expectancy in less developed countries.[9] A theory has been developed and tested which tries to reconcile apparently conflicting findings on the relationships of sanitation investments to health benefits.[10]

Another approach develops a locality-specific model of functional relationships in changing health status. The major emphasis of the work described in this report is the development and implementation of a functional model which could contribute to the sorting out of desirable from less desirable policy alternatives for a specific population. This model utilizes reasonable assumptions derived from what is currently known, or thought, in order to calculate health effects of current or projected health sector programs or strategies. The relevant data has been gathered and refined with the expectation that as improved data becomes available, the model would be ready to receive more specific figures. In descriptive terms the health sector model for developing countries uses the following components.

> A population, with a *particular age and sex distribution*, experiences a certain *set of diseases*, which can be defined through *"attack rates"*. Given whatever health care services are available, an estimable *proportion of the population* (by age and sex) *utilizes the services*. Deaths and days of disability (incapacity for performing normal functions) can be established for each disease identified, and these can be shown both for those who utilize health services and those who do not. Where *death, disability, and attack rates* are known to be *affected by levels of nutrition, sanitatition, immunization, promotion and organization of health services*, these can be entered into the model in varied combinations. It is from the combination

of these several indicators and conditions that *the expected effects* of various health service interventions *can be explored* through the computer model. These effectiveness levels can then be used for comparisions of programs carrying particular costs.

Testing the Model

The high-aggregation and the locality-specific models are mutually significant to estimating the validity of the data. The published crude death rates and age-specific mortality rates, for example, are used to check the sum of the cause and age-specific derivations from the calculations. If there is a wide discrepancy, we can return to the components of the model to see where it may be wrong. Thus the aggregated data provides control totals by which we discipline a locality-specific model. The aggregate data also contribute to the establishment of coefficients for estimating expected effects of program alternatives. While the components of the locality-specific model generate descriptive solutions, they are tentative and subject to verification in practice. By knowing the costs associated with each program option, the model generates information about the expected cost/effectiveness of various combinations.

Since the purpose of these models is the guidance of policy choices, the various feasible program combinations (policies) are ranked according to the projected contribution of each type of policy to improved health status at several budget levels. Within reasonable limits, the model's assumptions (relationship specifications) were varied, and new solutions calculated. Sensitivity analysis shows which canges in uncertain rela-

tionships significantly altered the policy rankings. The assumptions shown by sensitivity analysis to affect policy rankings should have priority for more intensive research so that they might be specified more reliably.

Policy and Research Connections

In addition to the increased sense of direction which such a model could provide decision-makers, a functional model's development is also an arena through which epidemiologists, environmental health scientists, medical care analysts, health officers, and economists from both developed and developing countries can communicate and collaborate. The model can be used as a framework into which to introduce new data and approaches and calculate resultant program costs, health effects, and the effects of alternative patterns of allocating program resources.

This report describes the explorations following the decision to develop a model for Indonesian policies for health development in rural Java. Researchers from The University of Michigan worked with Indonesian government officials to specify policy alternatives, establish the model's classifications and assumptions, and design field surveys to validate quantitative estimates for the model's calculations.

Basic population data, attack rates, case fatality and disability rates, and utilization patterns were stipulated and indicators of effect calculated. The effects of varied conditions of nutrition, sanitation, immunization and medical care organization on these rates and patterns were calculated, and then their consequences for health status changes

were compared. Combinations of programs and their effects in terms of mortality and disability were projected at different budgets. The cost estimating procedures, establishment of various rates, and computer programs for calculating the model are described below.

Specified combinations of health policy options are compared at fixed cost levels to essay an approximate answer to the questions, "Which of these program combinations have the greatest effect in reducing mortality and disability under specified budgetary levels?" and "By how much would additional expenditures in the health sector be expected to influence changes in mortality and disability?"

II. DESCRIPTION OF THE MODEL FOR LOCALITY-SPECIFIC COST-EFFECTIVENESS COMPARISONS

In order to consider the potential effect of any future intervention on an existing system, it is necessary to know the current situation. Considering the questions surrounding the possible options for improving health, a set of rates and relationships must describe the threats to a population's health, use and effect of service programs, and the costs associated with service delivery.

Figure 1 illustrates the progression of health sector activity from specifying interventions to measuring effects and costs. At the top program specifications are shown as developing from consideration of the available resources and prevailing conditions. Then the health factors

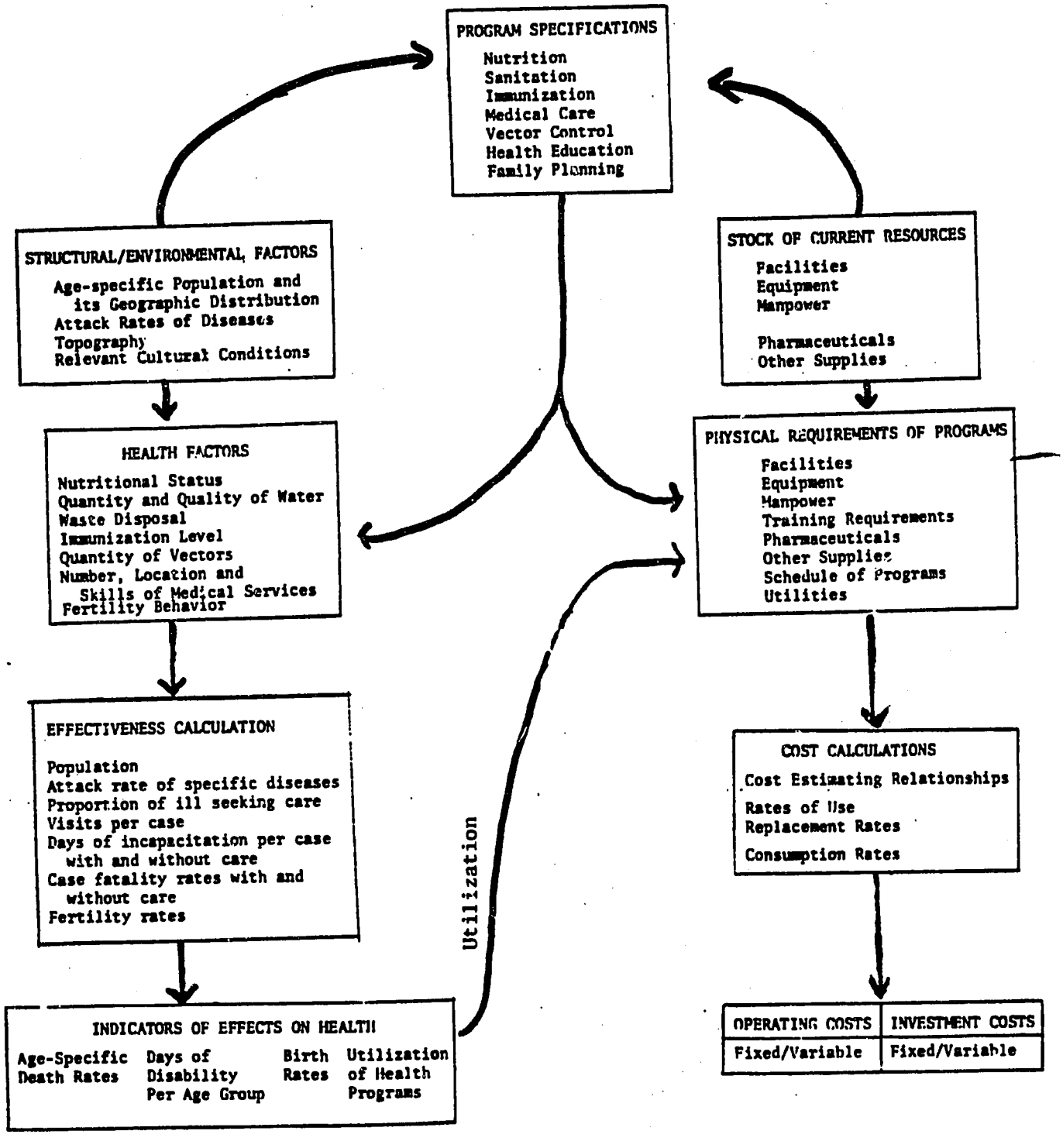
which a program might address and the calculating relationships are shown parallel to the program development requirements and costs. Finally, the outcome indicators are shown in units that permit comparisons of effects and costs. The utilization rate feeds back from effects to costs since there is a connection between amount and program issued and its resource requirements.

When the programs for intervention have been specified and their costs and effects calculated according to the model, the output comparisons show ranked preferences for specific interventions by effectiveness in reducing morbidity or mortality in that portion of the population reached.

From the policy maker's perspective, the output from the model is useful for matching resources to program development; health service developments could then be focused toward those age groups or conditions where the changes in health status will be integrated effectively with the goals of other sectors such as education, commerce, or agriculture.

Figure 1

A Model of Health Sector Policy Cost and Effectiveness in a Developing Area



Effectiveness Calculation

Specifying the model requires numbers for the calculation variables shown in Figure 1. The following information was obtained for description of the current health status and projection of expected effects under varied intervention strategies:

P_j = Number of people in each age cohort j

R_{ij} = Attack rate of relevant diseases (i) in each age class (j)

N_{ijk} = Proportion of people in age cohort j with disease i who seek care from source k

$\bar{F}_{ij}$ = Case fatality rate of disease i in each age cohort j for those who *do not use* medical care

$\bar{D}_{ij}$ = Days of disability associated with disease i in age cohort j for those who *do not use* medical care.

D_{ijk} - Days of disability associated with disease i in age cohort j of those who seek care from source k

Computer calculations will be used to assess health status expected under varied strategies of health care. A public health promotional program or a medical care service may be expected to influence attack rates, proportion seeking care, disability days, and/or case fatality rates. These influences can be estimated from established relationships, expert judgment, sample surveys, or theories about cause and effect. For example, some attack rates vary with nutritional status, immunization, and sanitation. The proportions seeking care are related to the distance, time, and cost of visiting a medical care facility, as well as the anticipated benefits and alternatives to such care. Disability days and case fatality rates vary with nutritional status, and where care is received, with the effectiveness of that care.

Effects of medical care interventions can then be calculated using age-specific disease profiles showing the days of incapacitation (perhaps at specific levels of disability) and the number of deaths given various combinations of service utilizations.

The calculation of total mortality is basically the product of attack rates and age-specific population times the fatality (or disability) rates with and without care summed across all diseases, age cohorts, sources of care.

$$\text{Number of Deaths} = \sum_{i=1}^{\text{Diseases } (n)} \sum_{j=1}^{\text{Cohorts } (m)} \sum_{k=1}^{\text{Sources } (p)} \underbrace{R_{ij}}_{\text{Attack Rate}} \cdot \underbrace{P_j}_{\text{Population in Age Cohort}} \cdot \underbrace{[(N_{ijk}F_{ijk}) + (1-N_{ijk})(\bar{F}_{ij})]}_{\text{Proportion Who Seek Care and Die plus the Proportion Who Die Without Care}}$$

Cost Calculations

National or regional policy may vary on what are the feasible sources of care, but each option needs to be described clearly, and each will have certain resource requirements such as physical facilities; utilities; pharmaceuticals; equipment and other supplies; personnel, training requirements. Each of these resources can be associated with a set of cost-estimating relationships. The rate at which consumable resources are used will affect supplies; the flow of clients will affect personnel, and facilities will have upkeep costs related to level of use. The relationships between cost and utilization are illustrated when calculations show that for a modest per-capita budget for health care, only a portion of the whole population would be covered by program services.

Output Calculations

Once the rates have been specified for calculation they are entered as inputs to the model. Then the program definitions and selected budgets can be entered, and output will permit comparison of varied program alternatives. There are three distinct types of output attainable from this model, and the policy-maker will select whatever is most relevant to present information requirements.

First, the tables of expenditures show what effects could be expected from each of the stated program options at each of several budget levels. Second, an analysis of effectiveness by budget level is prepared, and an envelope curve illustrates the combination of program components that are most effective in reducing mortality or disability days at stated budget levels. Finally, sensitivity analysis examines the ranking of preferred alternatives for health status improvement. Where the rank order appears to be sensitive to varying the input assumptions over a reasonable range, those input variables then become priority areas for further research.

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III. APPLICATION OF THE MODEL TO RURAL JAVA, INDONESIA

Background

As the Indonesian government further develops its rural health care system, important questions have arisen around the present standard of having a health center for each 50,000 persons. In rural areas the terrain and distance make utilization of one central facility too difficult or costly for a sizeable portion of the population. An increased number of points of contact are considered desirable: what kinds and how many would be effective? If subcenters were to be established, what would be their cost, what staffing patterns would be anticipated, and how much would the population utilize these services? Shortage and maldistribution of physicians is one of the problems the rural health development program would be trying to overcome. Perhaps village health workers would be an effective means for disseminating health services; what would be an effective ratio of such workers to population? What are the expected costs of these program options, and how does each service arrangement affect the disability days from illness and mortality rate of the population?

It was the government of Indonesia's interest in these questions which led to collaboration with an interdisciplinary team from The University of Michigan. *

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* A detailed report on the interaction can be read in the 1978 report on APHA Project: AID/ta-c-1320, On the Statistical Implementation of a Health Sector Resource Allocation Model in Indonesia.

Java, the most densely populated island in the world, with approximately 80 million people, was selected as the area for experimenting with the Health Sector Resource Allocation Model's use for rural health planning. Working with national, provincial, and district public health experts, the model co-efficients and assumptions were derived.

If one health center for 50,000 persons would not yield sufficient coverage of the population, the Indonesian government needs to know how to determine the number and types of contact points between the rural population and health care. Several combinations of health delivery were suggested for comparison: the single health center, a health center and subcenters, and village health workers of varied numbers per population unit of 50,000. The matrix which follows (figure 2) shows how these combinations of medical care were compared across varied levels of health promotional programs. Figure 3 illustrates how promotional programs may significantly reduce child mortality.

Specifying the Model for Rural Java

For over a year before this project began, an interdisciplinary team had been working on a descriptive model of a population's health patterns in developing countries. An expert on Indonesian experience, J.Jarrett Clinton, M.D., had set out figures on age-specific population, their respective attack rates for specific diseases, their respective mortality rates when not treated and expected rates of mortality when medical care was used. These were reviewed at a University of Michigan seminar

Figure 2

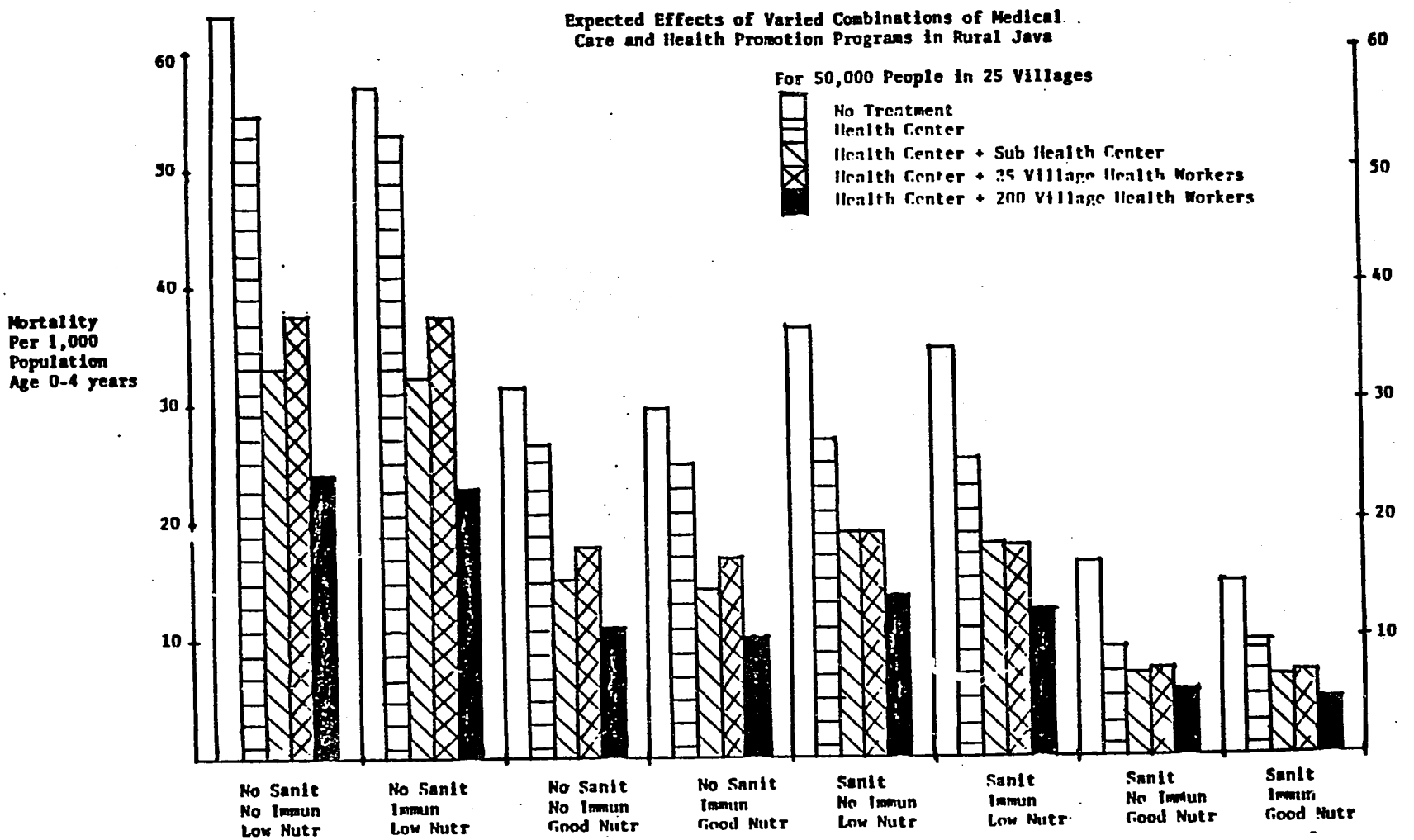
Seventy-two Combinations of Programs and Conditions of Developing Rural Public Health

Medical Care Service Organization Per Each 50,000 Population	Influencing Conditions							
	No Sanitation No Immunization Low Nutrition	No Sanit Immun Low Nutr	No Sanit No Immun Good Nutr	No Sanit Immun Good Nutr	Sanit No Immun Low Nutr	Sanit Immun Low Nutr	Sanit No Immun Good Nutr	Sanit Immun Good Nutr
1 Health Center (HC)								
1 HC, 8 Subcenters (SHC)								
1 HC, 8 SHC, 25 Village Health Workers (VHW)								
1 HC, 8 SHC, 200 VHW								
1 HC, 25 VHW								
1 HC, 200 VHW								
25 VHW								
200 VHW								
No Medical Care System Organized (NMC)								

Note: Entries in cells would be expected mortality by age group and days of disability per year expected given the assumptions on attack rates of diseases specified in model, utilization rates of services specified, and relationship between utilization and disability/mortality.

Figure 5

Expected Effects of Varied Combinations of Medical Care and Health Promotion Programs in Rural Java



Source: R. N. Grosse and J. L. de Vries, "Estimating the Costs and Effectiveness of Health Sector Policy Alternatives in Developing Countries," The University of Michigan, January 1978.

which included physicians, economists, planners, epidemiologists, and environmental health experts. Several of these were from developing countries, a few were Indonesian and all had had experience in the public health sector of rural development. The interactions and literature review of this group refined numbers and relationships between illness, treatment, and outcome; "disease profiles" for the population cohorts 0-1, 1-4, 5-14, 15-45, and 45+ were drawn.

A further check on the age-specific relationships and attack rates was made by sending the estimated rates for review to the U.S. Center for Disease Control in Atlanta. The questions and comments which this review contributed were particularly useful in discriminating incidence and fatality rates for specific diseases by age category.

If expert judgment and literature review were the interactive steps 1 and 2 of specifying the model, step 3 was clearly a check on the workability of those estimates. Step 3 involved running the model in the computer and carefully checking the output against control totals from published material such as Crude Death Rate for a region - clearly the combined mortality rates for all specified diseases should not sum to more than the known death rate!

At this point, in August of 1978, the University of Michigan team traveled to Indonesia, and the most interactive phase of specifying the model began. Just before the University of Michigan team visited Indonesia, the Center for Health Services Research and Development (P4K) in Surabaya had designated Kabupaten Tulungagung as the population base for a

household survey of health status and utilization of care for statistical implementation of the model. Such a preliminary study was carried out in July. Participation in that survey prepared regional health officials for useful discussions and suggestions for improvement of estimates on morbidity, mortality, and utilization.

This negotiation process for final specification of the model was extremely dynamic - each disease profile was reviewed age group by age group and experience at successively more local levels was incorporated into the estimated numbers. It was reassuring that frequently there was close correspondence between the University of Michigan lists, the Surabaya figures, and the local experience. Where the independently derived estimates did not match, careful negotiation continued until mutually acceptable figures were achieved. Local leaders were most helpful in adding to the list of specified health problems certain disease categories which had not previously been included. A final list of thirty-one conditions was developed with full specification of age-specific attack rates, utilization of care, and outcome rates of disability and mortality estimated for each.

Part of the plan for practical use of functional models to inform public decisions is that the input data be as current and accurate as possible. Ideally, this would be derived from an ongoing sample survey to monitor rates and numbers relevant to the model. Although the report offered below is *not* based on empirical data from such a survey, the estimates used are felt to be the *best approximations* attainable as a starting

point. As explained earlier, this model illustrates how cost/effectiveness comparisons can be made using computer calculations; as more specific data becomes available, they can be incorporated to improve the accuracy of the output.

Once the estimated disease profiles were established, including the expected mortality and disability rates with and without utilization of medical care and promotional programs, then the decision rules for guiding effectiveness calculations were specified. At any given level of expenditure for a five year period, there may be insufficient funds to put into place and operate a program alternative for each 50,000 of the population. As the recent policy of the Government of Indonesia has been to provide a physician-directed health center for every 50,000 people, in those alternatives for which a health center was specified, every 50,000 population in the region was assumed to have a health center *before* the other program elements (subhealth centers, village health workers, promotional programs) were added. These elements were added only so far as funds would permit. Thus, in many of the alternatives at the lower expenditure levels part of the population is covered only by health centers while another part of the population has other health service elements as well. The more expensive these elements, at any total expenditure level, the smaller the proportion of the population which would have access to them.

As a consequence then, of fund limitations, the lack of apparent effectiveness of a particular alternative may lie largely in its inadequate coverage caused by its costs, rather than its intrinsic capacity. These issues are discussed further in sections below.

The current report does not include time-phasing of programs. Further work on time-phasing would be expected to consider constraints on health manpower and training capacity. When demands of a program were heavily taxing training or supply of personnel, then effectiveness of particular alternatives would be expected to decline as coverage of the population would be reduced. Calculations on these factors were not yet completed for inclusion in this report, but are receiving attention in further development of the model.

An important element in the use of the model for planning is the capacity to manipulate many conceivable programs. The estimated input conditions or decision rules can be altered, and outcomes generated inexpensively; several options can be rejected without requiring program investment. Options which seem most effective for a given budget from the computer output would not necessarily be verified exactly in field experience, but field experience can be used to continually improve the relationships set into the model. The use of sensitivity analysis points out where such improvements are most critical.

IV. OPERATION AND INTEPRETATION OF THE MODEL FOR RURAL JAVA, 1978

The procedures surrounding the development of inputs for a health sector model have been described in preceeding chapters as a combination of literature review, expert judgement, and local empirical experience. In this section the actual numbers used for the operation of the model are introduced and their arrangement is explained. Detailed tables and graphs are available as specific appendices. As mentioned earlier, these numbers are the most accurate estimates currently available of the expected values. They are, however, subject to estimating error as well as to change over time. After the introducing "inputs" and "outputs", the tentative conclusions and comparison of alternatives are presented with sensitivity analyses and recommendations for improving the model's usefulness as a policy planning tool.

It is important to bear in mind certain constraints on the model's usefulness. Some categories of inputs which make a significant difference in the outcomes are summarized here. Politically, program options which did not include a Health Center for each district did not seem viable alternatives. Therefore, with a health center in the budget for each 50,000 population district, all remaining program components had to be considered as additions to - not substitutes for - a Health Center.

Geographically the study area is composed of coastal areas rising into a central mountain range, with population spread out in small hamlets; when a village is located at great distance from a Health Center, there is low probability of utilization by that part of the "covered" population. Since effectiveness measures are based on the difference between treated and untreated mortality and disability rates, the issue

of accessibility is central to the model's use.

Epidemiologically, the incidence of certain diseases is affected by nutrition, sanitation, and immunization or chemical prophylaxis. Some potentially useful program components were not included in the 1978 rural Java specifications because the government was not considering their use; these included measles immunization (requiring refrigeration), and malarial chemoprophylaxis. In understanding the inputs it is essential to realize that both medical care and programs such as immunization are only tested as specified below, not as generalized assessments of that type of intervention.

Note that this model uses disease states rather than infections as the variables of interest. Some infections may be endemic in the population, but here the attention is on conditions which produce notable maladaption to living in the environment. Given the conditions within East Java, the conditions which might be affected by health intervention programs were estimated, using Kabupaten Tulungagung as the area for specific field checking. In order to analyze the health system, units of population numbering 50,000 were taken for developing rates. This population would be distributed in approximately 25 villages. The operation of the model is explained as (A) inputs, (B) outputs, (C) comparisons, (D) sensitivity analyses and interpretation.

A. THE INPUTS

Information necessary to the specification of a cost-effectiveness model for health programs was designated as follows (in order of explanation):

Population per age cohort,

Attack rates of identified diseases (given no new programs of health promotion),

Public health promotional programs: specifications and expected effects,

Medical care: nontreatment or utilization of varied sources of care and clinical prognosis of disability days and case-fatality rates for each,

Cost estimates for each program component,

After the expected utilization and effects of various programs had been estimated, a disease profile was generated for each of the alternative health programs considered. These disease profiles, then, became inputs for comparing the effectiveness of combinations of programs under alternative budgets. (See pages 10-11 for symbols and summation equations.)

1. Attack Rates for Population Cohorts by Disease

The age distribution for each area of analysis is shown in Table 1.

TABLE 1

Age Distribution Estimated for Each 50,000 Persons

Age Group	Number (rounded to nearest 100)	Percent of Population
0-1	1,500	3
1-4	7,000	14
5-14	13,000	26
15-44 Male	10,500	21
15-44 Female	11,000	22
45+	7,000	14
	50,000	100

(Source: P4K, Surabaya; population breakdown for East Java, 1975)

The classification of diseases used in the model was developed over a period of many months through the efforts of international and multi-disciplinary experts as described on pages 19-20. The list of 31 diseases which was finally utilized in the model covers over 90 percent of the disabilities and deaths in rural Java. The list was translated into local terms, or—where no local term was known—into a description of the symptoms. This mutually understood disease list was essential for the field checking in Tulungagung where estimates of experts were linked with the experience reported by the local population. The disease list used in the model was the following:

English Term	Indonesian Term
1. Lower Respiratory Infection	Radang paru-paru
2. Upper Respiratory Infection	Influensa, Watuk-Pilek
3. Otitis Media	Kopoken
4. Skin Diseases	Gudig, Borok, Eksim
5. Mild Diarrhoea	Ngebrek, Mencret, Murus
6. Severe Diarrhoea	Mencret-Mencret, Murus-Murus
7. Tuberculosis	Kematus
8. Malaria	Panas Tis, Malaria
9. Diptheria	symptoms
10. Tetanus	Seqan Kayu
11. Pertussis	symptoms
12. Measles	Gabag, Campak
13. Burns	Kobong, Desiram Banyu Panas
14. Fracture	Balung Tugel
15. Cuts	Kebacok
16. Anaemia	Pucet
17. Malnutrition	symptoms, Beri-Beri
18. Intestinal Parasites	Cacingan
19. Chronic Heart Disease	Symptoms: Menggeh-Menggeh
20. Cerebro-Vascular Disease	Mati Separo, Lumpuh Separo
21. Complication of Pregnancy and Child Birth	Kluron-(means abortion)
22. Typhoid Fever	Tipes
23. Hepatitis	Kuning
24. Conjunctivitis	Beleken
25. Rheumatic Fever	Encok
26 Varicella	Cangkrangen (virus)
27. Mumps	Gondong
28. Gonorrhoea	Kencing Nanah
29. Goiter	Gondok (endemic)
30. Vit. A Deficiency	symptoms
31. Dental Health	Panyakit Gigi Dan Mulut

Attack rates were estimated for each age group. These are presented as times per year a person in a given age group contracts the condition: there is a probability aspect to the attack rate. Over the entire age cohort the incidence of the disease is expected to affect individuals with this frequency. While age is not a significant variable in all conditions, age has an effect on the incidence of most diseases as well as on the progress of the person affected and the action taken to counteract the symptoms. Appendix A lists the incidence rates for the 31 diseases with no new promotional programs as well as the expected incidence under several combinations of health development strategies.

Three public health promotional strategies are introduced next, with their expected effects on direct reduction of disease incidence or case fatality rate (the proportion of those contracting disease who die from the condition).

2. Public Health Promotional Programs

Before consideration of the various combinations of medical care, it is important to assess the impact on health which might occur under various public health measures such as improved sanitation, nutrition, or immunization.

The descriptions below propose specific programs, which were the basis for cost and effect calculations. Effectiveness calculations are based on levels expected after five years of operation. As explained above, these programs are designed for the population units of 50,000 persons used for analysis.

Sanitation—house connections for safe drinking water and latrines:

- Water supply with at least one tap that brings not less than 30 gallons/person/day to the kitchen of each house,

- Drainage systems that carry waste water from bathing and cooking away from the village,

- A pour-flush latrine or pit latrine near each house. (Pour-flush latrines would be more accepted and are more efficient as they can be put near the house because of lack of odor.)

Nutrition Intervention—food supplement program which is expected to reduce the current levels of childhood malnutrition by 60 percent within five years of program initiation. One midwife/supervisor would coordinate:

- A program of health education for mothers about nutritional problems,

- Weighing and measuring children,

- Supplemental food (soy flour) for 1,600 children 0-2 years and 2,500 pregnant/lactating mothers with first or second degree malnutrition.

Immunization—children and mothers for four basic diseases. Three auxiliary nurses or auxiliary midwives with three local assistants per district would provide annually:

- 18,500 DPT shots (3 basic; booster at one year and five years)
- 6,600 BCG shots (1 basic; booster at ten years)
- 6,700 Smallpox vaccination (1 basic; booster at five years)
- 2,100 Tetanus toxoid (1 for pregnant women)

33,700

Note on nutrition and vaccine effectiveness. The World Health Organization EPI Program Document states that the percentages of effective protection resulting from giving vaccinations are: Diphtheria and Tetanus - 95%; Pertussis - 80%. There has been some indication in recent literature that the effectiveness of the vaccine is also related to the nutritional status of the children vaccinated. Although there is a certain amount of malnutrition in East Java, no allowance has been made for a reduction of vaccination effectiveness due to this nutritional factor. This may be an important area of consideration, and further research in this area should try to document and quantify this relationship.

Note on nutrition and effects of disease. In the East Java case, only the disease states of severe Diarrhea, mild Diarrhea, and Measles are assumed to be affected by the reduction of malnutrition in the children. Other diseases besides those indicated would also be affected, both in terms of occurrence and severity. Some of the other diseases considered in the East Java case which might be affected are: the occurrence and severity of Lower Respiratory Infection.* More research into the nutritional link is called for to establish the relationship of malnourishment on incidence and duration of Intestinal Parasites, Tuberculosis, Anemia, Vitamin A Deficiency, Otitis Media, and Lower and Upper Respiratory Infection.

The expected effects from these three public health promotional programs are given in tabular form on the following 3 pages.

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* David Morley, Paediatric Priorities in the Developing World, Butterworths, London, 1973, p. 197.

TABLE 2: SANITATION AND REDUCED INCIDENCE OF SPECIFIC DISEASES

		Before Sanitation Improvement Incidence Per Person Per Year[1]	With Sanitation Incidence Per Person Per Year[2]
Skin Disease	0-1 Year	.05	.020
	1-4	.10	.040
	5-14	.05	.020
	15-44m	.05	.020
	15-44f	.02	.008
	45+	.02	.008
Mild Diarrhea	0-1 Year	3.0	1.2
	1-4	3.0	1.2
	5-14	1.0	.4
	15-44m	1.0	.4
	15-44f	1.0	.4
	45+	1.0	.4
Severe Diarrhea	0-1 Year	.40	.0600
	1-4	.50	.0750
	5-14	.05	.0075
	15-44m	.05	.0075
	15-44f	.05	.0075
	45+	.05	.0075
Intestinal Parasites	0-1	.01	.003
	1-4	1.00	.300
	5-14	1.00	.300
	15-44m	.20	.060
	15-44f	.20	.060
	45+	.20	.060
Typhoid	0-1	0	0.
	1-4	.202	.0060
	5-14	.010	.0030
	15-44m	.005	.0015
	15-44f	.005	.0015
	45+	.005	.0015
Hepatitis	0-1	0	0
	1-4	.006	.0024
	5-14	.010	.0040
	15-44m	.004	.0016
	15-44f	.004	.0016
	45+	.004	.0016

1. Disease Profile, Tulungagung, Indonesia. (See Appendix A, Attack Rates.)

2. Saunders and Warford, Village Water Supply, World Bank, Washington, D.C., 1976, p. 114; from White, Bradley, and White, Drawers of Water, p. 191.

TABLE 3: NUTRITION PROGRAM EFFECTS ON SPECIFIC DISEASES

	Incidence Per Person Per Year with Current Nutritional Level	Incidence Per Person Per Year with No Malnutrition	Incidence Per Person Per Year with Malnutrition Reduced 60%[3]
Mild Diarrhea[1]			
0-1 year	3.0	.75	1.65
1-4 years	2.0	.50	1.10
5-14 years	1.0	.25	.55
Severe Diarrhea[1]			
0-1 year	.4	.220.	.292
1-4 years	.5	.275	.365

	Case Fatality Current Nutritional Level		Case Fatality No Malnutrition		Case Fatality with Malnutrition Reduced 60%	
	With Treatment at a Health	No Treatment Center	With Treatment at a Health	No Treatment Center	With Treatment at a Health	No Treatment Center
Measles[2]						
0-1 year	5.00	20.00	1.250	5.00	2.750	11.00
1-4 years	.50	5.00	.125	1.25	.275	2.75
5-14 years	.50	1.00	.125	.20	.275	.55

Footnotes:

1. Scrimshaw, Taylor, and Gordon, Interactions of Nutrition and Infection, World Health Organization, Geneva, 1968.

2. David Morley, Paediatric Priorities in the Developing World, Butterworths, London, 1973, p. 207.

3. Sojogyo, Nutrition Guidance Project for Village Population: Report for Second Year (1976/77), Agricultural Foundation. 1976.

   William D. Drake and Luis F. Farjardo, The Promotora Program in Candeloria: A Colombian Attempt to Control Malnutrition and Disease, 1968 -1974, Cali, Colombia, Community Systems Foundation, 1976.

TABLE 4: EFFECTS OF IMMUNIZATION ON SPECIFIC DISEASES

	Unvaccinated[1]	Vaccinated[2]
Tetanus		
0-1 year	.0213	.001100
1-4	.0010	.000050
5-14	.0006	.000003
Whooping Cough		
0-1	.01	.002
1-4	.05	.010
5-14	.01	.002
Tuberculosis		
0-1	.001	.001
1-4	.002	.002
5-14	.003	.003

1. Disease Profile, Tulungagung, Indonesia (See Appendix A: Attack Rates.)

2. World Health Organization Immunization Programming Manual, EPI/G/77.1, p. 2.I.3.

ADDITIONAL SOURCES

SANITATION

A.V. Hardy, M.D., "Diarrheal Diseases of Infants and Children," Bulletin WHO, 21:309-319 (1959).

Arthur C. Hollister, M.D., "Influence of Water Availability on Shigella Prevalence in Children of Farm Labor Camps," American Journal of Public Health, 45:354-362.

World Bank, Appropriate Sanitation Alternatives: A Technical and Economic Appraisal Summary Report, February 1979, P.O. Report No. Res. 20.

World Bank, Observations of Rural Water Supply and Sanitation Programs in Eight Developing Countries, P.O. Report No. Res. 42, Sept. 1978.

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Rybczynski, W., Polprasert, C., McGany, M., Low Cost Technology Options for Sanitation: A State-of-the-Art Review and Annotated Bibliography, International Development Research Centre, Ottawa, Canada, 1978.

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Feachem, Bradley, Garelick, Mara, Health Aspects of Excreta and Waste Water Management. London: Tri-Med, October 1978.

NUTRITION

Sri Kardjati, Kusin, J. A., de With, C, East Java Nutrition Studies Report I: Geographical Distribution and Prevalence of Nutritional Deficiency Diseases in East Java, Indonesia; School of Medicine, University Airlangga, Surabaya; Provincial Health Services, Surabaya; Royal Tropical Institute, Amsterdam, May 1977.

Kielmann, Taylor, Desweemer, Uberoi, Takulia, Masih Vohra, The Narangwal Experiment on Interactions of Nutrition and Infections: II. Morbidity and Mortality Effects, supported by Indian Council of Medical Research, WHO-H9/181/23.

Rohde, Jon Eliot, The Mother as Primary Health Care Worker: Training her and her Trainers. Gajah Mata University, Jogjakarta, 1977.

Sayogyo, USAHA Perbakan Gizi Keluarga: ANP-Evaluation Study, 1973, Departemen Kesehatan, Jakarta, 1975.

IMMUNIZATION

Expanded Programme on Immunization, Programming Manual. Geneva: World Health Organization, EPI/G/77.1.

J. M. Mahieu, Summary of a Study on the Operational Feasibility, Coverage and Costs of Maintenance Immunizations in Children by District Mobile Teams in Kenya. Geneva: World Health Organization, EPI/WG/76.16.

I. F. Setiady, Progress Report on the Implementation of the Expanded Immunization Programme (Preparatory Period) in Indonesia. Geneva: World Health Organization EPI/WG/76.16.

Berman, J. G., Coffi, E., Bomba-Irek, R., Foster, S. O., Herrmann, K. L., "Evaluation of a Measles-Smallpox Vaccination Campaign by a Sero-Epidemiologic Method," American Journal of Epidemiology 102(6), 1975, pp. 564-571.

3. Medical Care Services: Utilization and Effects

Utilization of medical care services is expected to increase with ease of access to a source of trained personnel. For each region of 50,000 persons, the following kinds of medical care delivery components were entered into the model:

+ a Health Center
+ 8 Sub Health Centers
+ 25 Village Health Workers
+ 200 Village Health Workers

These delivery arrangements could be separate, in combination with each other, and in combination with public health promotional programs. For purposes of this study, only those alternatives which included a Health Center were analyzed. This decision rule is critical to the comparisons of budget allocations and effects which are presented as output of this model. It means that for many budget levels, additional components of care do not reach 100% of the population.

The proportion of ill seeking care is expected to vary with the proximity of services. As the number of contact points are increased (e.g., by adding more Village Health Workers), the utilization rates would be expected to rise. The effectiveness of treatment, however, would not be expected to rise in direct proportion to number of contact points due to differences in level of training and effects of the procedures delivered. The Case Fatality Rates estimated as measures of effect and expected utilization rates are central to the outcomes of the model because the differences in mortality and days of disability between

treated and untreated disease occurrence is the basis for comparing alternative programs (see effectiveness, below). The proportions of each age group expected to utilize each type of medical service for each disease is shown in Appendix B.

Effectiveness estimates for different components of the medical care delivery system are shown in Appendix C. The disability level is measured in days lost annually by persons contracting the disease with treatment (DLRX) and with no treatment (DLNRX); mortality from a disease is measured as Case Fatality Rate (CFRX) with treatment, and without treatment (CFNRX): this is the number of people who are expected to die of a condition for each 100 who have the disease. Table 5 illustrates the utilization rates and the expected effectiveness rates for a selected disease extracted from Appendices B and C.

TABLE 5

ESTIMATED UTILIZATION AND EFFECTIVENESS OF SERVICE ALTERNATIVES FOR

LOWER RESPIRATORY INFECTION

	Expected Proportion of Cases Utilizing Source of care(1)			Effectiveness Measures: Days Lost Per Year Per Case (2)			Effectiveness Measures: Fatality Rate Per 100 Cases (3)		
	HC	VHW		HC	VHW	NO CARE	HC	VHW	NO CARE
Lower Respiratory Infection		(25)	(200)	(DLRX)		(DLNR)	(CFRX)		(CFNRX)
Age 0-1	0.1	0.5	0.8	10	13	25	0.2	4.16	20
1-4	0.1	0.5	0.8	10	13	25	0.2	2.16	10
5-14	0.1	0.5	0.8	10	12	20	0.2	1.16	5
15-44m	0.1	0.5	0.8	10	11	15	0.05	.64	3
15-44f	0.1	0.5	0.8	10	11	15	0.05	.44	2
45+	0.1	0.5	0.8	10	11	15	0.05	1.04	5

The figures on utilization and effectiveness were based on (and/or developed from) these sources:

1. L.A. Gunawan, Pardoko, Sumartono, Sutejo, Susdo, Martodipuro, Rahanto, Household Survey in Karanganyar Regency (Central Java), 1973, P4K.

   Hari Sutedjo, Sumartono, Gunawan et al; Studies in the Health Care Delivery System in Four Health Centers in East Java, Surabaya: National Institute of Public Health, 1975.

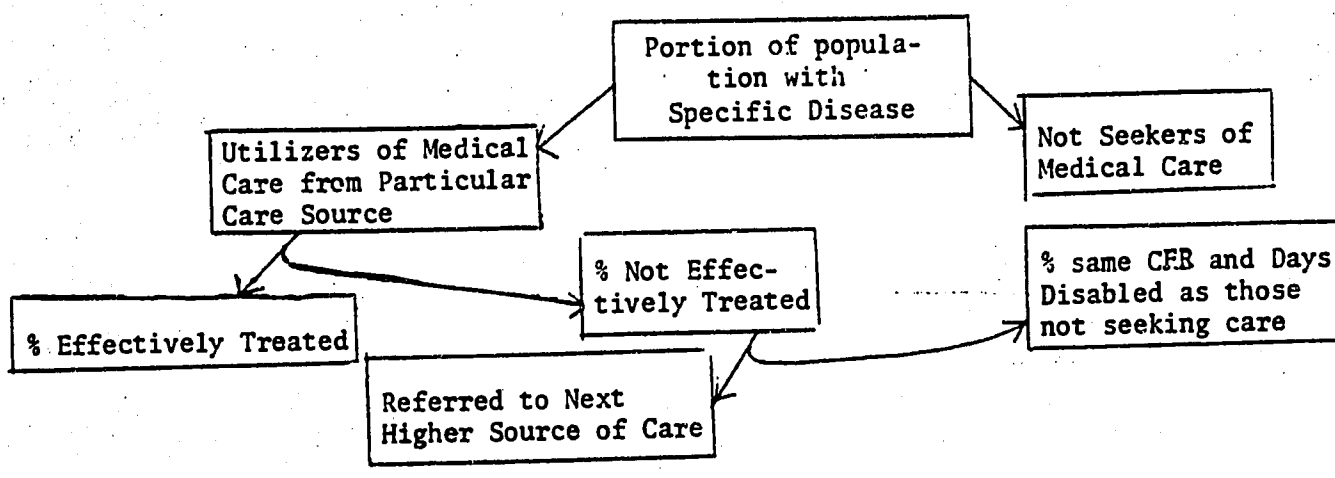
   Sulianti Saroso, Julie and Ratna Liana Pundarika, Household Survey in Indonesia (undated).

2. These physicians contributed to the disability estimates: Henry Pardoko, Suharto Wijowidagdo, Berlian T.P. Siagian, and Jan deVries.

3. Ministry of Health, Jakarta August 20, 1977: Third Five Year Plan. (Keadaan Status Kesehatan Masyarkat Dan Faktor Lingkongan Fisik, Biologis Serta Sosial Dan Budaya).

Since the effectiveness in treatment is expected to diminish as levels of training change from Health Center to Sub Health Center to Village Health Worker, an estimated referral rate was developed disease by disease. This is the percent of patients who could not be treated effectively and would be sent on to the next higher source of medical care. A referral rate at or near zero means approximately equal effectiveness expected from each source of care; if people utilize a source of care, at least a portion of those seeking care would need to be sent onto the next higher level for treatment. The referral rate, then, reflects the difference between sources of care on their effectiveness rates. Figure 4 illustrates the flow of patients through sources of care or non-utilization of services when ill.

FIGURE 4
DIAGRAM FOR VISUALIZING THE RELATIONSHIPS OF UTILIZATION & EFFECTIVENESS



The relationships among utilization, referral, and relative effectiveness of various sources of care are built into the model and result in output on effectiveness of alternative programs.

4. Costs of Programs

The requirements for delivery of public health promotional programs and medical services have been specified in sufficient detail so that their costs could be estimated. The details appear in Appendix D; the definitions cover staffing, rate of utilization, facilities, equipment, supplies, and training needed to establish and operate the programs compared in this report.

A Health Center, for example, would be managed by a physician, and would have an annual operating cost of $16,200; initial investment costs to begin a program of a Health Center for 50,000 population would be $64,300. If eight Sub Health Centers were to be included in a health development program, they would each be staffed by one trained medical paraprofessional. An annual budget of $14,870 would operate the eight offices, and an investment of $84,080 would launch them. Our analysis looks at costs over five years; this permits inclusion of start-up costs and considers the fact that utilization of a program by the population may not be established until implementation is fully realized. The annual cost, then, should be interpreted as average yearly cost of fully functional program.

In calculations of costs, only the Health Centers were assigned an income from fees. It would, of course, be possible to collect fees for other types of health programs. The costs used here for specifying the model were the estimated budget outlays for each type of program alternative.

B. DISEASE PROFILES (output from rates, input for comparisons)

For 48 program combinations a complete profile of utilization and effect was generated by computer from the inputs explained above. An example of the output is given on the next page (Table 6) and in Appendix E. Reading from left to right, the profile shows the following information for the 31 diseases by age cohort:

ATTACK RATE	The incidence expected annually by each person in age cohort
INCIDENCE IN POPULATION	Number of persons in age cohort expected to contract disease in a year
XPSC	The percent in each age cohort who seek medical attention
NUSC	The number in each age cohort who seek medical attention
VC	Visits per case: expected visits per case to medical attention rounded to nearest whole number
TOVC	Total visits for care: annual number of visits for all cases seeking care
DLRX	Days lost with treatment: annual disability days when medical attention is received for a case of this disease
DLRNRX	Days lost without treatment: annual disability days from this disease per case if untreated
X	Total days lost to disability when this disease is treated: annual total for the age cohort
Y	Total days lost when this disease is untreated: annual total for this age cohort
CFRX	Case fatality rate when treated: percent of those in age cohort who contract disease for whom a case is fatal with receipt of medical care
CFNRX	Case fatality rate when no medical care is received: Percent of cohort for whom a case of disease is fatal with receipt of medical care
S	The number of deaths in cohort, treated
R	The number of deaths in cohort, untreated
S & R	The total mortality expected in age cohort expected from this disease

Table 6: Disease Profile Sample: Health Center Only, No Promotional Programs

RATE=ANNUAL RATE
INC.=ANNUAL INCIDENCE
NUSC=NU.SEEKING CARE
XPSC=PROPORTION SEEKING CARE
VC=VISITS PER CASE
TOVT=TOTAL NU. VISITS
DLNRX=DAYS LOST PER CAPNRX
X=TOTAL DAYS LOST RX
GOT=NU. NONEFFECTIVE PICKED UP HC. SHC
Y=TOTAL DAYS LOST NRX
X+Y=TOTAL DAYS LOST
CFRX=CASE FATALITY RATE RX
CFNRX=CASE FATAL. RATE NRX
S=DEATHS RX
R=DEATHS NRX
S+R=DEATHS TOTAL

	RATE	INC.	XPSC	NUSC	VC	TOVT	DLRX	DLNRX	X	Y	X+Y	CFRX	CFNRX	S	R	S+R	
LOWER RESPIRATORY INFECTION																	
0-1 YEAR	0.1000	150	0.10	15	2.	30.	10.	25.	150.	3375.	3525.	0.2	20.0	0.0	27.0	27.0	
1-4 YEAR	0.0500	350	0.10	35	2.	70.	10.	25.	350.	7875.	8225.	0.2	10.0	0.1	31.5	31.6	
5-14 YEA	0.0100	130	0.10	13	2.	26.	10.	20.	130.	2340.	2470.	0.2	5.0	0.0	5.8	5.9	
15-44 MA	0.0050	52	0.10	5	2.	8.	10.	15.	50.	705.	755.	0.1	3.0	0.0	1.4	1.4	
15-44 FE	0.0100	110	0.10	11	2.	17.	10.	15.	110.	1485.	1595.	0.1	2.0	0.0	2.0	2.0	
45+ YEAR	0.0300	210	0.10	21	2.	32.	10.	15.	210.	2835.	3045.	0.1	5.0	0.0	9.4	9.5	
		1002.				182.					19615.						77.3
UPPER RESPIRATORY INFECTION																	
0-1 YEAR	3.0000	4500	0.10	450	1.	585.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	2.0000	14000	0.10	1400	1.	1680.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.5000	6500	0.05	325	1.	390.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.5000	5250	0.0	0	1.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	1.0000	11000	0.0	0	1.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	1.0000	7000	0.0	0	1.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		48250.				2655.					0.						0.0
OTITIS MEDIA																	
0-1 YEAR	0.0200	29	0.10	2	1.	2.	15.	30.	30.	810.	840.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.1000	700	0.10	70	1.	84.	15.	30.	1050.	18900.	19950.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		729.				86.					20790.						0.0
SKIN DISEASE																	
0-1 YEAR	0.0500	75	0.01	0	1.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.1000	700	0.05	35	1.	34.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0500	650	0.10	65	1.	72.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0500	525	0.10	52	1.	57.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0200	219	0.10	21	1.	23.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0200	139	0.10	13	1.	14.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		2308.				205.					0.						0.0
MILD DIARRHEA																	
0-1 YEAR	3.0000	4500	0.04	179	1.	251.	3.	4.	537.	17284.	17821.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	3.0000	21000	0.04	836	1.	1175.	3.	5.	2517.	100805.	103322.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	1.0000	13000	0.04	519	1.	727.	3.	5.	1557.	62405.	63962.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	1.0000	10500	0.04	419	1.	587.	1.	1.	419.	10081.	10500.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	1.0000	11000	0.04	439	1.	615.	1.	1.	439.	10561.	11000.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	1.0000	7000	0.04	279	1.	391.	1.	1.	279.	6721.	7000.	0.0	0.0	0.0	0.0	0.0	
		67000.				3744.					213605.						0.0

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For each disease the following variables are summed for the whole population; these values are shown as the last line of each disease age breakdown:

- annual incidence in population of that disease
- annual disability days from disease
- annual mortality from that disease

It is these totals which are particularly useful for comparing the relative impacts of different program components; the totals can also be compared with empirical evidence for checking the model's validity. Depending on what is of particular interest for comparison, the disease profiles can be sorted to show problems of a particular age group, a particular set of diseases, etc.

C. COMPARISON OF ALTERNATIVES

At the outset of this study a question was posed about the relative effects of a single Health Center for a population of 50,000 persons compared to the effects and costs of other components of a health care system.

The model's output is descriptive of multiple attributes: age, disability, death, utilization rates, referral rates and effectiveness of multiple care sources, costs. The user must choose a perspective relevant to the policy or the program questions of most importance. One

approach would be to focus on costs and the reduction of mortality across the whole population; another would be to narrow the attention to child mortality, or to focus on disability days.

If employment productivity is important, then comparisons which focus on the reduction of disability days among persons 15 to 55 years old would be of paramount interest. If reducing infant and childhood mortality is seen as an indicator of improved population health status, then mortality rates for ages 0-1 and 1-4 would be given priority attention.

One effect on policy choices that a computer model can have is to highlight areas where one public program will be expected to have an impact on others. Where program emphasis would be on sharp reductions in mortality of infants and children, allocations in the areas of schooling, employment, and housing would need immediate consideration unless birth rate reductions kept pace with the declining mortality.

Where geographic and political separations make distribution of benefits from Health Centers a problem, distribution questions must be addressed before comparing alternatives. Does the decision rule of viewing as alternatives only those plans where there is a Health Center for each 50,000 persons agree with political-economic realities? This rule's use has guided the comparison of alternatives below. What sort of budget constraints exist? What schedule for initiating change would be feasible, both for training and for socially acceptable innovation? Would certain types of improvement in health be more welcomed by the public than others? Given responses to these questions, the output from the model can be addressed from a chosen perspective.

1. Fixed Budget Programs

If a given amount of resources were distributed to health development, what would be the effect in terms of mortality rate and disability days? This question was tested on the 48 combinations of medical care delivery and public health promotional programs indicated below. Using the inputs described above, the computer model generated "equal cost cases" for each of the budgets shown on the right hand column below. Table 7 is a $10 per capita budget over 5 years; output shown in Appendix F provides details and lower and higher per capita outlays.

Six Medical Care Programs	Eight Promotional Programs	Twelve Per Capita Levels of Budget
1. HC-Health Center	1. None	2.06
2. HC, 8 SubHealth Centers	2. Sanitation	2.50
3. HC, 8 SHC, 25 Village Health Workers	3. Immunization	3.00
4. HC, 8 SHC, 200 VHW	4. Sanitation & Immunization	4.00
5. HC, 25 VHW	5. Nutrition	5.00
6. HC, 200 VHW	6. Sanitation & Nutrition	7.50
	7. Nutrition & Immunization	10.00
	8. Sanitation, Nutrition, & Immunization	12.50
		15.00
		20.00
		25.00
		30.00

The columns in Table 7 are explained on the next page. Notice the horizontal line on Table 7 indicating the program identified as "producing" the lowest crude death rate of 7.05. Nine dollars and fifty-eight cents would be needed to provide Nutrition and Immunization programs plus 25 Village Health Workers and a Health Center over 5 years. There would be $0.42 remaining for other uses, and 100% of the population would be covered by the programs.

EXPLANATION OF COLUMNS IN FIXED BUDGET PROGRAMS

MEDICAL CARE ALTERNATIVE PROGRAM: See list previous page.

PREVENTIVE PUBLIC HEALTH PROMOTIONAL PROGRAM: See list previous page.

COST: in $ per capita to operate that program alternative covering 100% of the population; this figure is the same at all budget levels because it represents the unstrained cost.

% ADD COVERAGE: Percent of population which could be covered by specifi combination on this budget.
NOTE: All budgets considered to cover 100% of population with a Health at $2.06 per capita; additional budget would cover some or all of the population with additional program component(s).

MORT.1000W/COV: Mortality rate for the whole population with medical care treatment (preventive program).

DII/CAP W/COV: Days of disability annually per capita for population covered by medical care.

EXCESS BUDGET: Amount remaining after full funding of the alternative; this amount, presumably, could be allocated to alternatives in or out of health sector.

MORTALITY BY AGE COHORT: Rate per 1000 for age cohorts, 0-1, 1-4, and 5-14.

DII: Disability days annually per capita for age cohorts 14-44, 45+.

TOTALS: Annual disability days per person (MORB) and total mortality (MORT) per 1000 population.

****
* EQUAL COST FOR INDONESIA TULUNG AGUNG EAST JAVA
* WITH A BUDGET FOR 5 YEARS OF 10.00 PER CAPITA
****

TABLE 7 - FIXED BUDGET PROGRAMS (OR, EQUAL COST CASES) $10 Per Capita Over 5 Years

*** COST IS IN U.S. DOLLARS ***

ALTERNATIVE	PV	COST	BAND COVERAGE	MORT/1000 A/C+V	DIT/C+P A/C+V	FALSE NEGATIVE	0-1 MORT	1-4 MORT	5-14 MORT	15-44 DIT	45+ DIT	TOTAL MORB	TOTAL MORT
1	1	2.00	100.00	10.97	11.36	7.94	103.95	28.26	2.67	3.64	5.48	11.36	10.97
1	2	10.86	56.71	7.00	6.54	0.0	94.18	20.16	1.98	2.74	4.57	8.65	8.76
1	3	3.41	100.00	10.23	10.41	6.59	85.88	27.44	2.40	3.64	5.48	10.91	10.23
1	4	17.47	51.52	6.34	6.14	0.0	70.08	20.48	1.91	2.82	4.65	8.67	8.58
1	5	6.06	100.00	9.36	10.15	3.94	83.32	21.15	2.67	3.64	5.48	10.15	9.36
1	6	20.06	44.11	6.28	6.13	0.0	83.65	20.51	2.13	2.94	4.77	9.05	8.90
1	7	7.47	100.00	8.02	9.71	2.53	65.26	20.33	2.40	3.64	5.48	9.71	8.62
1	8	19.41	45.76	5.54	5.84	0.0	74.62	19.85	1.99	2.91	4.75	8.76	8.49
2	1	5.61	100.00	8.40	10.55	4.39	83.78	18.74	1.85	3.36	4.98	10.55	8.40
2	2	19.61	45.24	5.83	6.13	0.0	85.43	19.76	1.89	2.82	4.57	8.49	8.65
2	3	7.02	100.00	7.84	10.11	2.98	69.16	18.27	1.69	3.36	4.98	10.11	7.84
2	4	21.12	41.88	5.27	5.69	0.0	80.68	20.20	1.88	2.89	4.63	8.98	8.58
2	5	9.61	100.00	7.21	9.46	0.34	67.89	13.66	1.85	3.36	4.98	9.46	7.21
2	6	24.61	36.84	5.16	5.72	0.0	85.09	20.37	2.04	2.98	4.73	9.28	8.83
2	7	11.02	88.62	6.66	9.01	0.0	59.03	14.90	1.80	3.39	5.03	9.28	7.15
2	8	22.46	37.99	4.60	5.28	0.0	78.95	19.95	1.95	2.96	4.71	9.05	8.55
3	1	7.35	100.00	6.83	10.51	2.65	84.00	21.06	2.02	3.36	4.95	10.51	8.83
3	2	21.35	41.16	5.71	6.05	0.0	84.80	20.51	1.99	2.80	4.63	9.17	8.80
3	3	8.70	100.00	8.22	10.07	1.24	68.27	20.52	1.82	3.36	4.95	10.07	8.22
3	4	22.76	38.36	5.09	5.61	0.0	80.12	20.83	1.96	2.94	4.69	9.15	8.72
3	5	11.35	85.47	7.58	9.41	0.0	72.66	17.55	2.11	3.40	5.03	9.69	8.08
3	6	25.35	34.09	5.11	5.64	0.0	84.90	21.09	2.11	3.02	4.78	9.41	8.47
3	7	12.76	74.21	6.97	8.97	0.0	65.13	18.56	2.04	3.44	5.09	9.58	8.00
3	8	24.70	35.07	4.50	5.20	0.0	76.83	20.69	2.02	3.00	4.76	9.20	8.70
4	1	15.49	59.12	6.45	9.27	0.0	79.74	18.70	1.98	3.31	4.84	10.13	8.30
4	2	29.49	28.45	4.53	5.34	0.0	87.67	21.06	2.12	3.05	4.74	9.63	9.11
4	3	16.[illegible]	53.50	5.47	8.83	0.0	73.84	14.37	1.94	3.34	4.90	10.01	8.24
4	4	30.90	27.53	4.94	4.94	0.0	84.44	21.86	2.09	3.08	4.77	9.59	9.04
4	5	19.49	45.55	5.69	8.39	0.0	80.05	19.53	2.14	3.38	4.98	10.00	8.56
4	6	33.49	25.26	4.13	5.06	0.0	88.01	22.19	2.19	3.13	4.83	9.76	9.24
4	7	20.90	42.14	5.10	7.94	0.0	75.38	19.99	2.10	3.40	5.02	9.92	8.50
4	8	32.84	25.88	3.54	4.01	0.0	83.72	21.94	2.13	3.12	4.82	9.62	9.00
5	1	4.17	100.00	8.97	10.54	5.93	85.34	21.35	2.06	3.40	5.05	10.54	8.97
5	2	18.17	49.29	5.76	8.07	0.9	81.38	18.97	1.87	2.76	4.51	8.75	8.40
5	3	5.54	100.00	8.32	10.10	4.42	88.90	20.74	1.83	3.40	5.05	10.10	8.32
5	4	19.54	45.32	5.14	5.04	0.0	75.75	19.43	1.83	2.83	4.58	8.76	8.31
5	5	8.17	100.00	7.70	9.44	1.34	88.23	15.92	2.06	3.40	5.05	9.44	7.70
5	6	22.17	39.48	5.15	5.20	0.0	81.44	19.43	2.03	2.94	4.70	9.11	8.07
5	7	[illegible]	100.00	7.05	9.00	10.42	51.75	-15.31-	1.83	3.40	5.05	9.00	7.05 *
5	8	21.52	40.48	5.50	5.21	0.0	74.55	15.40	1.91	2.91	4.67	8.85	8.33
6	1	12.12	78.93	6.94	9.44	0.0	74.93	16.70	1.83	3.30	4.88	9.84	7.79
6	2	25.12	33.00	4.75	5.50	0.0	88.23	20.82	2.05	3.01	4.73	9.43	8.92
6	3	13.54	69.22	6.31	9.06	0.0	87.29	17.58	1.77	3.34	4.95	9.72	7.74
6	4	27.53	31.17	5.16	5.06	0.0	82.16	21.00	2.02	3.04	4.77	9.39	8.84
6	5	16.12	50.47	6.08	8.56	0.0	75.92	17.90	2.07	3.40	5.05	9.77	8.21
6	6	30.12	28.40	4.32	5.17	0.0	88.40	21.51	2.14	3.10	4.84	9.61	9.09
6	7	17.54	51.11	5.45	8.11	0.0	70.17	15.03	2.01	3.42	5.09	9.69	8.14
6	8	29.47	28.97	4.07	4.73	0.0	81.30	21.19	2.06	3.08	4.82	9.44	8.46

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2. Identifying Preferred Programs

When a criterion is determined, such as Crude Death Rate or annual number of disability days, the program which is shown to produce the lowest rate is the "preferred" alternative. If two program combinations produce the same rate, they are declared "tied" for top ranking. (In Appendix F, an asterisk is placed next to the lowest Crude Death Rate shown in the far right hand column.)

Some of the uses of the Fixed Budget Program output are illustrated on the following two pages. Figure 5 is a matrix showing the disability days expected annually for all ages at the $20 budget. Note that the Health Center and 25 Village Health Workers plus Sanitation and Immunization is expected to reduce days to 5.6

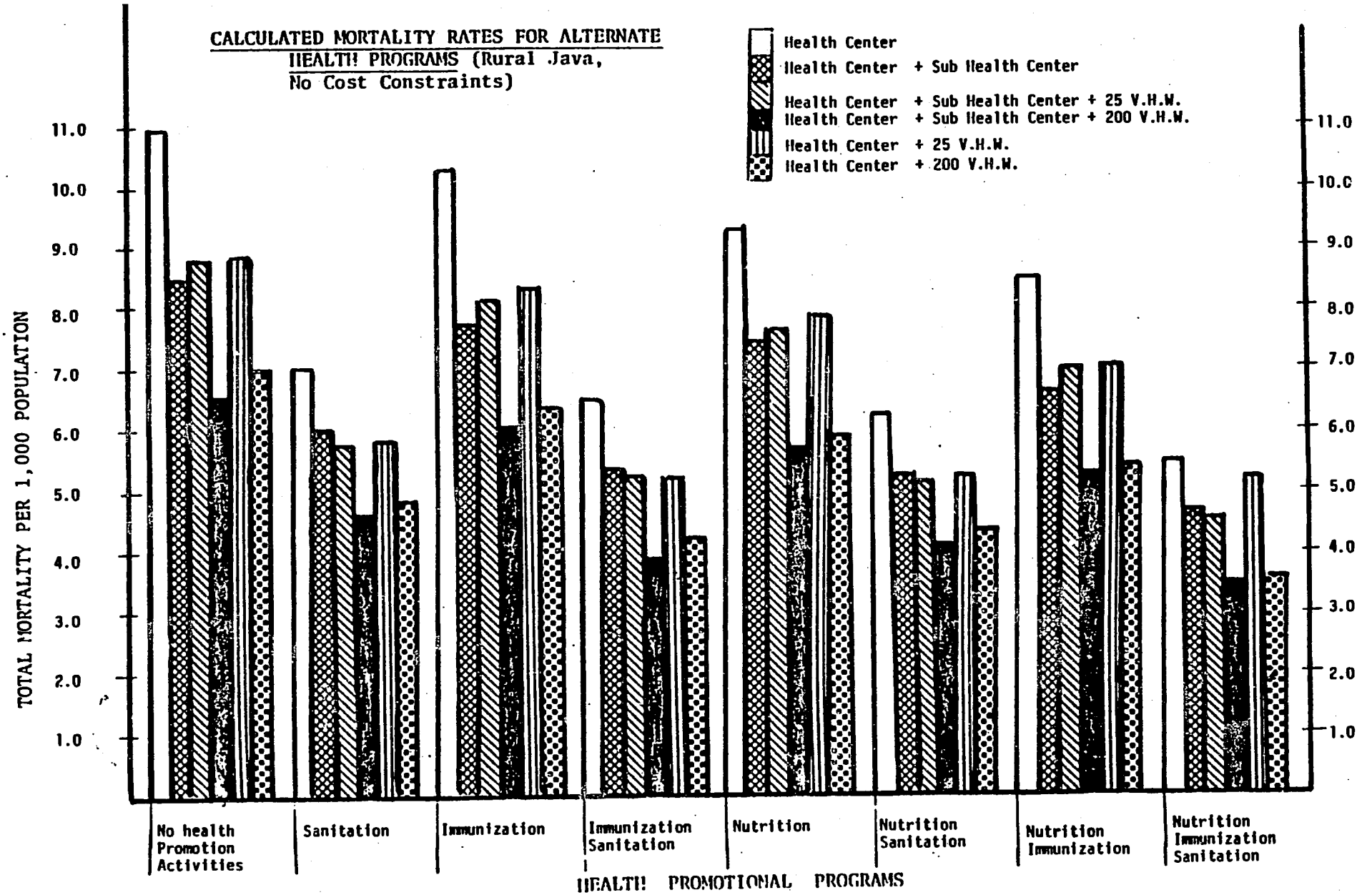
Figure 6 shows the expected mortality for the whole population where coverage is 100 percent and there are no budget constraints. To note the differences in program effect by age, Figure 6 can be compared to Figure 3 (page 20) where the programs were illustrated for the age cohorts 0-4 years.

FIGURE 5

TOTAL DAYS DISABLED ANNUALLY BY PROGRAM FOR BUDGET OF $20 PER CAPITA OVER 5 YEARS

Medical Care Service Organization Per Each 50,000 Population	Influencing Conditions							
	1 Low Sani No Immun Low Nut	2 Sani No Immun Low Nut	3 Low Sani Immun Low Nut	4 Sani Immun Low Nut	5 Low Sani No Immun Good Nut	6 Sani No Immun Good Nut	7 No Sani Immun Good Nut	8 Sani Immun Good Nut
1 Health Center (HC)	11.4	6.6	10.9	6.1	10.2	6.2	9.7	5.7
1 HC, 8 Subcenters (SHC)	10.6	6.1	10.1	6.0	9.5	6.7	9.0	6.1
1 HC, 8 SHC, 25 Village Health Workers (VHW)	10.5	6.4	10.1	6.4	9.4	7.0	9.0	6.5
1 HC, 8 SHC, 200 VHW	9.3	7.5	8.8	7.4	8.4	7.8	8.1	7.4
1 HC, 25 VHW	10.5	6.1	10.1	5.6	9.4	6.3	9.0	5.7
1 HC , 200 VHW	9.4	7.0	9.0	6.9	8.5	7.4	8.1	7.0

FIGURE 6


CALCULATED MORTALITY RATES FOR ALTERNATE HEALTH PROGRAMS (Rural Java, No Cost Constraints)
Health Center
Health Center + Sub Health Center
Health Center + Sub Health Center + 25 V.H.W.
Health Center + Sub Health Center + 200 V.H.W.
Health Center + 25 V.H.W.
Health Center + 200 V.H.W.
TOTAL MORTALITY PER 1,000 POPULATION
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
No health Promotion Activities
Sanitation
Immunization
Immunization Sanitation
Nutrition
Nutrition Sanitation
Nutrition Immunization
Nutrition Immunization Sanitation
HEALTH PROMOTIONAL PROGRAMS

There are many uses for the information provided in the Equal Cost Case output. The % ADDED COVERAGE column tells how widely the components additional to the Health Center could be distributed across the population. Programs with higher-cost components cannot reach large percentages of the population until the allocation of resources is adequate; thus at low budgets, the less expensive programs are favored because they cover a larger portion of the population than more expensive programs.

Once a program reaches full funding, delivering its full specifications to 100 percent of the population, it cannot become any more effective. When seeking to identify how far the relationship between investment and reduction of mortality could be carried before the downward trend in mortality would level off, the "fully funded" program combinations were generated to indicate expected mortality for each age cohort. These results are presented in Appendix G as "Cost Effectiveness Curves." In these displays no budget constraint is used and 100 percent population coverage is assumed. The difference between effectiveness of a program which is only accessible to a portion of the population is made explicit through Appendices F and G. The implications of the comparisons are developed in the next section.

Note: Since the magnitude of reductions in mortality rate varies by age, the curves in the Appendix G are shown on separate scales for various age cohorts. The infants vary from over 100 deaths per 1,000 to close to 20; the 1-4 year olds from over 20 to below 4; the 5-14 year olds from over 2 to close to 0.5; adult females from near 3.5 to about 2 and males between 13 and 10; adults over 45 show mortality rates of 11 to about 4—all of these as coverage by health system changes from Health Center only to increasingly costly combinations of medical care services and preventive programs.

Appendix G is interpreted by identifying, from left to right, the 8 entries for each medical care digit; once the 8 have been located, the n'th promotional program can be identified as shown on key. Beware! Numbers may be hard to find, such as when a 1 appears along a graph line composed of I's.

3. Analysis of Preferred Programs

Decisions about which program alternatives are preferable will, in part, be based on what resources are available in the budget. At each level of budget in our analysis, from $5 to $30 per capita over a five year period, the preferred program was identified according to the lowest computed crude death rate.

Throughout the range of budgetary levels examined, several generalizations emerge. One is that under the decision rule of one Health Center for each 50,000 population, *the use of Village Health Workers without SubHealth Centers produces the lowest mortality levels at almost every level of expenditure*. At the budget levels of $5, $10, $20 per capita, the 25 Village Health Worker alternative is preferable, while at higher levels, $15 and $30 per capita, the 200 Village Health Worker organization is preferred. The exception to this is at $7.50 per capita when SubHealth Centers are preferred, and at $25 when both SubHealth Centers with Village Health Workers and Village Health Workers alone are tied.

A second generalization is that *among the promotional/preventive programs, immunization is always preferred. Nutrition is next preferred as an additional program when budget permits. Sanitation is added only at the highest budget levels.*

A third generalization is that *almost every budget level has a different combination of medical care organization and promotional programs yielding the lowest mortality*. The exception is that the same combination of 25 Village Health Workers and Nutrition appears at the budget level of $20 per capita and $25 per capita.

The reason the ranking of programs varies by level of budget is that

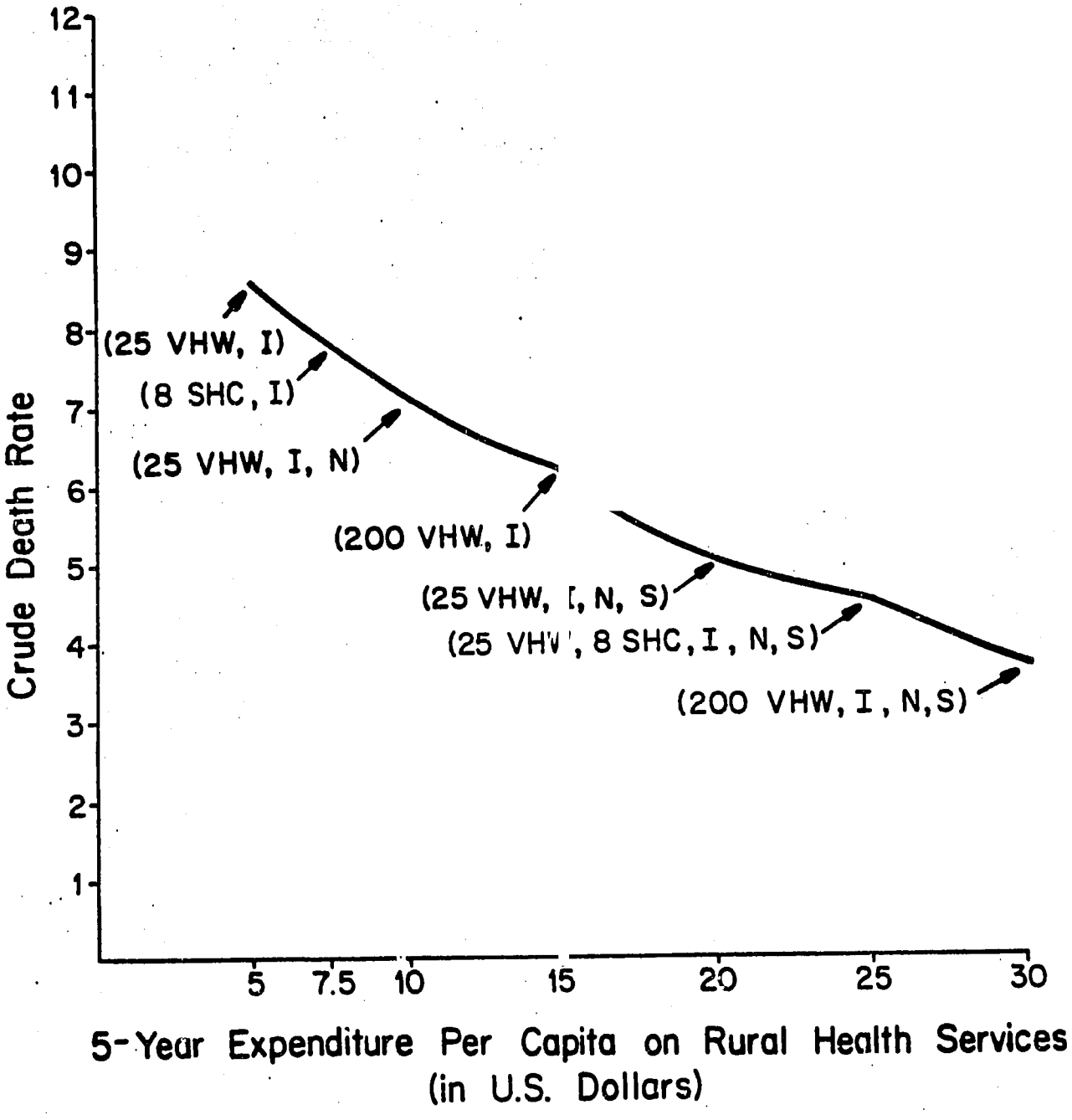
additional expenditure either increases the number of Village Health Workers or increases coverage of promotional programs which lowers computed mortality. Under tight budgetary constraints, there are insufficient resources to cover the whole population with expensive programs.

The five-year outlay of $2.06 per capita could cover a Health Center only; the budgetary outlays ranging from $5 to $30 are shown in Table 8 along with the various combinations of preferred programs added to the Health Center. Figure 7 illustrates the relationships of programs and levels of deaths-per-thousand by resources expended on health development. The programs identified are "producing" health effects at the most "efficient" point for the respective budget levels.

TABLE 8: PREFERRED PROGRAMS AT SEVEN BUDGET LEVELS

Five Year Outlays Per Capita (US$)	Minimum Crude Death Rate (per 1,000)	Preferred Program per 50,000 Population
5.00	8.8	Center, 25 Village Workers, Immunization Program
7.50	7.8	Center, 8 SubHealth Centers, Immunization Program
10.00	7.1	Center, 25 Village Workers, Immunization and Nutrition Programs
15.00	6.3	Center, 200 Village Workers, Immunization Program
20.00	5.0	Center, 25 Village Workers, Immunization, Nutrition, Sanitation Programs
25.00	4.5	Center, 25 Village Workers, 8 SubHealth Centers, Immunization, Nutrition, Sanitation Programs
30.00	3.7	Center, 200 Village Workers, Immunization, Nutrition, Sanitation Programs

Figure 7



Each rural health program plotted includes a health center plus one or more of the following designations:

25 VHW = 25 Village Health Workers
200 VHW = 200 Village Health Workers
8 SHC = 8 SubHealth Centers
I = Immunization
N = Nutrition
S = Sanitation

Should additional resources become available, either a more efficient health program could be implemented with additional resources, or additional resources could be allocated outside the health sector. Ideally we should calculate the effect of spending this "excess budget" on education, transportation, etc., so that we could measure the opportunity cost of selecting a health program which uses all the funds. Our model and our information does not permit such a calculation. What is shown are the increments in health status associated with increments in expenditure in the health sector. Whether these expenditures are worthwhile depends on the valuation of the health results relative to other national objectives.

The generalizations in this analysis of outcomes, while important and suggestive, cannot be fully accepted given the uncertainty of the inputs used in the model and the multiple criteria on which program alternatives could be ranked. Therefore, sensitivity analyses were performed to test the importance of uncertainty in these areas.

D. SENSITIVITY ANALYSIS

Sensitivity analyses were conducted to identify the important areas of uncertainty in the model, determine the implication of these results, and from these suggest research priorities for future collaboration on the model in developing countries. In theory, a sensitivity analysis can be general or selective. A general sensitivity analysis based on known probabilities of variables can be used to calculate the probabilities of any specific outcome from a given alternative. In a selective sensitivity analysis, as used here, estimates of selective assumptions are varied to determine the relative influence of their uncertainty on the conclusions of the study.

In our analysis, we altered the values of selected variables estimated in the model to determine which variables had the greatest impact on changing the ranking of program alternatives. We looked at the outputs used as criteria to determine preferences among rural health program alternatives and the inputs used to describe and quantify the effects and costs of program alternatives.

1. Sensitivity Analyses of the Criteria

In these analyses, the criteria used to rank the alternative health programs were crude death rate (all ages), infant mortality, days of illness (all ages), and days of illness for persons aged 15 to 44 years. The sensitivity of the rankings to the criteria indicates the importance of criteria selection for decision-making in the health sector. In the formation of health policy, the policy maker is faced with a variety of objectives, including lowering days of illness or lowering death rates among a specific

age group. The policy maker needs information to be able to compare expected outcomes under different criteria and choose which program alternatives are preferred under multiple objectives. (Multiple objectives are common to public programs where minimizing a single criterion may not match political realities.) Through paired comparisons of alternatives, policy makers can use the model as a *tool* for decision-making.

a. Ranking Under Alternative Criteria

When the ranking of the program alternatives was based on the criterion of crude death rate, Immunization ranked first among promotional programs, then Nutrition, followed by Sanitation. In medical services ranking, Village Health Workers were preferred over SubHealth Centers at budgetary levels of $5.00, $7.50, $10.00, $15.00, $20.00, and $30.00. At $25.00, SubHealth Centers and Village Health Workers are tied with Village Health Workers alone.

When the ranking of health programs was based on the criterion of infant mortality, the health promotional program preferred is Immunization at every budget level. At all budget levels except $5.00 per capita, Nutrition is also included. Sanitation is added to Immunization and Nutrition at high budget levels. Village Health Workers are preferred as the type of medical care over SubHealth Centers at all budget levels except $7.50 per capita. The only medical care preferred at $7.50 per capita is the Health Center.

The ranking of programs using the criterion of infant mortality differs slightly from the ranking by total mortality. When infant mortality is the criterion, Nutrition is a preferred program at more budget levels than when total mortality is the criterion. Diseases which are the highest

killers for infants (lower respiratory infection and severe diarrhea) are also the largest killers for the total population, which explains the similarity in the preferred programs under the criteria of crude death rate and infant mortality. In addition to lower respiratory infection and severe diarrhea, tetanus is a significant cause of death among infants. Since the fatality from tetanus can be reduced by an immunization program, the preference for immunization at all budget levels under the criterion of infant mortality is understandable.

The ranking of health programs using the criterion of days of illness was significantly different from the ranking by crude death rate. At budget levels of $7.50, $10.00, and $15.00, Sanitation is preferred with a Health Center only. At a budget level of $20.00 per capita, Village Health Workers are preferred with Sanitation and Immunization. At higher budgetary levels, Nutrition is added to the health programs.

When days of illness are examined for ages 15-44, Sanitation is preferred at every budget level, but Immunization is no longer preferred, presumably because 15-44 year olds are past the age where immunization would be effective.

b. Ranking Under Multiple Criteria

The application of the two criteria, days of illness and mortality, reduces the number of program alternatives for consideration by decision-makers. The choice at a particular budget level between Village Health Workers plus Immunization or Immunization plus Sanitation depends on the valuation given to reducing crude death rate compared to reducing days of illness. The health planner can systematically narrow the number of alternatives that policy makers have to compare, by identifying the "undominated" alternatives. By "undominated," we mean an alternative which is equal to

or superior to all other alternatives in at least one outcome attribute (mortality or disability). "Dominated" alternatives are those which are inferior to some other alternative in both days of illness and crude death rate. Dominated alternatives are eliminated from further consideration in the selection of preferred programs. Undominated program alternatives are "efficient" because it is impossible to find a different program alternative that improves the level of days of illness without increasing the crude death rate or vice versa.

For each budgetary level, we identified in Table 9 the undominated alternatives using the criteria of days of illness and crude death rate. At each budgetary level, one to six program combinations from among the 48 alternatives were undominated. Once the list of possible program alternatives has been narrowed to a small set of undominated alternatives, the decision-maker can apply relevant political criteria to the choice.

TABLE 9

UNDOMINATED PROGRAM ALTERNATIVES ACCORDING TO RATES FOR DAYS OF ILLNESS AND CRUDE DEATH RATES AT INCREASING BUDGET LEVELS

Budget Level per Capita Over 5 Years	Days of Illness per Person per Year	Crude Death Rate	Program Alternatives
$ 5.00	10.30	8.76	HC, 25 VHW, Immunization
$ 7.50	10.11	7.84	HC, 8 SHC, Immunization
	9.50	8.06	HC, 25 VHW, Nutrition
$10.00	8.65	8.76	HC, Sanitation
	8.67	8.58	HC, Sanitation, Immunization
	8.75	8.40	HC, 25 VHW, Sanitation
	8.76	8.31	HC, 25 VHW, Sanitation, Immunization
	9.00	7.05	HC, 25 VHW, Nutrition, Immunization
$15.00	6.95	7.37	HC, Sanitation
	9.00	6.31	HC, 200 VHW, Immunization
	6.98	7.08	HC, Sanitation, Immunization
	7.11	6.78	HC, 25 VHW, Sanitation
	7.13	6.64	HC, 25 VHW, Sanitation, Immunization
	8.63	6.36	HC, 200 VHW, Nutrition, Immunization
$20.00	5.63	5.11	HC, 25 VHW, Sanitation, Immunization
	5.69	5.01	HC, 25 VHW, Sanitation, Immunization Nutrition
$25.00	5.20	4.50	HC, 8SHC, 25 VHW, Sanitation, Immunization, Nutrition
	5.21	4.50	HC, 25 VHW, Sanitation, Immunization, Nutrition
$30.00	4.72	3.69	HC, 200 VHW, Sanitation, Immunization, Nutrition

2. Sensitivity Analysis of Inputs

The ranking of alternative rural health programs is determined by the interaction of numerous *inputs* (utilization rates, attack rates, cost calculations, and other values) about which there is considerable uncertainty. The stability of the program rankings to variations of the values of inputs within reasonable ranges, helps us to evaluate the relative importance of accuracy in the estimated inputs. Therefore, sensitivity analyses were performed to determine which inputs, when varied within such ranges, altered the ranking of alternatives at each budget level.*

When the ranking of the preferred program is sensitive to changes of the assumptions, then research to improve the accuracy of these inputs is indicated. Where ranking is insensitive to changes in assumed input values, within a reasonable range, greater precision is less important.

The preferred programs under the criteria of days of illness and crude death rate were identified in Table 9. In the sensitivity analysis, we tested the inputs that led to the ranking of Immunization, then Nutrition and the preference for Village Health Workers, with the criterion of crude death rate. Then we tested the inputs that led to the ranking of programs under the criterion of days of illness.

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* Technical note: To do the sensitivity analysis we changed the inputs in the computer program of the model to higher or lower values and generated the equal cost case outcomes. If a change in rankings did occur, we graphed this change to find the specific crossover point from the originally preferred program alternative to the newly preferred program alternative. (The crude death rate was the Y axis, and the input values were the X axis.) This crossover point was determined by plotting the crude death rate for the originally preferred program alternative under the old input value and the new input value at one budget level, and connecting these points; then the crude death rates for the newly preferred program alternative under the old input value and the new input value were plotted and connected. The point at which these two lines crossed was identified as the point at which a change in the preferred program alternative took place. Usually this crossover point varied with the budget level; the range for these crossover points defined the percents within which the change in rankings would occur.

In general, when crude death rate was the criterion, doubling the attack rate for diseases which cause the highest fatality produced no changes in the rankings. Halving the number seeking care for severe diarrhea, mild diarrhea, lower respiratory infection or measles (diseases which have high case fatality rates) added additional components to the preferred programs. The rankings were most sensitive to changes in relative cost, effectiveness, and the case fatality rate for diseases which are the major causes of death.

The Immunization program's ranking was found to be most sensitive to changes in the effectiveness inputs. Lowering the effectiveness of immunization 20 to 40 porcent changed the ranking of preferred health program from Immunization to Nutrition. The diseases preventable by the specified immunization program were diphtheria, pertussis, and tetanus. Although the vaccines for these diseases are in themselves very effective, the overall success of an immunization program is dependent on many factors, including the health beliefs and attitudes of the population requiring immunization, and the operation of the programs. Since a lower effectiveness estimate for immunization would make it less desirable, it is important to learn more about the effects of immunization on children presently covered by the Indonesian Expanded Immunization Program.

Nutrition would *replace* Immunization as the promotional program of first choice if the case fatality rate for severe diarrhea and measles were substantially increased or the cost of the nutrition program lowered. Nutrition is *added* to Immunization as a preferred program when the assumed level of effectiveness of the nutrition program is increased slightly.

Although the prime disease targets of the specified nutrition program are severe diarrhea and measles, increasing the attack rate for these diseases

did not change the ranking. The hypothesis that the incidence of pneumonia might be reduced by the nutrition program also failed to change the ranking of the nutrition program.

The most important areas of sensitivity in the ranking of the nutrition program using the criterion of crude death rate, then, relate to the case fatality rate for severe diarrhea and measles, the cost of the nutrition program, and its effect as a disease control strategy.

The case fatality rate for severe diarrhea and measles would have to be increased by 50 percent in order for Nutrition to become the preferred program instead of Immunization. The case fatality rates for these diseases in the model were derived from the iterative process between expert judgment, medical texts, and field experience noted earlier. It is unlikely that these estimates would vary as much as 50 percent from the original assumptions.

It was assumed that when fully operational the nutrition program would be capable of shifting 60 percent of the malnourished children to the normal category. This effectiveness figure would have to rise 6 to 16 percent in order to equal the effectiveness of the immunization program at those budget levels where nutrition was not already a part of the preferred program.

The presumed cost of the nutrition program would have to be reduced 5 to 40 percent in order to make Nutrition as cost effective as Immunization. The cost of the specified nutrition program was derived from guidelines for nutrition education and food supplementation. Since the nutrition program specified here is only one particular prototype for nutrition intervention, it is possible that other types of nutrition intervention

would cost less; therefore it would be wise to research the cost of other alternatives.

Using the criterion of crude death rate, sanitation programs would be preferred to Nutrition only if the cost per capita of Sanitation could be significantly reduced. Changes by factors of two in attack rates, numbers seeking and receiving care, and changing coefficients from the assumed level of effectiveness in reducing disease incidence were insufficient to change the ranking of Sanitation. In the original calculations, the water supply and sanitation costs were estimated at $14 per capita. In order to make Sanitation preferred to either Immunization or Nutrition, the cost would have to be reduced by about 30 to 60 percent at most budget levels.

While considerable uncertainty exists with regard to water and sanitation costs, it does not seem likely that on a wide basis costs could be low enough to produce any change in program selection. Low cost systems have been installed in East Malaysia, and it is possible that in certain regions these might be replicated in Indonesia (e.g., those regions with hilly topography and high rainfall). It seems worthwhile to examine the conditions under which such low cost systems might be practical, because in these areas, Sanitation would be the most cost effective health promotional activity under most budget levels.

The uncertainty of the rankings of different types of medical care organization centered around Village Health Workers and SubHealth Centers. Since Village Health Workers are preferred at five of the seven budget levels when crude death rate is the criterion, we tested the sensitivity of the inputs that led to this preference. Specified values for the

incidence of certain diseases, utilization rates, costs, and effectiveness estimates were varied.

When the numbers of those seeking care for severe diarrhea, lower respiratory infection, and measles were decreased by 50 percent, there was no change in the ranking of Village Health Workers. Increasing the incidence of diseases for which Village Health Workers' effectiveness is low (severe diarrhea, tetanus, and complications of childbirth) changed the preferred medical care program to SubHealth Centers at low budget levels.

The cost of the Village Health Worker is assumed to be low because of their minimal training and equipment. If this cost is raised 14 percent, SubHealth Centers become preferred as a form of medical care organization.

While the accuracy of the cost estimate may be important, the effectiveness of medical treatment by the Village Health Worker seems the most sensitive issue. If the effectiveness of the Village Health Worker is reduced 3 to 6 percent from the original estimated level for treatment, then SubHealth Centers become the preferred mode of medical care delivery. As it is likely that the Village Health Worker's effectiveness in medical care delivery will be different from the original estimates, it is crucial that this area of uncertainty be resolved before significant quantities of resources are allocated into this program. It is important to emphasize that here we are referring to the Village Health Worker's effectiveness in medical care delivery. Since we have not accounted for the capability of the Village Health Worker in health education and hygiene, the evaluation of the Village Health Worker is limited by our definitions.

The sensitivity analysis of inputs was also studied using the criteria

of days of illness. The rankings of program alternatives under these criteria were most sensitive to inputs of cost and effectiveness.

Since Sanitation is the preferred health program for all budget levels above $5 per capita using the criterion of days of illness, it was important to test the values of inputs which specify the sanitation program. At budget levels of $7.50 per capita, Sanitation left the preferred position when the costs were raised by 14 percent. At higher budgets of $10.00 and $15.00 per capita, the cost of sanitation was raised 57 to 79 percent before Nutrition and Immunization took its place.

As indicated before, there is considerable uncertainty surrounding the cost of sanitation. While it seems unlikely that the cost would be over 79 percent more than the original estimate, it is possible that Sanitation cost could be raised more than 14 percent ($16.00). Both higher and lower cost sanitation systems have been implemented in countries other than Indonesia, and it would be helpful to see how representative those might be of the costs in rural Java.

E. RECOMMENDATIONS AND SUGGESTIONS

The calculations and the sensitivity analyses which were performed with the model indicate the signal role that the values of policy makers play in determining preferred methods of delivering medical care and selecting promotional or preventive activities. The criteria used for judging programs and policies make substantial difference in selecting preferred alternatives. When the criteria have multiple attributes such as mortality and disability, analysis reduces the number of alternatives among which to choose, and makes estimates of the outcomes. Beyond this, policy makers must use their own judgments, albeit informed by the results of the analytic calculations.

Preferred programs and policies change, depending upon the levels of budget allocated to health. While health sector budget levels are in part determined by the resources available to society, they are also a function of the values assigned to health relative to other sectors of society. There is no uniquely technical or analytic answer to optimal or preferred policies. Analysis aided by a model measures effects of policies. The evaluation of these effects is determined by decision-maker's values.

The sensitivity analyses indicated that the results are usually robust with respect to uncertainties or variations in underlying epidemiological data, attack rates and case fatality rates. On the other hand, there is considerable sensitivity in the relative rankings of programs to estimates of their costs and to estimates of the effects of specific interventions.

These last conclusions have immediate research implications. One is that it points to the usefulness of serious attention to cost analysis,

something neglected by most health agencies.

By cost analyses we mean more than a simple extrapolation of accounting records. Cost analysis consists of specifying programs in terms of physical descriptions of people, things, activities and schedules and applying cost estimating relationships to these to translate them into budgetary implications.

Apart from issues of relevance and completeness, costs must be sorted according to time of impact, source of funding, spending agency and sometimes beneficiaries or targets of expenditures. These require careful analysis of fixed, variable, onetime and recurrent costs.

We believe it would be helpful if a project were to be implemented in Indonesia for the purpose of formulating appropriate cost analysis, developing cost-estimating relationships, designing systems and procedures for reporting and estimating costs as needed for each of the health program specifications that are to be considered. Prototypes for such an activity exist in the Cost Analysis Department of the Rand Corporation, and other operations research institutes.

The effectiveness of specific rural health interventions is another immediate area for further research. First, there is a need for a more intensive search for and scrutiny of past studies dealing with effectiveness. Additionally, there is a need to conduct studies on the specific interventions under consideration. For example, in the Tulungagung area of Indonesia, studies on the effects of immunization intervention are presently being conducted to provide model inputs. Program-specific studies

like this can provide highly selective and pertinent data on the effect of an intervention.

While the search for past studies would require literature searches in a variety of places, program-specific studies should be carried out und conditions that are similar to the rural areas where the program will actually be implemented to provide sufficiently accurate inputs on effectiveness for planning.

is report should not be viewed as recommending health policy. Rather the analyses offer guidance for further research and possibly for the design of additional program alternatives which may prove to be bette than any of those yet considered in the study.

The application of the model to rural Java is an illustration of the uses and limitations of a quantitative approach to assist health sector decision making. Much work remains to be done, not only in examining other alternatives and improving the reliability of input estimates, but also in taking into account such questions as the time phasing of programs, constraints other than those of the budget, health behavior, fertility behavior, referral patterns among institutions, and the implications of self-care and traditional medicine.

APPENDIX A

Disease Incidence Rates for Promotional Programs

APPENDIX A

Annual Incidence Rates for Different Mixes of Health Promotional Activities Proposed for Rural Indonesia

(Rates are given in average number of cases annually per person)

	No Promotional Programs	Immun	Nutr	Immun Nutr	Sanit	Immun Sanit	Nutr Sanit	Immun Nutr Sanit
1. L. R. I.								
0-1	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
1-4	0.05	0.05	0.05	0.05	0.05	0.05	0 05	0.05
5-14	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
15 + F	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
15 + M	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
45 +	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
2. A. U. R. I.								
0-1	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
1-4	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
5-14	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
15 + F	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
15 + M	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
45 +	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3. Otitis Media								
0-1	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1-4	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
5-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15 + F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15 + M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45 +	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Skin Disease								
0-1	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02
1-4	0.10	0.05	0.05	0.05	0.04	0.04	0.04	0.04
5-14	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02
15 + F	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02
15 + M	0.20	0.20	0.20	0.20	0.08	0.08	0.08	0.08
45 +	0.02	0.02	0.02	0.02	0.008	0.008	0.008	0.008

	No Promotional programs	Immun.	Nutr.	Immun. Nutr.	Sanit.	Immun. Sanit.	Nutr. Sanit.	Immun. Nutr. Sanit.
5. Mild Diarrhea								
0-1 yr.	3.00	3.00	1.65	1.65	1.20	1.20	0.66	0.66
1-4 yrs.	3.00	3.00	1.65	1.65	1.20	1.20	0.66	0.66
5-14 yrs.	1.00	1.00	1.00	1.00	0.40	0.40	0.40	0.40
15-44 male	1.00	1.00	1.00	1.00	0.40	0.40	0.40	0.40
15-44 Female	1.00	1.00	1.00	1.00	0.40	0.40	0.40	0.40
45+ yrs.	1.00	1.00	1.00	1.00	0.40	0.40	0.40	0.40
6. Severe Diarrhea								
0-1 yr.	0.40	0.40	0.292	0.292	0.06	0.06	0.0438	0.0438
1-4 yrs.	0.30	0.30	0.219	0.219	0.045	0.045	0.3285	0.03285
5-14 yrs.	0.08	0.08	0.0584	0.0584	0.012	0.012	0.012	0.0088
15-44 Male	0.08	0.08	0.08	0.08	0.012	0.012	0.012	0.012
15-44 Female	0.08	0.08	0.08	0.08	0.012	0.012	0.012	0.012
45+ yrs.	0.08	0.08	0.08	0.08	0.012	0.012	0.012	0.012
7. T.B.								
0-1 yr.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1-4 yrs.	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
5-14 yrs.	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
15-44 yrs Male	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
15-44 yrs Female	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
45+ yrs.	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
8. Malaria								
0-1 yr.	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
1-4 yrs.	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
5-14 yrs.	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
15-44 yrs. Male	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
15-44 yrs. Female	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
45+ years	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050

	No Promotional programs	Immun.	Nutr.	Immun. Nutr.	Sanit.	Immun. Sanit.	Nutr. Sanit.	Immun. Nutr. Sanit.
9. Diphtheria								
0-1 yr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-4 yrs.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-14 yrs.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-44 male	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-44 Female	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45+ yrs.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10. Tetanus								
0-1 yr.	0.0213	0.0011	0.0213	0.0011	0.0213	0.0011	0.0213	0.0011
1-4 yrs.	0.0010	0.0005	0.001	0.0005	0.001	0.0005	0.001	0.0005
5-14 yrs.	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
15-44 Male	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
15-44 Female	0.0001	0.00005	0.0001	0.00005	0.001	0.00005	0.001	0.00005
45+ yrs.	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
11. Pertussis								
0-1 yr.	0.010	0.002	0.010	0.002	0.010	0.002	0.010	0.002
1-4 yrs.	0.05	0.01	0.05	0.01	0.05	0.01	0.05	0.01
5-14 yrs.	0.01	0.002	0.01	0.002	0.01	0.002	0.01	0.002
15-44 yrs Male	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-44 yrs Female	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45+ yrs.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12. Measles								
0-1 yr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-4 yrs.	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
5-14 yrs.	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
15-44 yrs. Male	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-44 yrs. Female	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45+ years	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	No Promotional programs	Immun.	Nutr.	Immun. Nutr.	Sanit.	Immun. Sanit.	Nutr. Sanit.	Immun. Nutr. Sanit.
13. Burns								
0-1 yr.	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
1-4 yrs.	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
5-14 yrs.	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
15-44 male	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
15-44 Female	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
45+ yrs.	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
14. Fractures								
0-1 yr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-4 yrs.	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
5-14 yrs.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15-44 Male	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
15-44 Female	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
45+ yrs.	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
15. Cuts								
0-1 yr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-4 yrs.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
5-14 yrs.	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
15-44 yrs Male	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
15-44 yrs Female	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
45+ yrs.	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
16. Anemia								
0-1 yr.	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1-4 yrs.	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
5-14 yrs.	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
15-44 yrs. Male	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
15-44 yrs. Female	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
45+ years	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

	No Promotional programs	Immun.	Nutr.	Immun. Nutr.	Sanit.	Immun. Sanit.	Nutr. Sanit.	Immun. Nutr. Sanit.
17. Malnutrition								
0-1 yr.	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20
1-4 yrs.	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20
5-14 yrs.	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
15-44 male	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
15-44 Female	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
45+ yrs.	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
18. Intestinal Parasites								
0-1 yr.	0.01	0.01	0.01	0.01	0.003	0.003	0.003	0.003
1-4 yrs.	1.00	1.00	1.00	1.00	0.3	0.3	0.3	0.3
5-14 yrs.	1.00	1.00	1.00	1.00	0.3	0.3	0.3	0.3
15-44 Male	0.20	0.20	0.20	0.20	0.06	0.06	0.06	0.06
15-44 Female	0.20	0.20	0.20	0.20	0.06	0.06	0.06	0.06
45+ yrs.	0.20	0.20	0.20	0.20	0.06	0.06	0.06	0.06
19. Heart Disease								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-14 yrs.	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
15-44 yrs Male	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
15-44 yrs Female	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
45+ yrs.	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
20. Cerebro-vascular Disease								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-14 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 yrs. Male	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
15-44 yrs. Female	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
45+ years	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020

	No Promotional programs	Immun.	Nutr.	Immun. Nutr.	Sanit.	Immun. Sanit.	Nutr. Sanit.	Immun. Nutr. Sanit.
21. Complications of Childbirth and Pregnancy								
0-1 yr.	0.09	0.09	0.06	0.06	0.09	0.09	0.06	0.06
1-4 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-14 yrs.	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
15-44 male	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 Female	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024
45+ yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22. Typhoid Fever								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
5-14 yrs.	0.01	0.01	0.01	0.01	0.005	0.005	0.005	0.005
15-44 Male	0.005	0.005	0.005	0.005	0.0025	0.0025	0.0025	0.0025
15-44 Female	0.005	0.005	0.005	0.005	0.0025	0.0025	0.0025	0.0025
45+ yrs.	0.005	0.005	0.005	0.005	0.0025	0.0025	0.0025	0.0025
23. Hepatitis								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.006	0.006	0.006	0.006	0.003	0.003	0.003	0.003
5-14 yrs.	0.01	0.01	0.01	0.01	0.005	0.005	0.005	0.005
15-44 yrs Male	0.004	0.004	0.004	0.004	0.002	0.002	0.002	0.002
15-44 yrs Female	0.004	0.004	0.004	0.004	0.002	0.002	0.002	0.002
45+ yrs.	0.004	0.004	0.004	0.004	0.002	0.002	0.002	0.002
24. Conjunctivitis								
0-1 yr.	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
1-4 yrs.	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
5-14 yrs.	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060
15-44 yrs. Male	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
15-44 yrs. Female	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
45+ years	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010

	No Promotional programs	Immun.	Nutr.	Immun. Nutr.	Sanit.	Immun. Sanit.	Nutr. Sanit.	Immun. Nutr. Sanit.
25. Rheumatic Fever								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-14 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 male	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
15-44 Female	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
45+ yrs.	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
26. Varicella								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
5-14 yrs.	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
15-44 Male	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 Female	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45+ yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27. Mumps								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
5-14 yrs.	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
15-44 yrs Male	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 yrs Female	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45+ yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28. Gonorrhea								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-14 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 yrs. Male	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
15-44 yrs. Female	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
45+ years	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002

	No Promotional programs	Immun.	Nutr.	Immun. Nutr.	Sanit.	Immun. Sanit.	Nutr. Sanit.	Immun. Nutr. Sanit.
29. Goitre								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-14 yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 male	0.004	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 Female	0.004	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45+ yrs.	0.004	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30. Vitamin A Deficiency								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.02	0.02	0.004	0.004	0.02	0.02	0.004	0.004
5-14 yrs.	0.005	0.005	0.001	0.001	0.005	0.005	0.001	0.001
15-44 Male	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-44 Female	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45+ yrs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31. Dental Problem								
0-1 yr.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4 yrs.	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
5-14 yrs.	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
15-44 yrs Male	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
15-44 yrs Female	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
45+ yrs.	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

APPENDIX B

Utilization of Medical Care

APPENDIX B

Utilization of Medical Care Delivery Systems
Estimates for Tulungagung, Indonesia

Proportion of Cases Which Would Be Expected to Seek Care from Each Source

	Health Center	Sub Health Center	Village Worker 25 VHW	Village Worker 200 VHW
1. LOWER RESPIRATORY INFECTION				
0-1	0.10	0.10	0.50	0.80
1-4	0.10	0.60	0.50	0.80
5-14	0.10	0.60	0.50	0.80
15+ M	0.10	0.60	0.50	0.80
15+ F	0.10	0.60	0.50	0.80
45+	0.10	0.60	0.50	0.80
2. UPPER RESPIRATORY INFECTION				
0-1	0.10	0.20	0.30	0.90
1-4	0.10	0.20	0.30	0.90
5-14	0.05	0.20	0.30	0.90
15+ M	0.0	0.20	0.30	0.90
15+ F	0.0	0.20	0.30	0.90
45+	0.0	0.20	0.30	0.90
3. OTITIS MEDIA				
0-1	0.10	0.30	0.50	[illegible]
1-4	0.10	0.30	0.50	0.90
5-14	0.0	0.30	0.50	0.90
15+ M	0.0	0.30	0.50	0.90
15+ F	0.0	0.30	0.50	0.90
45+	0.0	0.30	0.50	0.90
4. SKIN DISEASE				
0-1	0.01	0.20	0.30	0.90
1-4	0.05	0.20	0.30	0.90
5-14	0.10	0.20	0.30	0.90
15+ M	0.10	0.20	0.30	0.90
15+ F	0.10	0.20	0.30	0.90
45+	0.10	0.20	0.30	0.90
5. MILD DIARRHEA				
0-1	0.04	0.30	0.30	0.80
1-4	0.04	0.30	0.30	0.80
5-14	0.04	0.30	0.30	0.80
15+ M	0.04	0.30	0.30	0.80
15+ F	0.04	0.30	0.30	0.80
45+	0.04	0.30	0.30	0.80
6. SEVERE DIARRHEA				
0-1	0.30	0.70	0.60	0.90
1-4	0.15	0.70	0.60	0.90
5-14	0.15	0.70	0.60	0.90
15+ M	0.15	0.70	0.60	0.90
15+ F	0.15	0.70	0.60	0.90
45+	0.15	0.70	0.60	0.90
7. TUBERCULOSIS				
0-1	0.10	0.30	0.30	0.60
1-4	0.10	0.30	0.30	0.60
5-14	0.10	0.30	0.30	0.60
15+ M	0.10	0.50	0.50	0.80
15+ F	0.10	0.50	0.50	0.80
45+	0.10	0.50	0.50	0.80

	Health Center	Sub Health Center	Village Worker 25 VHW	Village Worker 200 VHW
8. MALARIA				
	0.05	0.50	0.70	0.90
0-1	0.05	0.50	0.70	0.90
1-4	0.05	0.50	0.70	0.90
15+ M	0.05	0.50	0.70	0.90
15+ F	0.05	0.50	0.70	0.90
45+	0.05	0.50	0.70	0.90
9. DIPHTHERIA				
0-1	0.50	0.70	0.0	0.0
1-4	0.50	0.70	0.0	0.0
5-14	0.50	0.70	0.0	0.0
15+ M	0.0	0.70	0.0	0.0
15+ F	0.0	0.70	0.0	0.0
45+	0.0	0.70	0.0	0.0
10. TETANUS				
0-1	0.30	0.75	0.75	0.75
1-4	0.30	0.75	0.75	0.75
5-14	0.30	0.75	0.75	0.75
15+ M	0.30	0.75	0.75	0.75
15+ F	0.30	0.75	0.75	0.75
45+	0.30	0.75	0.75	0.75
11. WHOOPING COUGH				
0-1	0.10	0.50	0.50	0.90
1-4	0.10	0.50	0.50	0.90
5-14	0.10	0.60	0.50	0.90
15+ M	0.0	0.50	0.50	0.90
15+ F	0.0	0.60	0.50	0.90
45+	0.0	0.60	0.50	0.90
12. MEASLES				
0-1	0.10	0.40	0.60	0.90
1-4	0.20	0.40	0.60	0.90
5-14	0.10	0.40	0.60	0.90
15+ M	0.0	0.40	0.60	0.90
15+ F	0.0	0.40	0.60	0.90
45+	0.0	0.40	0.60	0.90
13. TYPHOID				
0-1	0.10	0.50	0.70	0.90
1-4	0.10	0.50	0.70	0.90
5-14	0.10	0.60	0.70	0.90
15+ M	0.10	0.60	0.70	0.90
15+ F	0.10	0.60	0.70	0.90
45+	0.10	0.60	0.70	0.90
14. FRACTURES				
0-1	0.75	0.70	0.70	0.90
1-4	0.75	0.70	0.70	0.90
5-14	0.75	0.70	0.70	0.90
15+ M	0.75	0.70	0.70	0.90
15+ F	0.75	0.70	0.70	0.90
45+	0.75	0.70	0.70	0.90
15. CUTS				
0-1	0.10	0.50	0.50	0.70
1-4	0.05	0.50	0.50	0.70
5-14	0.10	0.50	0.50	0.70
15+ M	0.10	0.50	0.50	0.70
15+ F	0.10	0.50	0.50	0.70
45+	0.10	0.50	0.50	0.70

	Health Center	Sub Health Center	Village Worker 25 VHW	200 VHW
16. ANEMIA				
0-1	0.05	0.10	0.20	0.40
1-4	0.05	0.10	0.20	0.40
5-14	0.05	0.10	0.20	0.40
15+ M	0.05	0.10	0.20	0.40
15+ F	0.05	0.10	0.20	0.40
45+	0.05	0.10	0.20	0.40
17. MALNUTRITION				
0-1	0.05	0.10	0.30	0.50
1-4	0.05	0.10	0.30	0.50
5-14	0.10	0.10	0.30	0.50
15+ M	0.0	0.10	0.30	0.50
15+ F	0.0	0.10	0.30	0.50
45+	0.0	0.10	0.30	0.50
18. INTESTINAL PARASITES				
0-1	0.01	0.05	0.10	0.30
1-4	0.01	0.05	0.10	0.30
5-14	0.01	0.05	0.10	0.30
15+ M	0.03	0.05	0.10	0.30
15+ F	0.03	0.05	0.10	0.30
45+	0.03	0.05	0.10	0.30
19. HEART DISEASE				
0-1	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0
5-14	0.05	0.0	0.0	0.0
15+ M	0.20	0.30	0.60	0.70
15+ F	0.15	0.25	0.50	0.60
45+	0.15	0.25	0.50	0.60
20. CEREBRO VASCULAR DISEASE				
0-1	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0
5-14	0.0	0.0	0.0	0.0
15+ M	0.50	0.70	0.80	0.85
15+ F	0.30	0.60	0.70	0.75
45+	0.30	0.60	0.70	0.75
21. COMPLICATIONS OF CHILDBIRTH AND PREGNANCY				
0-1	0.10	0.10	0.10	0.10
1-4	0.0	0.0	0.0	0.0
5-14	0.45	0.55	0.60	0.70
15+ M	0.0	0.0	0.0	0.0
15+ F	0.40	0.50	0.60	0.70
45+	0.0	0.50	0.60	0.70
22. THYPHOID				
0-1	0.0	0.01	0.05	0.10
1-4	0.10	0.10	0.20	0.40
5-14	0.20	0.20	0.20	0.40
15+ M	0.20	0.40	0.50	0.60
15+ F	0.20	0.30	0.40	0.50
45+	0.20	0.50	0.50	0.50
23. HEPATITIS				
0-1	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0
5-14	0.10	0.10	0.30	0.40
15+ M	0.20	0.20	0.20	0.40
15+ F	0.20	0.20	0.20	0.40
45+	0.20	0.0	0.0	0.0

Best Available Document

	Health Center	Sub Health Center	Village Worker 25 VHW	Village Worker 200 VHW
24. CONJUNCTIVITIS				
0-1	0.05	0.05	0.05	0.10
1-4	0.10	0.10	0.20	0.30
5-14	0.10	0.20	0.30	0.40
15+ M	0.05	0.20	0.30	0.40
15+ F	0.05	0.20	0.30	0.40
45+	0.05	0.10	0.10	0.20
25. RHEUMATIC FEVER				
0-1	0.0	0.0	0.0	0.0
1-4	0.0	0.05	0.10	0.20
5-14	0.0	0.10	0.20	0.30
15+ M	0.10	0.20	0.30	0.40
15+ F	0.10	0.20	0.30	0.40
45+	0.10	0.0	0.0	[illegible]
26. MALARIA				
0-1	0.0	0.01	0.05	[illegible]
1-4	0.15	0.05	0.01	0.20
5-14	0.15	0.10	0.20	0.40
15+ M	0.0	0.0	0.0	[illegible]
15+ F	0.0	0.0	0.0	[illegible]
45+	0.0	0.0	0.0	0.0
27. [illegible]				
0-1	0.0	0.0	0.0	0.0
1-4	0.10	0.05	0.05	[illegible]
5-14	0.10	0.10	0.20	[illegible]
15+ M	0.0	0.0	0.0	[illegible]
15+ F	0.0	0.0	0.0	[illegible]
45+	0.0	0.0	0.0	[illegible]
28. [illegible]				
0-1	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0
5-14	0.0	0.0	0.0	0.0
15+ M	0.20	0.05	0.05	[illegible]
15+ F	0.20	0.20	0.20	[illegible]
45+	0.20	0.50	0.50	[illegible]
29. GOITER				
0-1	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0
5-14	0.0	0.0	0.0	0.0
15+ M	0.05	0.10	0.10	0.20
15+ F	0.05	0.20	0.20	0.40
45+	0.05	0.10	0.10	0.20
30. VITAMIN A DEFICIENCY				
0-1	0.0	0.01	0.02	0.10
1-4	0.01	0.05	0.05	0.20
5-14	0.00	0.0	0.0	0.0
15+ M	0.0	0.0	0.0	0.0
15+ F	0.0	0.0	0.0	0.0
45+	0.0	0.0	0.0	0.0
31. DENTAL PROBLEM				
0-1	0.0	0.0	0.0	0.0
1-4	0.00	0.0	0.0	0.0
5-14	0.01	0.05	0.05	0.20
15+ M	0.05	0.10	0.10	0.20
15+ F	0.05	0.10	0.10	0.20
45+	0.05	0.20	0.20	0.30

APPENDIX C

Estimated Effectiveness of Treatment by Medical Care Delivery Components

APPENDIX C

Estimated Effectiveness of Treatment for Different Components of the Medical Care Delivery Systems

(NOTE: These figures must be considered in relation to attack rates per age cohort; see Appendix A)

	Days Lost per Person per Year				Fatalities per 100 Cases			
	Health Center	Sub Health	Village Health Worker	Untreated	Health Center	Sub Health	Village Health Worker	Untreat
	DLRX	DLRX	DLRX	DLNRX	CFRX	CFRX	CFRX	CFNRX
1. LRI								
0-1 yr.	10.	11.5	13	25.	0.2	2.18	4.16	20.
1-4 yrs.	10	11.5	13	25.	0.2	1.18	2.16	10
5-14 yrs.	10	11	12	20	0.2	.68	1.16	5
15+ Female	10	10.5	11	15	0.05	.345	.64	3
15+ Male	10	10.5	11	15	0.05	.245	.44	2
45+ yrs.	10	10.5	11	15	0.05	.545	1.04	5
2. URI								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15+ Male(yrs.)	0	0	0	0	0	0	0	0
15+ Female(yrs.)	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0

DLRX = per capita days lost for those treated

DLNRX = per capita days lost for those untreated

CFRX = percent of those dying from disease who receive treatment

CFNRX = percent of those dying from disease who do not receive treatment

	Health Center DLRX	Sub Health DLRX	Village Health Worker DLRX	Untreated DLNRX	Health Center CFRX	Sub Health CFRX	Village Health Worker CFRX	Untreat C:2 of 9 CFNRX
3. Otitis Media								
0-1 yr.	15	16.5	18	30	0	0	0	0
1-4 yrs.	15	16.5	18	30	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 male	0	0	0	0	0	0	0	0
15-44 Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
4. Skin Disease								
0-1 yr.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 Male	0	0	0	0	0	0	0	0
15-44 Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
5. Mild Diarrhea								
0-1 yr.	3	3.1	3.1	4	0	0	0	0
1-4 yrs.	3	3.2	3.2	5	0	0	0	0
5-14 yrs.	3	3.2	3.2	5	0	0	0	0
15-44 yrs Male	1	1	1	1	0	0	0	0
15-44 yrs Female	1	1	1	1	0	0	0	0
45+ yrs.	1	1	1	1	0	0	0	0
6. Severe Diarrhea								
0-1 yr.	5	5.2	5.4	7	1.5	2.75	4	14
1-4 yrs.	5	5.5	6.0	10	1	1.5	2.0	6
5-14 yrs.	5	5.5	6.0	10	0.5	0.6	0.7	1.5
15-44 yrs. Male	5	5.2	5.4	7	0.5	0.55	0.6	1.
15-44 yrs. Female	5	5.2	5.4	7	0.5	0.55	0.6	1.
45+ years	5	5.2	5.4	7	0.5	0.55	0.6	1

	Health Center DLRX	Sub Health DLRX	Village Health Worker DLRX	Untreated DLNRX	Health Center CFRX	Sub Health CFRX	Village Health Worker CFRX	Untreat CFNRX
7. T.B.								
0-1 yr.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	26	26	26	60	0	0	0	0
15-44 male	26	26	26	60	5	5	5	10
15-44 Female	26	26	26	60	5	5	5	10
45+ yrs.	26	26	26	90	10	10	10	20
8. Malaria								
0-1 yr.	5	5	5	20	0.05	0.05	0.05	1
1-4 yrs.	5	5	5	20	0.05	0.05	0.05	1
5-14 yrs.	3	3	3	10	0.01	0.01	0.01	0.5
15-44 Male	2	2	2	5	0	0	0	0.5
15-44 Female	2	2	2	5	0	0	0	0.5
45+ yrs.	2	2	2	5	0	0	0	0.5
9. Diphtheria								
0-1 yr.	21	21	21	21	10	12	15	20
1-4 yrs.	21	21	21	21	10	12	15	20
5-14 yrs.	21	21	21	21	10	12	15	20
15-44 yrs Male	0	0	0	0	0	0	0	0
15-44 yrs Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
10. Tetanus								
0-1 yr.	10	10	10	10	60	63	75	90
1-4 yrs.	10	10.5	12.5	15	20	24	40	60
5-14 yrs.	10	10.5	12.5	15	20	24	40	60
15-44 yrs. Male	10	11	15	20	20	24	40	60
15-44 yrs. Female	10	11	15	20	20	24	40	60
45+ years	10	11	15	20	20	24	40	60

	Center DLRX	Health DLRX	Health Worker DLRX	DLNRX	Center CFRX	Health CFRX	Health Worker CFRX	CFNRX
11. Pertussis								
0-1 yr.	60	60	60	60	5	7	9	25
1-4 yrs.	60	60	60	60	0.05	.145	0.24	1
5-14 yrs.	40	40	40	40	0.01	.014	.018	0.05
15-44 male	0	0	0	0	0	0	0	0
15-44 Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
12. Measles								
0-1 yr.	20	20	20	20	5	6.5	6.5	20
1-4 yrs.	20	20	20	20	0.5	.95	.95	5
5-14 yrs.	20	20	20	20	0.5	0.55	0.55	1
15-44 Male	0	0	0	0	0	0	0	0
15-44 Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
13. Burns								
0-1 yr.	10	10	10	10	.5	.55	.55	1
1-4 yrs.	10	10.4	10.4	14	0.01	.019	.019	0.10
5-14 yrs.	10	10.2	10.2	12	0.01	.029	.029	0.20
15-44 yrs Male	5	5	5	5	0.01	.01	.01	0.01
15-44 yrs Female	8	8	8	8	0.01	.01	.01	0.01
45+ yrs.	5	5	5	5	0.01	.01	.01	0.01
14. Fractures								
0-1 yr.	20	24	30	40	0.10	.28	.55	1
1-4 yrs.	25	28	32.5	40	0.10	.18	.3	0.50
5-14 yrs.	25	28	32.5	40	0.10	.28	.55	1
15-44 yrs. Male	25	28	32.5	50	1	1.2	1.5	2
15-44 yrs. Female	25	28	32.5	50	0.50	.28	.55	1
45+ years	25	28	32.5	50	1	1.2	1.5	2

	Health Center DLRX	Sub Health DLRX	Village Health Worker DLRX	Untreated DLNRX	Health Center CFRX	Sub Health CFRX	Village Health Worker CFRX	Untreat C:5 of 9 CFNRX
15. Cuts								
0-1 yr.	10	10	10	10	0.01	.018	.022	0.05
1-4 yrs.	7	8.4	9.1	14	0.01	.028	.037	0.10
5-14 yrs.	7	7.6	7.9	10	0	.01	.015	0.05
15-44 male	3	3.4	3.6	5	0	.002	.003	0.01
15-44 Female	3	3.4	3.6	5	0	.002	.003	0.01
45+ yrs.	3	3.4	3.6	5	0	.002	.003	0.01
16. Anemia								
0-1 yr.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 Male	0	0	0	0	0	0	0	0
15-44 Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
17. Malnutrition								
0-1 yr.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 yrs Male	0	0	0	0	0	0	0	0
15-44 yrs Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
18. Intestinal Parasites								
0-1 yr.	5	5.6	6	7	0	0	0	2.0
1-4 yrs.	3	3.6	4	5	0	0	0	0
5-14 yrs.	2	2.3	2.5	3	0	0	0	0
15-44 yrs. Male	2	2.3	2.5	3	0	0	0	0
15-44 yrs. Female	2	2.3	2.5	3	0	0	0	0
[illegible]	2	2.3	2.5	3	0	0	0	0

	Health Center DLRX	Sub Health DLRX	Village Health Worker DLRX	Untreated DLNRX	Health Center CFRX	Sub Health CFRX	Village Health Worker CFRX	Untreated CFNRX
19. Heart Disease								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	10.	21	21	21.	2.	5	5	5
15-44 yrs. Male	10	14.4	18.8	21	5	6.2	7.4	8
15-44 yrs. Female	10	14.4	18.8	21	5	6.2	7.4	9
45+ yrs.	10	14.4	18.8	21	10	10	10	10
20. Cerebro - vascular Disease								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 yrs. Male	21	26.4	29.1	30	5	8	9.5	10
15-44 yrs. Female	21	26.4	29.1	30	5	8	9.5	10
45+ yrs.	21	26.4	29.1	30	20	20	20	20
21. Complications of Childbirth and Pregnancy								
0-1 yrs.	0	0	0	0	1	1	3.0	20
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	14	17	21	24	3	4.8	7.2	9
15-44 yrs. Male	0	0	0	0	0	0	0	0
15-44 yrs. Female	10	13	17	20	2	3.5	5.5	7
45+ yrs.	0	0	0	0	0	0	0	0
22. Typhoid Fever								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	10	11	11.5	15	0	.2	.3	1
5-14 yrs.	10	12	14	20	1	1.8	2.6	5
15-44 yrs. Male	10	12	18	30	2	2.8	5.2	10
15-44 yrs. Female	10	12	18	30	3	3.7	5.8	10
45+ yrs.	10	16	20	30	3	5.1	6.5	10

	Health Center DLRX	Sub Health DLRX	Village Health Worker DLRX	Untreated DLNRX	Health Center CFRX	Sub Health CFRX	Village Health Worker CFRX	Untreated CFNRX
23. Hepatitis								
0-1 yrs.	0	0	0	0	0			0
1-4 yrs.	5	5	5	5	0			0
5-14 yrs.	10	10	10	10	0			0
15-44 yrs. Male	15	15	15	15	0.5	.5	.5	0.5
15-44 yrs. Female	15	15	15	15	0.5	.5	.5	0.5
45+ yrs.	15	15	15	15	0.5	.5	.5	0.5
24. Conjunctivitis								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 yrs. Male	0	0	0	0	0	0	0	0
15-44 yrs. Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
25. Rheumatic Fever								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 yrs. Male	14	14	14	7	0.1	.12	.15	0.2
15-44 yrs. Female	14	14	14	7	0.1	.12	.15	0.2
45+ yrs.	14	14	14	7	0.1	.12	.15	0.2
26. Varicella								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	10	10.4	10.8	14	0	0	0	0
5-14 yrs.	7	7.3	7.6	10	0	0	0	0
15-44 yrs. Male	0	0	0	0	0	0	0	0
15-44 yrs. Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0

	Health Center DLRX	Sub Health DLRX	Village Health Worker DLRX	Untreated DLNRX	Health Center CFRX	Sub Health CFRX	Village Health Worker CFRX	Untreated CFNRX
27. Mumps								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	7	7	7	7	0	0	0	0
5-14 yrs.	7	7	7	7	0	0	0	0
15-44 yrs. Male	0	0	0	0	0	0	0	0
15-44 yrs. Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
28. Gonorrhea								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 yrs. Male	0	0	0	0	0	0	0	0
15-44 yrs. Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
29. Goitre								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 yrs. Male	0	0	0	0	0	0	0	0
15-44 yrs. Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0
30. Vitamin A Deficiency								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	0	0	0	0	0	0	0	0
5-14 yrs.	1	1	1	0	0	0	0	0
15-44 yrs. Male	0	0	0	0	0	0	0	0
15-44 yrs. Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0

	Health Center DLRX	Sub Health DLRX	Village Health Worker DLRX	Untreated DLNRX	Health Center CFRX	Sub Health CFRX	Village Health Worker CFRX	Untreated CFNRX
31. Dental Problem								
0-1 yrs.	0	0	0	0	0	0	0	0
1-4 yrs.	1.	1	1	0	0	0	0	0
5-14 yrs.	0	0	0	0	0	0	0	0
15-44 yrs. Male	0	0	0	0	0	0	0	0
15-44 yrs. Female	0	0	0	0	0	0	0	0
45+ yrs.	0	0	0	0	0	0	0	0

APPENDIX D

Cost Specifications for Program Alternatives

APPENDIX D

Specifications and Cost Estimates for All Programs

Estimates are based on references noted by each program according to the following key.

1. Cost estimate by Soeharto Wirjowidagdo, M.D., 1977.
2. Cost estimate by Berlian T. P. Siagian, M.D., 1977.
3. Dr. C. Montoya, Health Manpower Planning, the Case of Indonesia WHO Planning Officer).
4. Health Centre Programming, BEI, 1975.
5. Saranto, M.D., M.P.H., Preliminary Report Operational Study on Health Sources in Pasuruan, East Java, 1970.
6. Soetopo, M.D., M.H.W., D.P.H., Hospital Utilization Study in Indonesia, 1973.
7. Timmer et al., Health Planning in Indonesia, July, 1973.
8. Cost estimate.
9. a. Petunyuk Pelaksanaan, Instruksi presiden Republic Indonesia (Instruction for plans, Instruction from the President of Indonesia.

   b. Projek penyuluhan Gizi Masyarakat di Pedesaan Leparan Kema (Project for Information on Nutrition in Rural Indonesia.
10. Immunization Programming Manual; Geneva:WHO, EPI/G/77.1.

    J. M. Mahieu, "Summary of a Study on the Operational Feasibility, Coverage and Costs of Maintenance Immunizations in Children by District Mobile Teams in Kenya", Geneva:WHO, EPI/WG/76.8.

    I. F. Setiady, "Progress Report on the Implementation of the Expanded National Immunization Programme (Preparatory Period) In Indonesia" WHO, EPI/WG/96.16.

    R. Labusquiere, "Planning and Execution of Vaccination Programs, The Developing Countries", In: International Conference on the Application of Vaccines Against Viral, Rickettsial, and Bacterial Diseases of Man, Pan American Health Organization: Washington, WHO Scientific Pub. #226, 1971.
11. Estimate based on a 1971 cost in Sarawak
12. Tender from Kiong Sieng hardware Kuching Sarawak, E. Malaysia 1971 - has been arbitrarily doubled for inflation.
13. Indonesia - Rural Sanitation Manpower Development, AID-DLC-2123.

Specifications for Health Center

A. Health maintenance unit staffed by
   1. Medical Doctor
   2. Approximately 6.6 medical paraprofessionals

B. Serving a catchment area of 50,000
   1. or a geographical area of from 18-26 kilometer per side
   2. or 324 km^2 - 676 km^2
   3. or 25 villages of 2000 apiece

C. With capacity to handle
   1. 250 people per workday
   2. 50 people per medical personnel per workday

D. Utilization
   1. .47 visits per person/year

Health Center Cost

Investment		
A. Building[1]	17.5	K
B. Land Cost[2]	3	K
C. Drugs[1]	7.9	K
D. Equipment[2]	7.2	K
E. Motorcycle[1]	1	K
F. Relocation of physicians[1] and paraprofessionals	1	K
G. Training[3]		
1) Physicians	25	K
2) Paraprofessionals	1.6	K
Investment total	64.3	K
Operating Cost 1 year		
A. Maintenance and replacement[1]	2.4	K
B. Drugs[1]	7.9	K
C. Personal Pay and allowances[2]	5.0	K
D. Fuel[1]	.5	K
E. Office Supplies	.4	K
Operation sub total	16.2	K
Less fees received (150rp per visit)	8.44	K
Operation total	7.75	K
Operation Cost 5 years	38.77	K
Investment	64.3	K
TOTAL	103.07	K

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Specification for Sub Health Center

A. Health Maintenance unit staffed by one trained medical Paraprofessional.

B. Serving a catchment area of 6250 people or 3.125 villages.
So that 8 units cover a region of 50,000 people.

C. With a capacity to handle 50 visits / Health sub center / workday

D. Utilization 2.03 visits per person / year

Sub Health Center Cost

Investments	1 SHC	8 SHC
A. Building[1]	2.9 K	23.2 K
B. Land Cost[2]	1 K	8 K
C. Drugs[1]	.31K	2.48K
D. Equipment[2]	.2 K	1.6 K
E. Bicycle[3]	.1 K	.8 K
F. Training	6 K	48 K
	Investment total	84.08K

Operating 1 year.

A. Maintenance[1]	.3 K	2.4 K
B. Drugs	.31K	7.75K
C. Pay & Allowance	.45K	3.6 K
D. Fuels	.14K	1.12K
	Operation 1 yr. total	14.87K
	Operating Cost 5 yr.	74.35K
	Investment.	84.08K
	Total----------	158.43K

Sub Health Center with Health Center Costs

Investment H.C.	64.3K
Investment S.H.C.	84.08 K
Investment Total	148.38 K

Sub total Operation H.C. 5 yr-less drugs	41.5 K
Sub total Operation S.H.C. 5 yr. less drugs	35.6 K
101731 visits @ $.1566 drugs	79.7 K
sub total	156.8 K
Less fees H.C. 5 yr.	24.5 K
Total Operation 5 yr	132.3 K
Investment	148.38K
Total----------	280.66 K

Specification for Village Health Unit

A. Health maintenance unit staffed by one trained village health worker

B. Serving (a) catchment area of one village of 2,000 people or 400 househo

(b) catchment area of 250 people or 50 households

C. With capacity to handle

(a) with 25 village health workers, 15 visits/village health worker/workday

(b) with 200 village health workers, 4 visits/village health worker/workday

D. Utilization

(a) with 25 village health workers, 2.25 visits/person/year

(b) with 200 village health workers, 4.7 visits/person/year

E. With physician-staffed health center backup

Village Health Unit Cost

	Village Health Workers		
	One	25*	200**
Investment			
A. Drugs[1]	.31 k	7.75 k	62.0 k
B. Equipment[2]	.2 k	5.0 k	40.0 k
C. Bicycle[3]	.1 k	2.5 k	20.0 k
D. Training[3]	.45 k	11.25 k	90.0 k
Investment Total		26.5 k	
Operating One Year			
A. Maintenance[1]	.03 k	.75 k	6.0 k
B. Drugs[1]	.31 k	7.75 k	62.0 k
C. Fuels[1]	.14 k	3.6 k	28.8 k
Total		12.1 k	96.8 k
Operating Cost Five Year		60.5 k	484.0 k
Investment		26.5 k	212.0 k
Total		87.0 k	696.0 k

* One for 400 households
** One for 50 households

Village Health Units with Health Center

	25 VHW (1 for 400 hses.)	200 VHW (1 for 50 houses)
Investment H.C.	64.3K	64.3K
Investment VHW	26.5K	212.0K
Investment Total	90.8K	276.3K

Subtotal 5 yr.	Operation H.C. less drugs	41.5K	41.5K
Subtotal 5 yr.	Operation VHW less drugs	21.75K	174.75K
5 yr.	Drugs @ $.1566 visit for 112646	88.20 K	184.60 K
	subtotal operation	151.45 K	400.85 K
	Less Fee $ H.C. 5 yr.	-38.93 K	-71.01 K
	St. operation	117.52 K	329.84 K
	Total Investment	90.80 K	276.30 K
	Total	208.32 K	606.14 K

Nutrition Intervention

Food Supplement Program Specification in a Rural Java Area of 50,000 People

I. Investment	
A. Facilities: Storage in Health Care Delivery System	2 K[8]
B. Equipment: Scales 25 @ .2K	5 K[9a]
C. Training 25 @ .4 K	10 K[8]
D. Stocks: Soy Flour for 1,600 Children and 2,500 Pregnant, Lactating Mothers	25 K[3]
II. Operation for One Year	
A. Equipment Replacement	1 K[8]
B. Pay and Allowance for One Supervisor/Midwife	.6 K[8]
C. Stocks: Soy Flour	25 K[9b]
D. Maternal Education Materials	5
Total Operating Cost for One Year	36.6 K
Total Operating Cost for Five Year	158 K
Investment	42 K
Total	200,000 K

Cost of Immunization Program (if integrated in health care delivery system)[10]

Investment			
A. Facilities	3.93 K		
B. Equipment	1.94 K		
C. Training	4.35 K		
D. Transport	.355 K		
Total Investment	10.575 K		
Operation 1 year			
A. Personnel			
1. AN/ANM	2.5 K		
2. Local aid	.9 K		
3. Travel allowances	.6 K		
Total	4 K		
B. Maintenance and replacement	1 K		
C. Vaccine	2 K	5 yr. operation	59.925 K
D. Administrative Cost	4.985 K	Investments	10.575 K
Total	11.985 K	Total	70.5 K

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Cost of Sanitation - Java

Gravity Feed Water Supply

I. Investment		
A. Facilities	15.1	K
B. Equipment		
Primary Mission		
1) Pipes PVC[12]	15.1	K
2) Pipes GIP[12]	55.4	K
3) Fittings[12]	80.5	K
4) Concrete[11]	16.8	K
5) Latrine superstructure[11]	33.5	K
6) Survey level and drafting tools[13]	1.7	K
7) Tools[13]	1.7	K
C. Miscellaneous		
1) Opportunity cost of[11] Volunteer labor 25 systems @ 4000 man day	167.6	K
2) Training[13]	1.7	K
Total	525	K
II. Annual Operating Cost		
A. Equipment replacement[11]	4.35	K
B. Maintenance[11]	25	K
C. Pay and Allowances[11]		
12 man months sanitarian @ 75	.9	K
6 man months L.I. @ 125	.75	K
D. Health Education	4	K
Total	35	K
Investment	525	K
5 yr. operation	175	K
TOTAL	700	K

14.00 per capita

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APPENDIX E

Disease Profiles for 31 Diseases

DISEASE PROFILE FOR INDONESIA TULONG AGONG EAST JAVA
50000. POEPLE

RATE=ANNUAL RATE
INC.=ANNUAL INCIDENCE
XPSC=PROPORTION SEEKING CARE
VC=VISITS PER CASE
DLNRX=DAYS LOST PER CAPNRX
X=TOTAL DAYS LOST RX
Y=TOTAL DAYS LOST NRX
X+Y=TOTAL DAYS LOST
CFNRX=CASE FATAL. RATE NRX
S=DEATHS RX
S+R=DEATHS TOTAL
NUSC=NU.SEEKING CARE
TOVT=TOTAL NU. VISITS
GOT=NU. NONEFFECTIVE PICKED UP HC. SHC
CFRX=CASE FATALITY RATE RX
R=DEATHS NRX

Disease Profile for Health Center
Only for Area of 50,000 Population

	RATE	INC.	XPSC	NUSC	VC	TOVT	DLRX	DLNRX	X	Y	X+Y	CFRX	CFNRX	S	R	S+R
LOWER RESPIRATORY INFECTION																
0-1 YEAR	0.1000	150	0.10	15	2.	30.	10.	25.	150.	3375.	3525.	0.2	20.0	0.0	27.0	27.0
1-4 YEAR	0.0500	350	0.10	35	2.	70.	10.	25.	350.	7875.	8225.	0.2	10.0	0.1	31.5	31.6
5-14 YEA	0.0100	130	0.10	13	2.	26.	10.	20.	130.	2340.	2470.	0.2	5.0	0.0	5.8	5.9
15-44 MA	0.0050	52	0.10	5	2.	8.	10.	15.	50.	705.	755.	0.1	3.0	0.0	1.4	1.4
15-44 FE	0.0100	110	0.10	11	2.	17.	10.	15.	110.	1485.	1595.	0.1	2.0	0.0	2.0	2.0
45+ YEAR	0.0300	210	0.10	21	2.	32.	10.	15.	210.	2835.	3045.	0.1	5.0	0.0	9.4	9.5
		1002.				182.					19615.					77.3
UPPER RESPIRATORY INFECTION																
0-1 YEAR	3.0000	4500	0.10	450	1.	585.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
1-4 YEAR	2.0000	14000	0.10	1400	1.	1680.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
5-14 YEA	0.5000	6500	0.05	325	1.	390.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 MA	0.5000	5250	0.0	0	1.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 FE	1.0000	11000	0.0	0	1.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
45+ YEAR	1.0000	7000	0.0	0	1.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
		48250.				2655.					0.					0.0
OTITIS MEDIA																
0-1 YEAR	0.0200	29	0.10	2	1.	2.	15.	30.	30.	810.	840.	0.0	0.0	0.0	0.0	0.0
1-4 YEAR	0.1000	700	0.10	70	1.	84.	15.	30.	1050.	18900.	19950.	0.0	0.0	0.0	0.0	0.0
5-14 YEA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 FE	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
		729.				86.					20790.					0.0
SKIN DISEASE																
0-1 YEAR	0.0500	75	0.01	0	1.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
1-4 YEAR	0.1000	700	0.05	35	1.	39.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
5-14 YEA	0.0500	650	0.10	65	1.	72.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 MA	0.0500	525	0.10	52	1.	57.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 FE	0.0200	219	0.10	21	1.	23.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
45+ YEAR	0.0200	139	0.10	13	1.	14.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
		2308.				205.					0.					0.0
MILD DIARRHEA																
0-1 YEAR	3.0000	4500	0.04	179	1.	251.	3.	4.	537.	17284.	17821.	0.0	0.0	0.0	0.0	0.0
1-4 YEAR	3.0000	21000	0.04	836	1.	1175.	3.	5.	2517.	100805.	103322.	0.0	0.0	0.0	0.0	0.0
5-14 YEA	1.0000	13000	0.04	519	1.	727.	3.	5.	1557.	62405.	63962.	0.0	0.0	0.0	0.0	0.0
15-44 MA	1.0000	10500	0.04	419	1.	587.	1.	1.	419.	10081.	10500.	0.0	0.0	0.0	0.0	0.0
15-44 FE	1.0000	11000	0.04	439	1.	615.	1.	1.	439.	10561.	11000.	0.0	0.0	0.0	0.0	0.0
45+ YEAR	1.0000	7000	0.04	279	1.	391.	1.	1.	279.	6721.	7000.	0.0	0.0	0.0	0.0	0.0
		67000.				3744.					213605.					0.0
SEVERE DIARRHEA																
0-1 YEAR	0.4000	599	0.30	179	2.	358.	5.	7.	895.	2940.	3835.	1.5	14.0	2.7	58.8	61.5

APPENDIX E

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1-4 YEAR	0.3000	2100	0.35	735	2.	1470.	5.	10.	3675.	13650.	17325.	1.0	8.0	7.3	109.2	116.5	
5-14 YFA	0.0800	1039	0.15	155	2.	279.	5.	10.	775.	8840.	9615.	0.5	1.5	0.8	13.3	14.0	
15-44 MA	0.0800	839	0.15	125	2.	225.	5.	7.	625.	4998.	5623.	0.5	1.0	0.6	7.1	7.8	
15-44 FF	0.0800	879	0.15	131	2.	236.	5.	7.	655.	5236.	5891.	0.5	1.0	0.7	7.5	8.1	
45+ YEAR	0.0800	559	0.15	83	2.	149.	5.	7.	415.	3332.	3747.	0.5	1.0	0.4	4.8	5.2	
		6015.				2717.					46036.						213.1
TUBERCULOSIS																	
0-1 YEAR	0.0010	1	0.10	0	12.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.0020	14	0.10	1	12.	12.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YFA	0.0030	39	0.10	3	12.	36.	26.	60.	78.	2160.	2238.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0050	52	0.10	5	12.	60.	26.	60.	130.	2820.	2950.	5.0	10.0	0.3	4.7	4.9	
15-44 FF	0.0040	44	0.10	4	12.	48.	26.	90.	104.	3600.	3704.	5.0	10.0	0.2	4.0	4.2	
45+ YEAR	0.0100	70	0.10	7	12.	84.	26.	90.	182.	5670.	5852.	10.0	20.0	0.7	12.6	13.3	
		220.				240.					14744.						22.4
MALARIA																	
0-1 YEAR	0.0050	7	0.05	0	1.	0.	5.	20.	0.	140.	140.	0.1	1.0	0.0	0.1	0.1	
1-4 YEAR	0.0200	139	0.05	6	1.	7.	5.	20.	30.	2660.	2690.	0.1	1.0	0.0	1.3	1.3	
5-14 YFA	0.0500	650	0.05	32	1.	38.	3.	10.	96.	6180.	6276.	0.0	0.5	0.0	3.1	3.1	
15-44 MA	0.0500	525	0.05	26	1.	31.	2.	5.	52.	2495.	2547.	0.0	0.5	0.0	2.5	2.5	
15-44 FE	0.0500	550	0.05	27	1.	32.	2.	5.	54.	2615.	2669.	0.0	0.5	0.0	2.6	2.6	
45+ YEAR	0.0500	350	0.05	17	1.	20.	2.	5.	34.	1665.	1699.	0.0	0.5	0.0	1.7	1.7	
		2221.				130.					16021.						11.3
DIPTHERIA																	
0-1 YEAR	0.0	0	0.50	0	2.	0.	21.	21.	0.	0.	0.	10.0	20.0	0.0	0.0	0.0	
1-4 YEAR	0.0	0	0.50	0	2.	0.	21.	21.	0.	0.	0.	10.0	20.0	0.0	0.0	0.0	
5-14 YFA	0.0	0	0.50	0	2.	0.	21.	21.	0.	0.	0.	10.0	20.0	0.0	0.0	0.0	
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		0.				0.					0.						0.0
TETANUS																	
0-1 YEAR	0.0213	31	0.30	9	3.	23.	10.	10.	90.	220.	310.	60.0	90.0	5.4	19.8	25.2	
1-4 YEAR	0.0010	6	0.30	1	3.	3.	10.	15.	10.	75.	85.	20.0	60.0	0.2	3.0	3.2	
5-14 YFA	0.0006	7	0.30	2	3.	5.	10.	15.	20.	75.	95.	20.0	60.0	0.4	3.0	3.4	
15-44 MA	0.0001	1	0.30	0	3.	0.	10.	20.	0.	20.	20.	20.0	60.0	0.0	0.6	0.6	
15-44 FE	0.0001	1	0.30	0	3.	0.	10.	20.	0.	20.	20.	20.0	60.0	0.0	0.6	0.6	
45+ YEAR	0.0001	0	0.30	0	3.	0.	10.	20.	0.	0.	0.	20.0	60.0	0.0	0.0	0.0	
		46.				30.					530.						33.0
WHOPPING COUGH																	
0-1 YEAR	0.0100	15	0.10	1	3.	3.	60.	60.	60.	840.	900.	5.0	25.0	0.0	3.5	3.5	
1-4 YEAR	0.0500	350	0.10	35	3.	105.	60.	60.	2100.	18900.	21000.	0.1	1.0	0.0	3.1	3.2	
5-14 YFA	0.0100	130	0.10	13	3.	39.	40.	40.	520.	4680.	5200.	0.0	0.1	0.0	0.1	0.1	
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		495.				147.					27100.						6.8
MEASLES																	
0-1 YEAR	0.0	0	0.10	0	2.	0.	20.	20.	0.	0.	0.	5.0	20.0	0.0	0.0	0.0	
1-4 YEAR	0.2000	1399	0.20	279	2.	558.	20.	20.	5580.	22400.	27980.	0.5	3.5	1.4	39.2	40.6	
5-14 YFA	0.0100	130	0.10	13	2.	20.	20.	20.	260.	2340.	2600.	0.5	1.0	0.1	1.2	1.2	
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FF	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		1529.				578.					30580.						41.8
BURNS																	
0-1 YEAR	0.0001	0	0.10	0	1.	0.	10.	10.	0.	0.	0.	1.0	0.5	0.0	0.0	0.0	
1-4 YEAR	0.0020	14	0.10	1	1.	1.	10.	14.	10.	182.	192.	0.0	0.1	0.0	0.0	0.0	
5-14 YFA	0.0050	64	0.10	6	1.	7.	10.	12.	60.	696.	756.	0.0	0.2	0.0	0.1	0.1	
15-44 MA	0.0050	52	0.10	5	1.	6.	8.	8.	40.	376.	416.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0100	110	0.10	11	1.	12.	5.	5.	55.	495.	550.	0.0	0.0	0.0	0.0	0.0	

45+ YEAR	0.0100	70	0.10	7	1.	8.	5.	5.	35.	315.	350.	0.0	0.0	0.0	0.0	0.0	
		310.				33.					2264.						0.2
FRACTURES																	
0-1 YEAR	0.0	0	0.75	0	3.	0.	20.	40.	0.	0.	0.	0.1	1.0	0.0	0.0	0.0	
1-4 YEAR	0.0005	3	0.75	2	3.	6.	25.	40.	50.	40.	90.	0.1	0.5	0.0	0.0	0.0	
5-14 YEA	0.0010	12	0.75	9	3.	27.	25.	40.	225.	120.	345.	0.1	1.0	0.0	0.0	0.0	
15-44 MA	0.0020	21	0.75	15	3.	45.	25.	50.	375.	300.	675.	0.5	1.0	0.1	0.1	0.1	
15-44 FE	0.0001	1	0.75	0	3.	0.	25.	50.	0.	50.	50.	1.0	2.0	0.0	0.0	0.0	
45+ YEAR	0.0001	0	0.75	0	3.	0.	25.	50.	0.	0.	0.	1.0	2.0	0.0	0.0	0.0	
		37.				78.					1160.						0.2
CUTS																	
0-1 YEAR	0.0	0	0.10	0	2.	0.	10.	10.	0.	0.	0.	0.0	0.1	0.0	0.0	0.0	
1-4 YEAR	0.0200	139	0.05	6	2.	9.	7.	14.	42.	1862.	1904.	0.0	0.1	0.0	0.1	0.1	
5-14 YEA	0.0100	130	0.10	13	2.	20.	7.	10.	91.	1170.	1261.	0.0	0.1	0.0	0.1	0.1	
15-44 MA	0.0200	209	0.10	20	2.	30.	3.	5.	60.	945.	1005.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0100	110	0.10	11	2.	17.	3.	5.	33.	495.	528.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0100	70	0.10	7	2.	11.	3.	5.	21.	315.	336.	0.0	0.0	0.0	0.0	0.0	
		658.				86.					5034.						0.2
ANEMIA																	
0-1 YEAR	0.2500	375	0.05	18	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.5000	3500	0.05	175	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.2000	2599	0.05	129	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.2000	2099	0.05	104	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.6000	6600	0.05	330	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.2000	1399	0.05	69	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		16572.				0.					0.						0.0
MALNUTRITION																	
0-1 YEAR	0.5000	750	0.05	37	3.	111.	0.	0.	0.	0.	0.	0.0	2.0	0.0	14.3	14.3	
1-4 YEAR	0.5000	3500	0.05	175	3.	525.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.3000	3900	0.10	390	3.	1170.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.2000	2099	0.0	0	3.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.2000	2199	0.0	0	3.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.2000	1399	0.0	0	3.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		13847.				1800.					0.						14.3
INTESTINAL PARASITES																	
0-1 YEAR	0.0100	15	0.01	0	1.	0.	5.	7.	0.	105.	105.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	1.0000	7000	0.01	70	1.	77.	3.	5.	210.	34650.	34860.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	1.0000	13000	0.01	130	1.	143.	2.	3.	260.	38610.	38870.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.2000	2099	0.03	62	1.	68.	2.	3.	124.	6111.	6235.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.2000	2199	0.03	65	1.	72.	2.	3.	130.	6402.	6532.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.2000	1399	0.03	41	1.	45.	2.	3.	82.	4074.	4156.	0.0	0.0	0.0	0.0	0.0	
		25712.				405.					90758.						0.0
HEART DISEASE																	
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0001	1	0.05	0	5.	0.	10.	21.	0.	21.	21.	2.0	5.0	0.0	0.0	0.0	
15-44 MA	0.0020	21	0.20	4	5.	20.	10.	21.	40.	357.	397.	5.0	8.0	0.2	1.4	1.6	
15-44 FE	0.0010	10	0.15	1	5.	5.	10.	21.	10.	189.	199.	5.0	8.0	0.0	0.7	0.8	
45+ YEAR	0.0500	350	0.15	52	5.	260.	10.	21.	520.	6258.	6778.	10.0	10.0	5.2	29.8	35.0	
		382.				285.					7395.						37.4
CEREBRO VASCULAR DISEASE																	
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0030	31	0.50	15	5.	75.	21.	30.	315.	480.	795.	5.0	10.0	0.8	1.6	2.3	
15-44 FE	0.0020	22	0.30	6	5.	30.	21.	30.	126.	480.	606.	5.0	10.0	0.3	1.6	1.9	
45+ YEAR	0.0200	139	0.30	41	5.	205.	21.	30.	861.	2940.	3801.	20.0	20.0	8.2	19.6	27.8	
		192.				310.					5202.						32.0
COMPLICATIONS OF CHILDBIRTH AND PREGNANCY																	
0-1 YEAR	0.0400	134	0.10	11	1.	13.	0.	0.	0.	0.	0.	1.0	20.0	0.1	24.2	24.3	

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1-4 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0015	19	0.45	8	5.	40.	14.	24.	112.	264.	376.	3.0	9.0	0.2	1.0	1.2	
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0240	264	0.40	105	5.	525.	10.	20.	1050.	3180.	4230.	2.0	7.0	2.1	11.1	13.2	
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		417.				578.					4606.						38.8
THYPHOID																	
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.0200	139	0.10	13	1.	13.	10.	15.	130.	1890.	2020.	0.0	1.0	0.0	1.3	1.3	
5-14 YEA	0.0100	130	0.20	25	1.	25.	10.	20.	250.	2100.	2350.	1.0	5.0	0.3	5.2	5.5	
15-44 MA	0.0050	52	0.20	10	1.	10.	10.	30.	100.	1260.	1360.	2.0	10.0	0.2	4.2	4.4	
15-44 FE	0.0050	54	0.20	10	2.	20.	10.	30.	100.	1320.	1420.	3.0	10.0	0.3	4.4	4.7	
45+ YEAR	0.0050	34	0.20	6	2.	12.	10.	30.	60.	840.	900.	3.0	10.0	0.2	2.8	3.0	
		409.				80.					8050.						18.8
HEPATITIS																	
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.0060	42	0.0	0	0.	0.	5.	5.	0.	210.	210.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0100	130	0.10	13	1.	13.	10.	10.	130.	1170.	1300.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0040	42	0.20	8	2.	16.	15.	15.	120.	510.	630.	0.5	0.5	0.0	0.2	0.2	
15-44 FE	0.0040	44	0.20	8	2.	16.	15.	15.	120.	540.	660.	0.5	0.5	0.0	0.2	0.2	
45+ YEAR	0.0040	28	0.20	5	2.	10.	15.	15.	75.	345.	420.	0.5	0.5	0.0	0.1	0.1	
		286.				55.					3220.						0.6
CONJUNCTIVITIS																	
0-1 YEAR	0.0200	29	0.05	1	1.	1.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.0400	279	0.10	27	1.	27.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0600	779	0.10	77	1.	77.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0100	105	0.05	5	1.	5.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0100	110	0.05	5	1.	5.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0100	70	0.05	3	1.	3.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		13				118.					0.						0.0
RHEUMATIC FEVER																	
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0050	52	0.10	5	2.	10.	14.	7.	70.	329.	399.	0.1	0.2	0.0	0.1	0.1	
15-44 FE	0.0050	54	0.10	5	2.	10.	14.	7.	70.	343.	413.	0.1	0.2	0.0	0.1	0.1	
45+ YEAR	0.0050	34	0.10	3	2.	6.	14.	7.	42.	217.	259.	0.1	0.2	0.0	0.1	0.1	
		140.				26.					1071.						0.3
VARICELLA																	
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.2000	1399	0.15	209	1.	209.	10.	14.	2090.	16660.	18750.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.1000	1300	0.15	194	1.	194.	7.	10.	1358.	11060.	12418.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		2699.				403.					31168.						0.0
MUMPS																	
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.2000	1399	0.10	139	1.	139.	7.	7.	973.	8820.	9793.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.1000	1300	0.10	130	1.	130.	7.	7.	910.	8190.	9100.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
		2699.				269.					18893.						0.0
GONORRHEA																	
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
1-4 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
5-14 YEA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 MA	0.0020	21	0.20	4	1.	4.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	
15-44 FE	0.0020	22	0.20	4	1.	4.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0	

	RATE	INC.	XPSC	NUSC	VC	TOVT	DLHX	DLNHX	X	Y	X+Y	CFRX	CFNRX	S	R	S+R
45+ YEAR	0.0020	14	0.20	2	1.	2.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
		57.				10.					0.					0.0
GOITER																
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
1-4 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
5-14 YEA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 MA	0.0040	42	0.05	2	1.	2.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 FE	0.0040	44	0.05	2	1.	2.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
45+ YEAR	0.0040	28	0.05	1	1.	1.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
		114.				5.					0.					0.0
VITAMIN A DEFICIENCY																
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
1-4 YEAR	0.0200	139	0.01	1	1.	1.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
5-14 YEA	0.0050	64	0.00	0	1.	0.	1.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 MA	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 FE	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
45+ YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
		203.				1.					0.					0.0
DENTAL PROBLEM																
0-1 YEAR	0.0	0	0.0	0	0.	0.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
1-4 YEAR	0.0500	350	0.00	1	0.	0.	1.	0.	1.	0.	1.	0.0	0.0	0.0	0.0	0.0
5-14 YEA	0.0300	390	0.01	3	1.	3.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 MA	0.1000	1050	0.05	52	2.	104.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
15-44 FE	0.1000	1100	0.05	55	2.	110.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
45+ YEAR	0.2000	1399	0.05	69	2.	138.	0.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	0.0
		4289.				355.					1.					0.0
		200210.				15615.					567843.					548.5

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APPENDIX F

Health Effects Under Fixed Budgets

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*****************************************************************************************
*  EQUAL COST FOR INDONESIA TULONG AGONG EAST JAVA
*  WITH A BUDGET FOR 5 YEARS OF        5.00 PER CAPITA
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$$$ COST IS IN U.S. DOLLARS $$$ Equal Cost for Indonesia Tulungagung East Java with a Budget for 5 Years of $5.00/Capita

ALTER-NATIVE	PV	COST	%ADD COVERAGE	MORT/1000 W/COV	DIT/CAP W/COV	EXCESS BUDGET	0-1 MORT	1-4 MORT	5-14 MORT	15-44 DIT	45+ DIT	TOTAL MORB	TOTAL MORT
1	1	2.06	100.00	10.97	11.36	2.94	103.95	28.26	2.67	3.64	5.48	11.36	10.97
1	2	16.06	21.00	7.09	6.59	0.0	96.63	25.26	2.41	3.31	5.14	10.36	10.15
1	3	3.41	100.00	10.23	10.91	1.53	85.88	27.44	2.40	3.64	5.48	10.91	10.23
1	4	17.47	19.08	6.34	6.14	0.0	93.85	25.38	2.39	3.34	5.17	10.36	10.09
1	5	6.06	73.50	9.36	10.15	0.0	88.79	23.03	2.67	3.64	5.48	10.47	9.78
1	6	20.06	16.33	6.28	6.13	0.0	96.43	25.39	2.47	3.38	5.22	10.50	10.20
1	7	7.47	54.34	8.62	9.71	0.0	82.92	23.95	2.52	3.64	5.48	10.46	9.69
1	8	19.41	16.95	5.54	5.69	0.0	93.09	25.15	2.42	3.37	5.21	10.40	10.05
2	1	5.61	02.82	8.40	10.55	0.0	87.25	20.38	1.99	3.41	5.06	10.69	8.84
2	2	19.61	16.75	5.83	6.13	0.0	97.09	25.11	2.38	3.34	5.14	10.48	10.11
2	3	7.02	59.27	7.84	10.11	0.0	83.33	22.34	2.09	3.48	5.18	10.61	9.12
2	4	21.02	15.51	5.27	5.69	0.0	95.34	25.28	2.38	3.36	5.17	10.48	10.09
2	5	9.61	38.94	7.21	9.46	0.0	89.91	22.57	2.35	3.53	5.28	10.62	9.51
2	6	23.61	13.64	5.16	5.72	0.0	96.97	25.34	2.43	3.40	5.20	10.59	10.18
2	7	11.02	32.81	6.66	9.01	0.0	87.32	23.32	2.35	3.55	5.31	10.59	9.56
2	8	22.96	14.07	4.60	5.28	0.0	94.69	25.18	2.40	3.39	5.19	10.50	10.07
3	1	7.35	55.58	8.83	10.51	0.0	92.86	24.26	2.31	3.49	5.19	10.89	9.78
3	2	21.35	15.24	5.71	6.05	0.0	96.88	25.39	2.42	3.37	5.16	10.55	10.17
3	3	8.76	43.88	8.22	10.07	0.0	88.29	24.86	2.30	3.52	5.25	10.79	9.76
3	4	22.76	14.20	5.09	5.61	0.0	95.13	25.51	2.41	3.38	5.19	10.54	10.14
3	5	11.35	31.65	7.58	9.41	0.0	92.37	24.30	2.46	3.55	5.31	10.74	9.90
3	6	25.35	12.62	5.11	5.64	0.0	96.89	25.61	2.46	3.41	5.22	10.64	10.23
3	7	12.76	27.48	6.97	8.97	0.0	89.58	24.67	2.44	3.57	5.33	10.70	9.87
3	8	24.70	12.99	4.50	5.20	0.0	94.65	25.46	2.43	3.41	5.21	10.56	10.13
4	1	15.49	21.89	6.45	9.27	0.0	94.99	24.72	2.41	3.52	5.24	10.90	9.98
4	2	29.49	10.72	4.53	5.39	0.0	98.00	25.82	2.46	3.42	5.20	10.72	10.28
4	3	16.90	19.81	5.87	8.83	0.0	92.80	24.97	2.40	3.53	5.26	10.86	9.96
4	4	30.90	10.19	3.94	4.94	0.0	96.73	25.89	2.45	3.43	5.22	10.70	10.25
4	5	19.49	16.87	5.69	8.39	0.0	95.10	25.03	2.47	3.55	5.29	10.86	10.08
4	6	33.49	9.35	4.13	5.06	0.0	98.05	26.01	2.49	3.45	5.24	10.77	10.33
4	7	20.90	15.61	5.10	7.94	0.0	93.37	25.20	2.46	3.55	5.31	10.82	10.06
4	8	32.84	9.55	3.54	4.61	0.0	96.46	25.92	2.47	3.45	5.23	10.71	10.26
5	1	4.17	100.00	8.97	10.54	0.83	85.34	21.35	2.06	3.40	5.05	10.54	8.97
5	2	18.17	18.25	5.76	6.07	0.0	95.59	24.82	2.37	3.32	5.12	10.39	10.02
5	3	5.58	83.52	8.32	10.10	0.0	74.67	21.98	1.97	3.44	5.12	10.30	8.76
5	4	19.58	16.78	5.11	5.63	0.0	93.51	24.99	2.36	3.34	5.15	10.40	9.99
5	5	8.17	48.12	7.70	9.44	0.0	86.76	22.32	2.38	3.53	5.27	10.43	9.40
5	6	22.17	14.62	5.15	5.66	0.0	95.82	25.18	2.43	3.38	5.19	10.52	10.12
5	7	9.58	39.10	7.05	9.00	0.0	83.56	23.20	2.34	3.55	5.31	10.43	9.44
5	8	21.52	15.11	4.50	5.21	0.0	93.06	24.98	2.39	3.37	5.18	10.43	9.99
6	1	12.12	29.22	6.94	9.44	0.0	93.21	23.91	2.36	3.52	5.26	10.80	9.79
6	2	26.12	12.22	4.75	5.50	0.0	97.39	25.50	2.44	3.41	5.20	10.64	10.21
6	3	13.53	25.63	6.31	9.00	0.0	90.38	24.31	2.34	3.53	5.28	10.75	9.78
6	4	27.53	11.54	4.12	5.06	0.0	95.88	25.60	2.43	3.42	5.22	10.63	10.18
6	5	16.12	20.91	6.08	8.54	0.0	93.57	24.45	2.45	3.55	5.32	10.77	9.95
6	6	30.12	10.48	4.32	5.17	0.0	97.45	25.76	2.47	3.44	5.24	10.71	10.27
6	7	17.53	19.00	5.45	8.10	0.0	91.44	24.69	2.42	3.56	5.33	10.74	9.92
6	8	29.47	10.73	3.69	4.72	0.0	95.56	25.64	2.44	3.44	5.24	10.65	10.19

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*****************************************************************************************
*  EQUAL COST FOR INDONESIA TULONG AGONG EAST JAVA
*  WITH A BUDGET FOR 5 YEARS OF          7.50 PER CAPITA
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$$$ COST IS IN U.S. DOLLARS $$$ Equal Cost for Indonesia Tulungagung East Java with a Budget for 5 Years of $7.50/Capita

ALTER-NATIVE	PV	COST	%ADD COVERAGE	MORT/1000 W/COV	DEI/CAP W/COV	EXCESS BUDGET	0-1 MORT	1-4 MORT	5-14 MORT	15-44 DEI	45+ DEI	TOTAL MORB	TOTAL MORT
1	1	2.06	100.00	10.97	11.36	5.44	103.95	28.26	2.67	3.64	5.48	11.36	10.97
1	2	16.06	38.86	7.08	6.59	0.0	90.41	22.71	2.20	3.02	4.86	9.50	9.46
1	3	3.41	100.00	10.23	10.91	4.09	85.88	27.44	2.40	3.64	5.48	10.91	10.23
1	4	17.47	35.30	6.34	6.14	0.0	85.27	22.93	2.15	3.08	4.91	9.52	9.34
1	5	6.06	100.00	9.36	10.15	1.44	83.32	21.15	2.67	3.64	5.48	10.15	9.36
1	6	20.06	30.22	6.28	6.13	0.0	90.04	22.95	2.30	3.16	5.00	9.78	9.55
1	7	7.47	100.00	8.62	9.71	0.03	65.26	20.33	2.40	3.64	5.48	9.71	8.62
1	8	19.41	31.35	5.54	5.69	0.0	83.86	22.50	2.20	3.14	4.98	9.58	9.27
2	1	5.61	100.00	8.40	10.55	1.89	83.78	18.74	1.85	3.36	4.98	10.55	8.40
2	2	19.61	31.00	5.83	6.13	0.0	91.26	22.44	2.14	3.08	4.85	9.74	9.38
2	3	7.02	100.00	7.84	10.11	0.48	69.16	18.27	1.69	3.36	4.98	10.11	7.84*
2	4	21.02	28.69	5.27	5.69	0.0	88.01	22.74	2.13	3.12	4.90	9.73	9.34
2	5	9.61	72.05	7.21	9.46	0.0	77.97	17.74	2.08	3.44	5.12	9.99	8.26
2	6	23.61	25.24	5.16	5.72	0.0	91.03	22.86	2.24	3.19	4.97	9.93	9.50
2	7	11.02	60.71	6.66	9.01	0.0	73.18	19.11	2.07	3.47	5.17	9.93	8.35
2	8	22.96	26.03	4.60	5.28	0.0	86.82	22.57	2.18	3.17	4.95	9.77	9.31
3	1	7.35	100.00	8.83	10.51	0.15	84.00	21.06	2.02	3.36	4.95	10.51	8.83
3	2	21.35	28.20	5.71	6.05	0.0	90.87	22.95	2.20	3.13	4.90	9.86	9.49
3	3	8.76	81.19	8.22	10.07	0.0	74.98	21.97	1.98	3.42	5.05	10.31	8.74
3	4	22.76	26.28	5.09	5.61	0.0	87.63	23.17	2.18	3.16	4.94	9.85	9.43
3	5	11.35	58.56	7.58	9.41	0.0	82.53	20.92	2.29	3.48	5.17	10.22	8.99
3	6	25.35	23.36	5.11	5.64	0.0	90.89	23.35	2.28	3.22	5.00	10.02	9.60
3	7	12.76	50.84	6.97	8.97	0.0	77.35	21.61	2.24	3.50	5.21	10.14	8.94
3	8	24.70	24.03	4.50	5.20	0.0	86.74	23.07	2.23	3.21	4.98	9.88	9.42
4	1	15.49	40.51	6.45	9.27	0.0	87.36	21.71	2.20	3.41	5.04	10.51	9.14
4	2	29.49	19.83	4.53	5.39	0.0	92.93	23.74	2.29	3.24	4.97	10.17	9.69
4	3	16.90	36.66	5.87	8.83	0.0	83.32	22.17	2.17	3.44	5.08	10.43	9.10
4	4	30.90	18.86	3.94	4.94	0.0	90.58	23.87	2.27	3.26	5.00	10.15	9.65
4	5	19.49	31.21	5.69	8.39	0.0	87.58	22.28	2.30	3.47	5.14	10.43	9.32
4	6	33.49	17.31	4.13	5.06	0.0	93.03	24.10	2.34	3.29	5.03	10.27	9.79
4	7	20.90	28.87	5.10	7.94	0.0	84.38	22.60	2.28	3.48	5.16	10.37	9.28
4	8	32.84	17.67	3.54	4.61	0.0	90.09	23.93	2.30	3.28	5.03	10.16	9.66
5	1	4.17	100.00	8.97	10.54	3.33	85.34	21.35	2.06	3.40	5.05	10.54	8.97
5	2	18.17	33.77	5.76	6.07	0.0	88.49	21.89	2.12	3.04	4.81	9.57	9.21
5	3	5.58	100.00	8.32	10.10	1.92	68.90	20.74	1.83	3.40	5.05	10.10	8.32
5	4	19.58	31.05	5.11	5.63	0.0	84.63	22.21	2.09	3.09	4.87	9.58	9.15
5	5	8.17	89.03	7.70	9.44	0.0	72.15	17.28	2.13	3.43	5.10	9.65	8.06
5	6	22.17	27.05	5.15	5.66	0.0	88.91	22.56	2.23	3.16	4.94	9.81	9.40
5	7	9.58	72.34	7.05	9.00	0.0	66.21	18.89	2.06	3.47	5.17	9.65	8.13
5	8	21.52	27.95	4.50	5.21	0.0	83.81	22.19	2.15	3.14	4.93	9.64	9.16
6	1	12.12	54.08	6.94	9.44	0.0	84.07	20.20	2.09	3.41	5.07	10.32	8.79
6	2	26.12	22.61	4.75	5.50	0.0	91.81	23.16	2.25	3.21	4.97	10.03	9.56
6	3	13.53	47.43	6.31	9.00	0.0	78.83	20.94	2.06	3.44	5.12	10.24	8.76
6	4	27.53	21.36	4.12	5.06	0.0	89.02	23.33	2.22	3.23	5.00	10.01	9.51
6	5	16.12	38.69	6.08	8.54	0.0	84.75	21.20	2.26	3.48	5.18	10.27	9.08
6	6	30.12	19.39	4.32	5.17	0.0	91.93	23.63	2.31	3.27	5.04	10.16	9.68
6	7	17.53	35.16	5.45	8.10	0.0	80.80	21.66	2.21	3.49	5.21	10.21	9.03
6	8	29.47	19.85	3.69	4.72	0.0	88.43	23.42	2.25	3.26	5.03	10.04	9.53

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*****************************************************************************************
*  EQUAL COST FOR INDONESIA TULONG AGONG EAST JAVA                                      *
*  WITH A BUDGET FOR 5 YEARS OF        10.00 PER CAPITA                                 *
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$$$ COST IS IN U.S. DOLLARS $$$ Equal Cost for Indonesia Tulungagung East Java with a Budget for 5 Years of$10.00/Capita

ALTER-NATIVE	PV	COST	%AUD COVERAGE	MORT/1000 W/COV	DTI/CAP W/COV	EXCESS BUDGET	0-1 MORT	1-4 MORT	5-14 MORT	15-44 DTI	45+ DTI	TOTAL MORB	TOTAL MORT
1	1	2.06	100.00	10.97	11.36	7.94	103.95	28.26	2.67	3.64	5.48	11.36	10.97
1	2	16.06	56.71	7.08	6.57	0.0	84.18	20.16	1.98	2.74	4.57	8.65	8.76
1	3	3.41	100.00	10.23	10.91	6.59	85.88	27.44	2.40	3.64	5.48	10.91	10.23
1	4	17.47	51.52	6.34	6.14	0.0	76.68	20.48	1.91	2.82	4.65	8.67	8.58
1	5	6.06	100.00	9.36	10.15	3.94	83.37	21.15	2.67	3.64	5.48	10.15	9.36
1	6	20.06	44.11	6.28	6.13	0.0	83.65	20.51	2.13	2.94	4.77	9.05	8.90
1	7	7.47	100.00	8.62	9.71	2.53	65.26	20.33	2.40	3.64	5.48	9.71	8.62
1	8	19.41	45.76	5.54	5.69	0.0	74.62	19.85	1.99	2.91	4.75	8.76	8.49
2	1	5.61	100.00	8.40	10.55	4.39	83.78	18.74	1.85	3.36	4.98	10.55	8.40
2	2	19.61	45.24	5.83	6.13	0.0	85.43	19.76	1.89	2.82	4.57	8.99	8.69
2	3	7.02	100.00	7.84	10.11	2.98	69.16	18.27	1.69	3.36	4.98	10.11	7.84
2	4	21.02	41.88	5.27	5.69	0.0	80.68	20.20	1.88	2.89	4.63	8.98	8.58
2	5	9.61	100.00	7.21	9.46	0.39	67.89	13.66	1.85	3.36	4.98	9.46	7.21
2	6	23.61	36.84	5.16	5.72	0.0	85.09	20.37	2.04	2.98	4.73	9.28	8.83
2	7	11.02	88.62	6.66	9.01	0.0	59.03	14.90	1.80	3.39	5.03	9.28	7.15
2	8	22.96	37.99	4.60	5.28	0.0	78.95	19.95	1.95	2.96	4.71	9.05	8.55
3	1	7.35	100.00	8.83	10.51	2.65	84.00	21.06	2.02	3.36	4.95	10.51	8.83
3	2	21.35	41.16	5.71	6.05	0.0	84.86	20.51	1.99	2.89	4.63	9.17	8.80
3	3	8.76	100.00	8.22	10.07	1.24	68.27	20.52	1.82	3.36	4.95	10.07	8.22
3	4	22.76	38.36	5.09	5.61	0.0	80.12	20.83	1.96	2.94	4.69	9.15	8.72
3	5	11.35	85.47	7.58	9.41	0.0	72.68	17.55	2.11	3.40	5.03	9.69	8.08
3	6	25.35	34.09	5.11	5.64	0.0	84.90	21.09	2.11	3.02	4.78	9.41	8.97
3	7	12.76	74.21	6.97	8.97	0.0	65.13	18.56	2.04	3.44	5.09	9.58	8.00
3	8	24.70	35.07	4.50	5.20	0.0	78.83	20.69	2.02	3.00	4.76	9.20	8.70
4	1	15.49	59.12	6.45	9.27	0.0	79.74	18.70	1.98	3.31	4.84	10.13	8.30
4	2	29.49	28.95	4.53	5.39	0.0	87.87	21.66	2.12	3.05	4.74	9.63	9.11
4	3	16.90	53.50	5.87	8.83	0.0	73.84	19.37	1.94	3.34	4.90	10.01	8.24
4	4	30.90	27.53	3.94	4.94	0.0	84.44	21.86	2.09	3.08	4.77	9.59	9.04
4	5	19.49	45.55	5.69	8.39	0.0	80.05	19.53	2.14	3.38	4.98	10.00	8.56
4	6	33.49	25.26	4.13	5.06	0.0	88.01	22.19	2.19	3.13	4.83	9.76	9.24
4	7	20.90	42.14	5.10	7.94	0.0	75.38	19.99	2.10	3.40	5.02	9.92	8.50
4	8	32.84	25.80	3.54	4.61	0.0	83.72	21.94	2.13	3.12	4.82	9.62	9.06
5	1	4.17	100.00	8.97	10.54	5.83	85.34	21.35	2.06	3.40	5.05	10.54	8.97
5	2	18.17	49.29	5.76	6.07	0.0	81.38	18.97	1.87	2.76	4.51	8.75	8.40
5	3	5.58	100.00	8.32	10.10	4.42	68.90	20.74	1.83	3.40	5.05	10.10	8.32
5	4	19.58	45.32	5.11	5.63	0.0	75.75	19.43	1.83	2.83	4.58	8.76	8.31
5	5	8.17	100.00	7.70	9.44	1.83	68.23	15.92	2.06	3.40	5.05	9.44	7.70
5	6	22.17	39.48	5.15	5.66	0.0	81.99	19.93	2.03	2.94	4.70	9.11	8.67
>5	7	9.58	100.00	7.05	9.00	0.42	51.79	15.31	1.83	3.40	5.05	9.00	7.05*
5	8	21.52	40.80	4.50	5.21	0.0	74.55	19.40	1.91	2.91	4.67	8.85	8.33
6	1	12.12	78.93	6.94	9.44	0.0	74.93	16.50	1.83	3.30	4.88	9.84	7.79
6	2	26.12	33.00	4.75	5.50	0.0	86.23	20.82	2.05	3.01	4.73	9.43	8.92
6	3	13.53	69.22	6.31	9.00	0.0	67.29	17.58	1.77	3.34	4.95	9.72	7.74
6	4	27.53	31.17	4.12	5.06	0.0	82.16	21.06	2.02	3.04	4.77	9.39	8.84
6	5	16.12	56.47	6.08	8.54	0.0	75.92	17.96	2.07	3.40	5.05	9.77	8.21
6	6	30.12	28.30	4.32	5.17	0.0	86.40	21.51	2.14	3.10	4.84	9.61	9.09
6	7	17.53	51.33	5.45	8.10	0.0	70.17	18.63	2.01	3.42	5.09	9.69	8.14
6	8	29.47	28.97	3.69	4.72	0.0	81.30	21.19	2.06	3.08	4.82	9.44	8.86

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*****************************************************************************************
*  EQUAL COST FOR INDONESIA TULONG AGONG EAST JAVA                                      *
*  WITH A BUDGET FOR 5 YEARS OF        15.00 PER CAPITA                                 *
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$$$ COST IS IN U.S. DOLLARS $$$ Equal Cost for Indonesia Tulungagung East Java with a Budget for 5 Years of $15.00/Capita

ALTER-NATIVE	PV	COST	%ADD COVERAGE	MORT/1000 W/COV	DII/CAP W/COV	EXCESS BUDGET	0-1 MORT	1-4 MORT	5-14 MORT	15-44 DII	45+ DII	TOTAL MORB	TOTAL MORT
1	1	2.06	100.00	10.97	11.36	12.94	103.95	28.26	2.67	3.64	5.48	11.36	10.97
1	2	16.06	92.43	7.08	6.59	0.0	71.74	15.06	1.54	2.16	4.00	6.95	7.37
1	3	3.41	100.00	10.23	10.91	11.59	85.88	27.44	2.40	3.64	5.48	10.91	10.23
1	4	17.47	83.97	6.34	6.14	0.0	59.52	15.58	1.42	2.30	4.14	6.98	7.08
1	5	6.06	100.00	9.36	10.15	8.94	83.32	21.15	2.67	3.64	5.48	10.15	9.36
1	6	20.06	71.89	6.28	6.13	0.0	70.87	15.63	1.79	2.49	4.33	7.60	7.60
1	7	7.47	100.00	8.62	9.71	7.53	65.26	20.33	2.40	3.64	5.48	9.71	8.62
1	8	19.41	74.58	5.54	5.69	0.0	56.16	14.55	1.56	2.45	4.29	7.13	6.92
2	1	5.61	100.00	8.40	10.55	9.39	83.78	18.74	1.85	3.36	4.98	10.55	8.40
2	2	19.61	73.73	5.83	6.13	0.0	73.77	14.41	1.40	2.31	3.99	7.50	7.18
2	3	7.02	100.00	7.84	10.11	7.98	69.16	18.27	1.69	3.36	4.98	10.11	7.84
2	4	21.02	68.25	5.27	5.69	0.0	66.03	15.12	1.38	2.41	4.10	7.49	7.08
2	5	9.61	100.00	7.21	9.46	5.39	67.89	13.66	1.85	3.36	4.98	9.46	7.21
2	6	23.61	60.05	5.16	5.72	0.0	73.21	15.41	1.64	2.56	4.27	7.97	7.48
2	7	11.02	100.00	6.66	9.01	3.98	53.26	13.19	1.69	3.36	4.98	9.01	6.66
2	8	22.96	61.91	4.60	5.28	0.0	63.20	14.72	1.50	2.52	4.23	7.59	7.03
3	1	7.35	100.00	8.83	10.51	7.65	84.00	21.06	2.02	3.36	4.95	10.51	8.83
3	2	21.35	67.08	5.71	6.05	0.0	72.83	15.63	1.56	2.42	4.10	7.80	7.44
3	3	8.76	100.00	8.22	10.07	6.24	68.27	20.52	1.82	3.36	4.95	10.07	8.22
3	4	22.76	62.51	5.09	5.61	0.0	65.12	16.15	1.52	2.51	4.19	7.76	7.30
3	5	11.35	100.00	7.58	9.41	3.65	67.36	15.73	2.02	3.36	4.95	9.41	7.58
3	6	25.35	55.56	5.11	5.64	0.0	72.90	16.57	1.75	2.63	4.33	8.18	7.71
3	7	12.76	100.00	6.97	8.97	2.24	51.64	15.18	1.82	3.36	4.95	8.97	6.97
3	8	24.70	57.16	4.50	5.20	0.0	63.01	15.92	1.61	2.60	4.30	7.84	7.27
4	1	15.49	96.35	6.45	9.27	0.0	64.49	12.68	1.54	3.10	4.43	9.35	6.62
4	2	29.49	47.17	4.53	5.39	0.0	77.74	17.50	1.77	2.68	4.27	8.54	7.93
4	3	16.90	87.20	5.87	8.83	0.0	54.89	13.77	1.48	3.15	4.53	9.15	6.52
4	4	30.90	44.87	3.94	4.94	0.0	72.15	17.83	1.73	2.73	4.33	8.48	7.82
4	5	19.49	74.24	5.69	8.39	0.0	65.00	14.03	1.80	3.22	4.67	9.15	7.05
4	6	33.49	41.17	4.13	5.06	0.0	77.97	18.36	1.88	2.80	4.42	8.7[illegible]	8.15
4	7	20.90	68.68	5.10	7.94	0.0	57.39	14.78	1.73	3.25	4.73	9.01	6.94
4	8	32.84	42.04	3.54	4.61	0.0	70.98	17.97	1.79	2.78	4.40	8.52	7.85
5	1	4.17	100.00	8.97	10.54	10.83	85.34	21.35	2.06	3.40	5.05	10.54	8.97
5	2	18.17	80.32	5.76	6.07	0.0	67.17	13.11	1.36	2.21	3.89	7.11	6.78
5	3	5.58	100.00	8.32	10.10	9.42	60.90	20.74	1.83	3.40	5.05	10.10	8.32
5	4	19.58	73.86	5.11	5.63	0.0	57.98	13.88	1.30	2.32	4.02	7.13	6.64
5	5	8.17	100.00	7.70	9.44	6.83	68.23	15.92	2.06	3.40	5.05	9.44	7.70
5	6	22.17	64.35	5.15	5.66	0.0	68.17	14.69	1.62	2.49	4.21	7.69	7.23
5	7	9.58	100.00	7.05	9.00	5.42	51.79	15.31	1.83	3.40	5.05	9.00	7.05
5	8	21.52	66.50	4.50	5.21	0.0	56.04	13.83	1.44	2.45	4.17	7.27	6.67
6	1	12.12	100.00	6.94	9.44	2.88	67.18	13.36	1.60	3.21	4.72	9.44	6.94
6	2	26.12	53.78	4.75	5.50	0.0	75.07	16.13	1.66	2.61	4.26	8.21	7.63
6	3	13.53	100.00	6.31	9.00	1.47	50.99	12.83	1.38	3.21	4.72	9.00	6.31*
6	4	27.53	50.80	4.12	5.06	0.0	68.45	16.53	1.61	2.66	4.33	8.16	7.49
6	5	16.12	92.03	6.08	8.54	0.0	58.28	11.47	1.69	3.25	4.78	8.77	6.47
6	6	30.12	46.12	4.32	5.17	0.0	75.35	17.25	1.81	2.75	4.44	8.50	7.90
6	7	17.53	83.65	5.45	8.10	0.0	48.89	12.56	1.59	3.28	4.84	8.63	6.36
6	8	29.47	47.21	3.69	4.72	0.0	67.03	16.74	1.68	2.73	4.41	8.23	7.53

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*****************************************************************************
*  EQUAL COST FOR INDONESIA TULONG AGONG EAST JAVA                          *
*  WITH A BUDGET FOR 5 YEARS OF        20.00 PER CAPITA                     *
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$$$ COST IS IN U.S. DOLLARS $$$ Equal Cost for Indonesia Tulungagung East Java with a Budget for 5 Years of $20.00/Capita

ALTER-NATIVE	PV	COST	%ADD COVERAGE	MORT/1000 W/COV	DII/CAP W/COV	EXCESS BUDGET	0-1 MORT	1-4 MORT	5-14 MORT	15-44 DII	45+ DII	TOTAL MORB	TOTAL MORT
1	1	2.06	100.00	10.97	11.36	17.94	103.95	28.26	2.67	3.64	5.48	11.36	10.97
1	2	16.06	100.00	7.08	6.59	3.94	69.10	13.98	1.45	2.04	3.88	6.59	7.08
1	3	3.41	100.00	10.23	10.91	16.59	85.88	27.44	2.40	3.64	5.48	10.91	10.23
1	4	17.47	100.00	6.34	6.14	2.53	51.03	13.16	1.19	2.04	3.88	6.14	6.34
1	5	6.06	100.00	9.36	10.15	13.94	83.32	21.15	2.67	3.64	5.48	10.15	9.36
1	6	20.06	99.67	6.28	6.13	0.0	58.09	10.75	1.46	2.05	3.89	6.15	6.30
1	7	7.47	100.00	8.62	9.71	12.53	65.26	20.33	2.40	3.64	5.48	9.71	8.62
1	8	19.41	100.00	5.54	5.69	0.59	39.87	9.87	1.19	2.04	3.88	5.69	5.54
2	1	5.61	100.00	8.40	10.55	14.39	83.78	18.74	1.85	3.36	4.98	10.55	8.40
2	2	19.61	100.00	5.83	6.13	0.39	63.02	9.47	0.95	1.84	3.46	6.13	5.83
2	3	7.02	100.00	7.84	10.11	12.98	69.16	18.27	1.69	3.36	4.98	10.11	7.84
2	4	21.02	94.62	5.27	5.69	0.0	51.38	10.04	0.89	1.93	3.57	5.99	5.58
2	5	9.61	100.00	7.21	9.46	10.39	67.89	13.66	1.85	3.36	4.98	9.46	7.21
2	6	23.61	83.25	5.16	5.72	0.0	61.33	10.44	1.24	2.14	3.80	6.66	6.13
2	7	11.02	100.00	6.66	9.01	8.98	53.26	13.19	1.69	3.36	4.98	9.01	6.66
2	8	22.96	85.84	4.60	5.28	0.0	47.45	9.48	1.05	2.09	3.75	6.14	5.50
3	1	7.35	100.00	8.83	10.51	12.65	84.00	21.06	2.02	3.36	4.95	10.51	8.83
3	2	21.35	93.00	5.71	6.05	0.0	60.81	10.75	1.13	1.95	3.56	6.42	6.07
3	3	8.76	100.00	8.22	10.07	11.24	68.27	20.52	1.82	3.36	4.95	10.07	8.22
3	4	22.76	86.67	5.09	5.61	0.0	50.11	11.47	1.07	2.07	3.69	6.38	5.88
3	5	11.35	100.00	7.58	9.41	8.65	67.36	15.73	2.02	3.36	4.95	9.41	7.58
3	6	25.35	77.03	5.11	5.64	0.0	60.90	12.05	1.40	2.24	3.89	6.95	6.46
3	7	12.76	100.00	6.97	8.97	7.24	51.64	15.18	1.82	3.36	4.95	8.97	6.97
3	8	24.70	79.24	4.50	5.20	0.0	47.20	11.15	1.21	2.20	3.85	6.48	5.84
4	1	15.49	100.00	6.45	9.27	4.51	63.00	12.09	1.50	3.08	4.39	9.27	6.45
4	2	29.49	65.40	4.53	5.39	0.0	67.62	13.34	1.42	2.31	3.80	7.45	6.76
4	3	16.90	100.00	5.87	8.83	3.10	47.68	11.64	1.31	3.08	4.39	8.83	5.87
4	4	30.90	62.21	3.94	4.94	0.0	59.86	13.79	1.36	2.37	3.89	7.37	6.60
4	5	19.49	100.00	5.69	8.39	0.51	51.49	9.09	1.50	3.08	4.39	8.39	5.69
4	6	33.49	57.08	4.13	5.06	0.0	67.93	14.54	1.58	2.48	4.02	7.76	7.07
4	7	20.90	95.22	5.10	7.94	0.0	39.41	9.58	1.37	3.10	4.45	8.11	5.38
4	8	32.84	58.28	3.54	4.61	0.0	58.24	13.99	1.44	2.45	3.99	7.43	6.64
5	1	4.17	100.00	8.97	10.54	15.83	85.34	21.35	2.06	3.40	5.05	10.54	8.97
5	2	18.17	100.00	5.76	6.07	1.83	58.16	9.40	1.04	1.86	3.51	6.07	5.76
5	3	5.58	100.00	8.32	10.10	14.42	68.90	20.74	1.83	3.40	5.05	10.10	8.32
5	4	19.58	100.00	5.11	5.63	0.42	41.71	8.78	0.82	1.86	3.51	5.63	5.11
5	5	8.17	100.00	7.70	9.44	11.83	68.23	15.92	2.06	3.40	5.05	9.44	7.70
5	6	22.17	89.21	5.15	5.66	0.0	54.34	9.45	1.22	2.05	3.72	6.27	5.78
5	7	9.58	100.00	7.05	9.00	10.42	51.79	15.31	1.83	3.40	5.05	9.00	7.05
5	8	21.52	92.19	4.50	5.21	0.0	37.52	8.25	0.96	1.99	3.66	5.69	5.01*
6	1	12.12	100.00	6.94	9.44	7.88	67.18	13.36	1.60	3.21	4.72	9.44	6.94
6	2	26.12	74.56	4.75	5.50	0.0	63.92	11.44	1.28	2.21	3.79	6.99	6.33
6	3	13.53	100.00	6.31	9.00	6.47	50.99	12.83	1.36	3.21	4.72	9.00	6.31
6	4	27.53	70.44	4.12	5.06	0.0	54.73	12.00	1.19	2.29	3.89	6.92	6.15
6	5	16.12	100.00	6.08	8.54	3.98	54.32	10.02	1.60	3.21	4.72	8.54	6.08
6	6	30.12	63.93	4.32	5.17	0.0	64.30	13.00	1.47	2.41	4.03	7.40	6.72
6	7	17.53	100.00	5.45	8.10	2.47	38.13	9.49	1.38	3.21	4.72	8.10	5.45
6	8	29.47	65.45	3.69	4.72	0.0	52.76	12.29	1.30	2.38	4.00	7.02	6.20

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*****************************************************************************************
*  EQUAL COST FOR INDONESIA TULUNG AGONG EAST JAVA                                      *
*  WITH A BUDGET FOR 5 YEARS OF        25.00 PER CAPITA                                 *
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$$$ COST IS IN U.S. DOLLARS $$$ Equal Cost for Indonesia Tulungagung East Java with a Budget for 5 Years of $25.00/Capita

ALTER-NATIVE	PV	COST	%ADD COVERAGE	MORT/1000 W/COV	DII/CAP W/COV	EXCESS BUDGET	0-1 MORT	1-4 MORT	5-14 MORT	15-44 DII	45+ DII	TOTAL MORB	TOTAL MORT
1	1	2.06	100.00	10.97	11.36	22.94	103.95	28.26	2.67	3.64	5.48	11.36	10.97
1	2	16.06	100.00	7.08	6.59	8.94	69.10	13.98	1.45	2.04	3.88	6.59	7.08
1	3	3.41	100.00	10.23	10.91	21.59	85.88	27.44	2.40	3.64	5.48	10.91	10.23
1	4	17.47	100.00	6.34	6.14	7.53	51.03	13.16	1.19	2.04	3.88	6.14	6.34
1	5	6.06	100.00	9.36	10.15	18.94	83.32	21.15	2.67	3.64	5.48	10.15	9.36
1	6	20.06	100.00	6.28	6.13	4.94	57.94	10.69	1.45	2.04	3.88	6.13	6.28
1	7	7.47	100.00	8.62	9.71	17.53	65.26	20.33	2.40	3.64	5.48	9.71	8.62
1	8	19.41	100.00	5.54	5.69	5.59	39.87	9.87	1.19	2.04	3.88	5.69	5.54
2	1	5.61	100.00	8.40	10.55	19.39	83.78	18.74	1.85	3.36	4.98	10.55	8.40
2	2	19.61	100.00	5.83	6.13	5.39	63.02	9.47	0.95	1.84	3.46	6.13	5.83
2	3	7.02	100.00	7.84	10.11	17.98	69.16	18.27	1.69	3.36	4.98	10.11	7.84
2	4	21.02	100.00	5.27	5.69	3.98	48.39	9.00	0.79	1.84	3.46	5.69	5.27
2	5	9.61	100.00	7.21	9.46	15.39	67.89	13.66	1.85	3.36	4.98	9.46	7.21
2	6	23.61	100.00	5.16	5.72	1.39	52.76	6.85	0.95	1.84	3.46	5.72	5.16
2	7	11.02	100.00	6.66	9.01	13.98	53.26	13.19	1.69	3.36	4.98	9.01	6.66
2	8	22.96	100.00	4.60	5.28	2.04	38.13	6.39	0.79	1.84	3.46	5.28	4.60
3	1	7.35	100.00	8.83	10.51	17.65	84.00	21.06	2.02	3.36	4.95	10.51	8.83
3	2	21.35	100.00	5.71	6.05	3.65	57.56	9.43	1.02	1.82	3.42	6.05	5.71
3	3	8.76	100.00	8.22	10.07	16.24	68.27	20.52	1.82	3.36	4.95	10.07	8.22
3	4	22.76	100.00	5.09	5.61	2.24	41.83	8.89	0.83	1.82	3.42	5.61	5.09
3	5	11.35	100.00	7.58	9.41	13.65	67.36	15.73	2.02	3.36	4.95	9.41	7.58
3	6	25.35	96.50	5.11	5.64	0.0	49.90	7.54	1.04	1.85	3.45	5.73	5.20
3	7	12.76	100.00	6.97	8.97	12.24	51.64	15.18	1.82	3.36	4.95	8.97	6.97
3	8	24.70	100.00	4.50	5.20	0.30	32.33	6.67	0.83	1.82	3.42	5.20	4.50*
4	1	15.49	100.00	6.45	9.27	9.51	63.00	12.09	1.50	3.08	4.39	9.27	6.45
4	2	29.49	83.63	4.53	5.39	0.0	57.49	9.19	1.07	1.93	3.34	6.36	5.58
4	3	16.90	100.00	5.87	8.83	8.10	47.68	11.64	1.31	3.08	4.39	8.83	5.87
4	4	30.90	79.54	3.94	4.94	0.0	47.58	9.76	1.00	2.02	3.44	6.26	5.38
4	5	19.49	100.00	5.69	8.39	5.51	51.49	9.09	1.50	3.08	4.39	8.39	5.69
4	6	33.49	72.99	4.13	5.06	0.0	57.89	10.71	1.28	2.15	3.61	6.76	5.98
4	7	20.90	100.00	5.10	7.94	4.10	36.17	8.64	1.31	3.08	4.39	7.94	5.10
4	8	32.84	74.53	3.54	4.61	0.0	45.50	10.01	1.10	2.12	3.57	6.33	5.44
5	1	4.17	100.00	8.97	10.54	20.83	85.34	21.35	2.06	3.40	5.05	10.54	8.97
5	2	18.17	100.00	5.76	6.07	6.83	58.16	9.40	1.04	1.86	3.51	6.07	5.76
5	3	5.58	100.00	8.32	10.10	19.42	68.90	20.74	1.83	3.40	5.05	10.10	8.32
5	4	19.58	100.00	5.11	5.63	5.42	41.71	8.78	0.82	1.86	3.51	5.63	5.11
5	5	8.17	100.00	7.70	9.44	16.83	68.23	15.92	2.06	3.40	5.05	9.44	7.70
5	6	22.17	100.00	5.15	5.66	2.83	48.34	7.17	1.04	1.86	3.51	5.66	5.15
5	7	9.58	100.00	7.05	9.00	15.42	51.79	15.31	1.83	3.40	5.05	9.00	7.05
5	8	21.52	100.00	4.50	5.21	3.48	31.90	6.55	0.82	1.86	3.51	5.21	4.50*
6	1	12.12	100.00	6.94	9.44	12.88	67.18	13.36	1.60	3.21	4.72	9.44	6.94
6	2	26.12	95.34	4.75	5.50	0.0	52.76	6.75	0.89	1.81	3.32	5.78	5.04
6	3	13.53	100.00	6.31	9.00	11.47	50.99	12.83	1.38	3.21	4.72	9.00	6.31
6	4	27.53	90.07	4.12	5.06	0.0	41.01	7.47	0.78	1.91	3.44	5.69	4.80
6	5	16.12	100.00	6.08	8.54	8.88	54.32	10.02	1.60	3.21	4.72	8.54	6.08
6	6	30.12	81.75	4.32	5.17	0.0	53.25	8.74	1.14	2.07	3.63	6.30	5.53
6	7	17.53	100.00	5.45	8.10	7.47	38.13	9.49	1.38	3.21	4.72	8.10	5.45
6	8	29.47	83.69	3.69	4.72	0.0	38.50	7.84	0.92	2.03	3.59	5.81	4.88

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*****************************************************************************************
*  EQUAL COST FOR INDONESIA TULONG AGONG EAST JAVA                                      *
*  WITH A BUDGET FOR 5 YEARS OF        30.00 PER CAPITA                                 *
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$$$ COST IS IN U.S. DOLLARS $$$ Equal Cost for Indonesia Tulungagung East Java with a Budget for 5 Years of $30.00/Capita

ALTER-NATIVE	PV	COST	%ADD COVERAGE	MORT/1000 W/COV	DII/CAP W/COV	EXCESS BUDGET	0-1 MORT	1-4 MORT	5-14 MORT	15-44 DII	45+ DII	TOTAL MORB	TOTAL MORT
1	1	2.06	100.00	10.97	11.36	27.94	103.95	28.26	2.67	3.64	5.48	11.36	10.97
1	2	16.06	100.00	7.08	6.59	13.94	69.10	13.98	1.45	2.04	3.88	6.59	7.08
1	3	3.41	100.00	10.23	10.91	26.59	85.88	27.44	2.40	3.64	5.48	10.91	10.23
1	4	17.47	100.00	6.34	6.14	12.53	51.03	13.16	1.19	2.04	3.88	6.14	6.34
1	5	6.06	100.00	9.36	10.15	23.94	83.32	21.15	2.67	3.64	5.48	10.15	9.36
1	6	20.06	100.00	6.28	6.13	9.94	57.94	10.69	1.45	2.04	3.88	6.13	6.28
1	7	7.47	100.00	8.62	9.71	22.53	65.26	20.33	2.40	3.64	5.48	9.71	8.62
1	8	19.41	100.00	5.54	5.69	10.59	39.87	9.87	1.19	2.04	3.88	5.69	5.54
2	1	5.61	100.00	8.40	10.55	24.39	83.78	18.74	1.85	3.36	4.98	10.55	8.40
2	2	19.61	100.00	5.83	6.13	10.39	63.02	9.47	0.95	1.84	3.46	6.13	5.83
2	3	7.02	100.00	7.84	10.11	22.98	69.16	18.27	1.69	3.36	4.98	10.11	7.84
2	4	21.02	100.00	5.27	5.69	8.98	48.39	9.00	0.79	1.84	3.46	5.69	5.27
2	5	9.61	100.00	7.21	9.46	20.39	67.89	13.66	1.85	3.36	4.98	9.46	7.21
2	6	23.61	100.00	5.16	5.72	6.39	52.76	6.85	0.95	1.84	3.46	5.72	5.16
2	7	11.02	100.00	6.66	9.01	18.98	53.26	13.19	1.69	3.36	4.98	9.01	6.66
2	8	22.96	100.00	4.60	5.28	7.04	38.13	6.39	0.79	1.84	3.46	5.28	4.60
3	1	7.35	100.00	8.83	10.51	22.65	84.00	21.06	2.02	3.36	4.95	10.51	8.83
3	2	21.35	100.00	5.71	6.05	8.65	57.56	9.43	1.02	1.82	3.42	6.05	5.71
3	3	8.76	100.00	8.22	10.07	21.24	68.27	20.52	1.82	3.36	4.95	10.07	8.22
3	4	22.76	100.00	5.09	5.61	7.24	41.83	8.89	0.83	1.82	3.42	5.61	5.09
3	5	11.35	100.00	7.58	9.41	18.65	67.36	15.73	2.02	3.36	4.95	9.41	7.58
3	6	25.35	100.00	5.11	5.64	4.65	48.06	7.22	1.02	1.82	3.42	5.64	5.11
3	7	12.76	100.00	6.97	8.97	17.24	51.64	15.18	1.82	3.36	4.95	8.97	6.97
3	8	24.70	100.00	4.50	5.20	5.30	32.33	6.67	0.83	1.82	3.42	5.20	4.50
4	1	15.49	100.00	6.45	9.27	14.51	63.00	12.09	1.50	3.08	4.39	9.27	6.45
4	2	29.49	100.00	4.53	5.39	0.51	48.40	5.45	0.76	1.60	2.92	5.39	4.53
4	3	16.90	100.00	5.87	8.83	13.10	47.68	11.64	1.31	3.08	4.39	8.83	5.87
4	4	30.90	96.88	3.94	4.94	0.0	35.29	5.73	0.63	1.66	3.00	5.14	4.16
4	5	19.49	100.00	5.69	8.39	10.51	51.49	9.09	1.50	3.08	4.39	8.39	5.69
4	6	33.49	88.90	4.13	5.06	0.0	47.85	6.89	0.97	1.83	3.20	5.75	4.89
4	7	20.90	100.00	5.10	7.94	9.10	36.17	8.64	1.31	3.08	4.39	7.94	5.10
4	8	32.84	90.77	3.54	4.61	0.0	32.76	6.03	0.76	1.79	3.16	5.23	4.23
5	1	4.17	100.00	8.97	10.54	25.83	85.34	21.35	2.06	3.40	5.05	10.54	8.97
5	2	18.17	100.00	5.76	6.07	11.83	58.16	9.40	1.04	1.86	3.51	6.07	5.76
5	3	5.58	100.00	8.32	10.10	24.42	68.90	20.74	1.83	3.40	5.05	10.10	8.32
5	4	19.58	100.00	5.11	5.63	10.42	41.71	8.78	0.82	1.86	3.51	5.63	5.11
5	5	6.17	100.00	7.70	9.44	21.83	68.23	15.92	2.06	3.40	5.05	9.44	7.70
5	6	22.17	100.00	5.15	5.66	7.83	48.34	7.17	1.04	1.86	3.51	5.66	5.15
5	7	9.58	100.00	7.05	9.00	20.42	51.79	15.31	1.83	3.40	5.05	9.00	7.05
5	8	21.52	100.00	4.50	5.21	8.48	31.90	6.55	0.82	1.86	3.51	5.21	4.50
6	1	12.12	100.00	6.94	9.44	17.88	67.18	13.36	1.60	3.21	4.72	9.44	6.94
6	2	26.12	100.00	4.75	5.50	3.88	50.26	5.70	0.80	1.72	3.22	5.50	4.75
6	3	13.53	100.00	6.31	9.00	16.47	50.99	12.83	1.38	3.21	4.72	9.00	6.31
6	4	27.53	100.00	4.12	5.06	2.47	34.07	5.17	0.58	1.72	3.22	5.06	4.12
6	5	16.12	100.00	6.08	8.54	13.88	54.32	10.02	1.60	3.21	4.72	8.54	6.08
6	6	30.12	99.57	4.32	5.17	0.0	42.20	4.49	0.81	1.73	3.23	5.19	4.35
6	7	17.53	100.00	5.45	8.10	12.47	39.13	9.49	1.38	3.21	4.72	8.10	5.45
6	8	29.47	100.00	3.69	4.72	0.53	25.74	3.86	0.58	1.72	3.22	4.72	3.69*
ALTER-	PV	COST	%ADD	MORT/1000	DII/CAP	EXCESS	0-1	1-4	5-14	15-44	45+	TOTAL	TOTAL

APPENDIX G

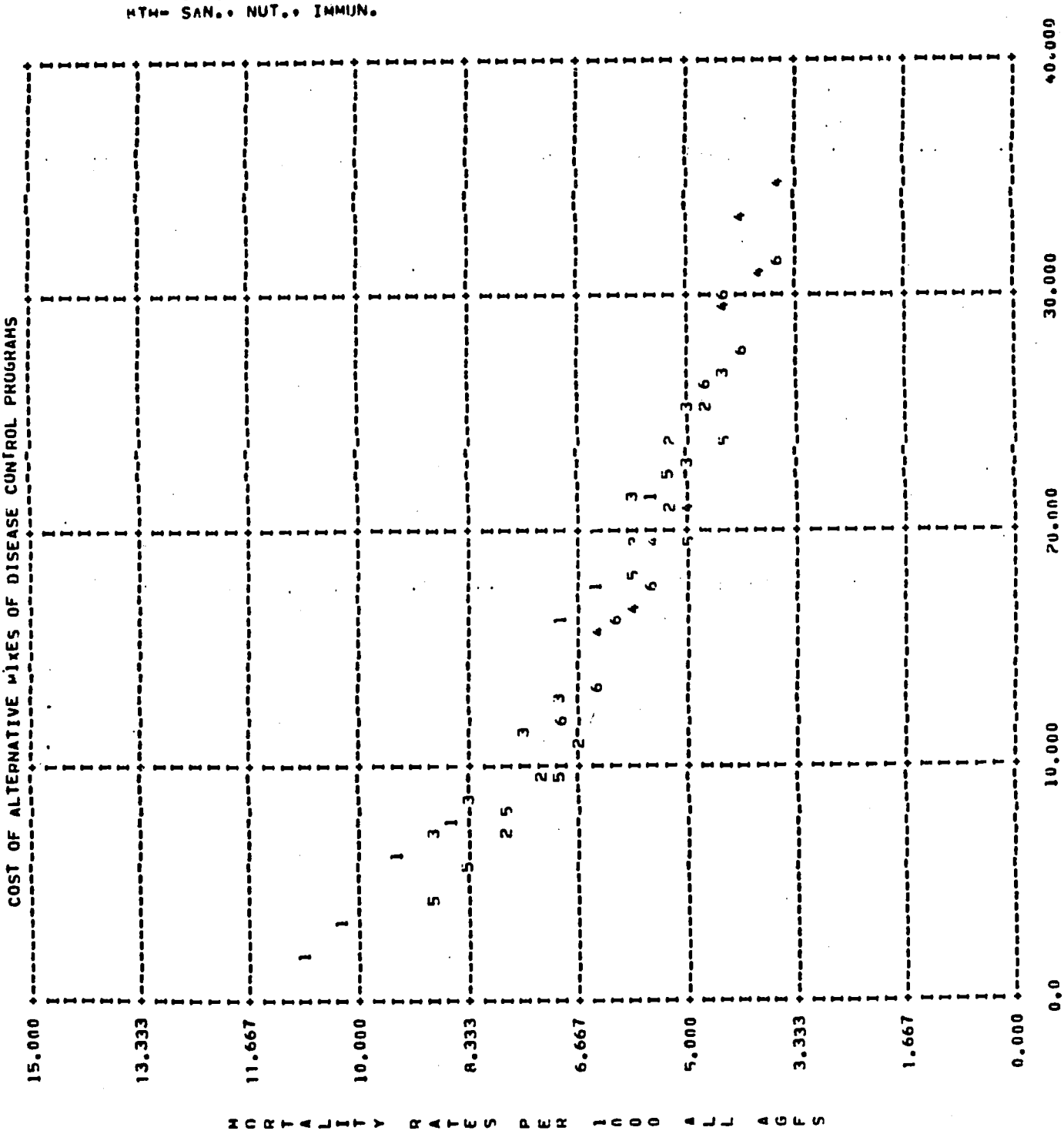
Cost-Effectiveness Curves

Appendix G: Cost-Effectiveness Curves

DISEASE PROFILE FOR INDONESIA TULONG AGONG EAST JAVA
50000.00 PEOPLE

1 = HEALTH CENTER(HC)
2. = HEALTH CENTER AND 8 SUB HEALTH CENTERS(SHC)
3. = HEALTH CENTER 8 SHC AND 25 VILLAGE HEALTH WORKERS(VHW)
4. = HC 8 SHC AND 200 VHW
5. = HC AND 25 VHW
6. = HC AND 200 VHW

HEALTH PROMOTION
1ST- NONE
2ND- IMMUNIZATION(NUT)
3RD- NUTRITION(NUT)
4TH- NUT.+ AND IMMUN.
5TH- SANITATION(SAN)
6TH- SAN.+ IMMUN.
7TH- SAN.+ NUT.
8TH- SAN.+ NUT.+ IMMUN.



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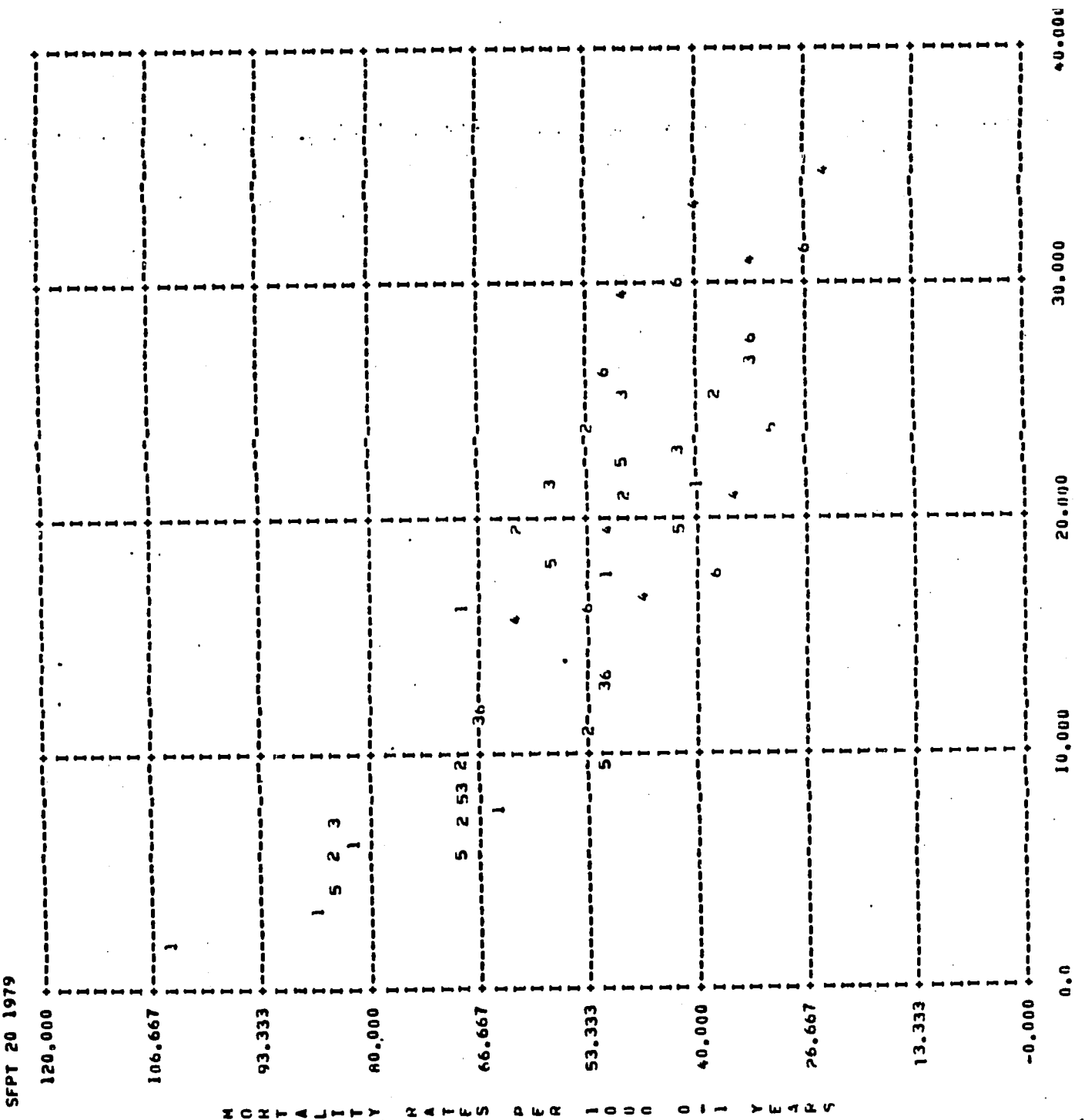
6TH- SAN.+ IMMUN.
7TH- SAN.+ NUT.
8TH- SAN.+ NUT.+ IMMUN.



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7TH- SAN.+ NUT.
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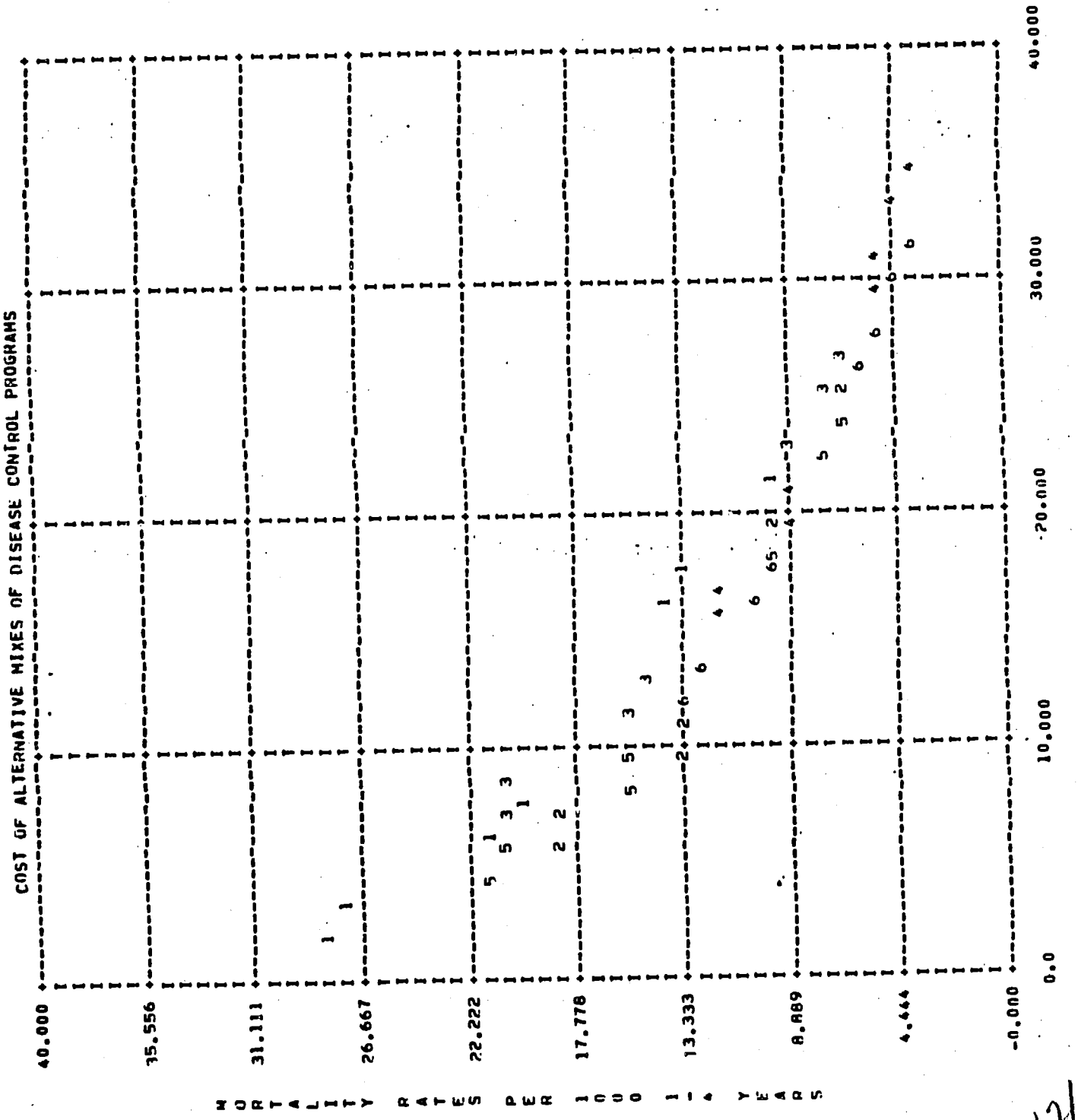

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Appendix G: Cost-Effectiveness Curves

DISEASE PROFILE FOR INDONESIA TULONG AGONG EAST JAVA
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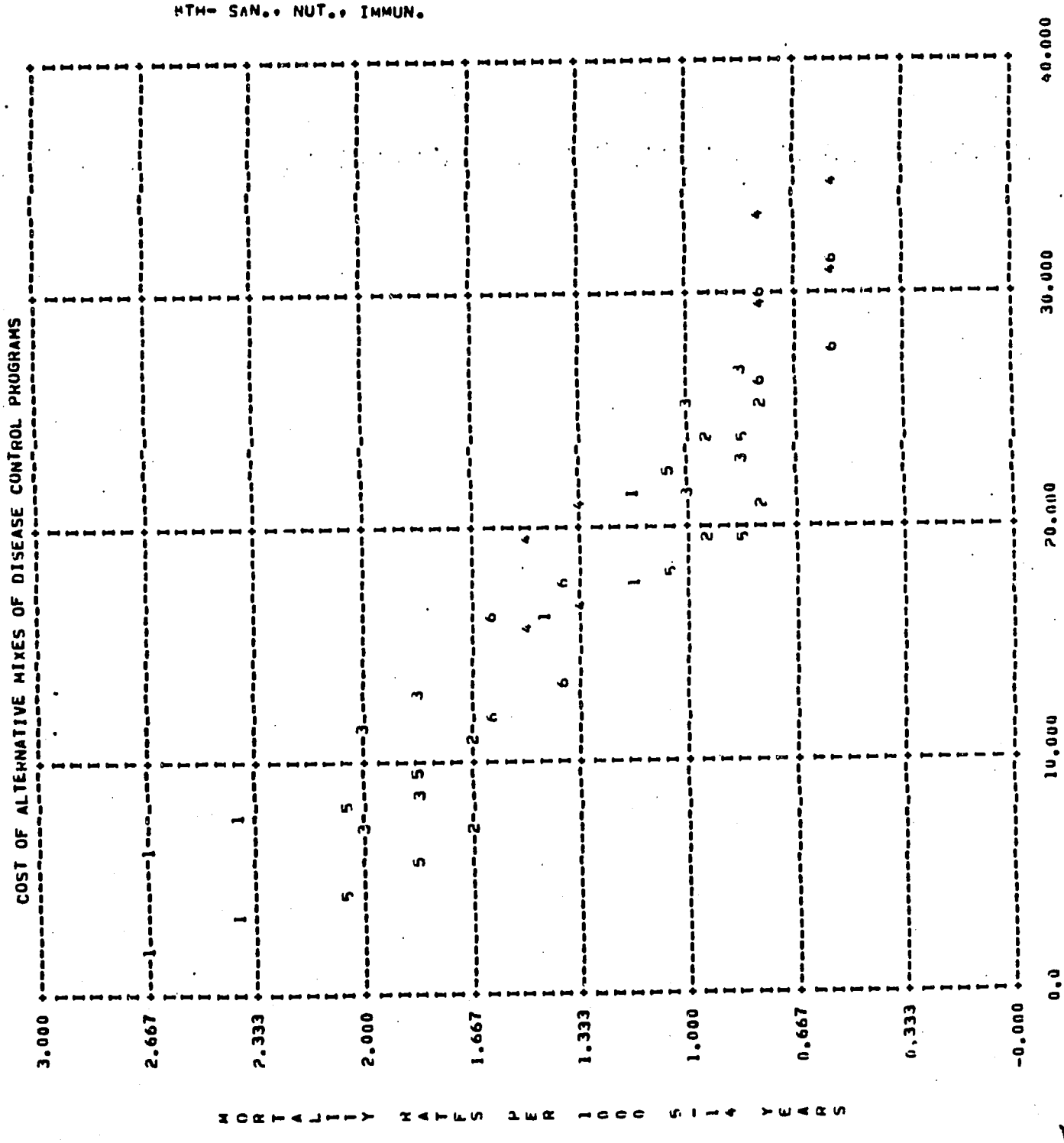

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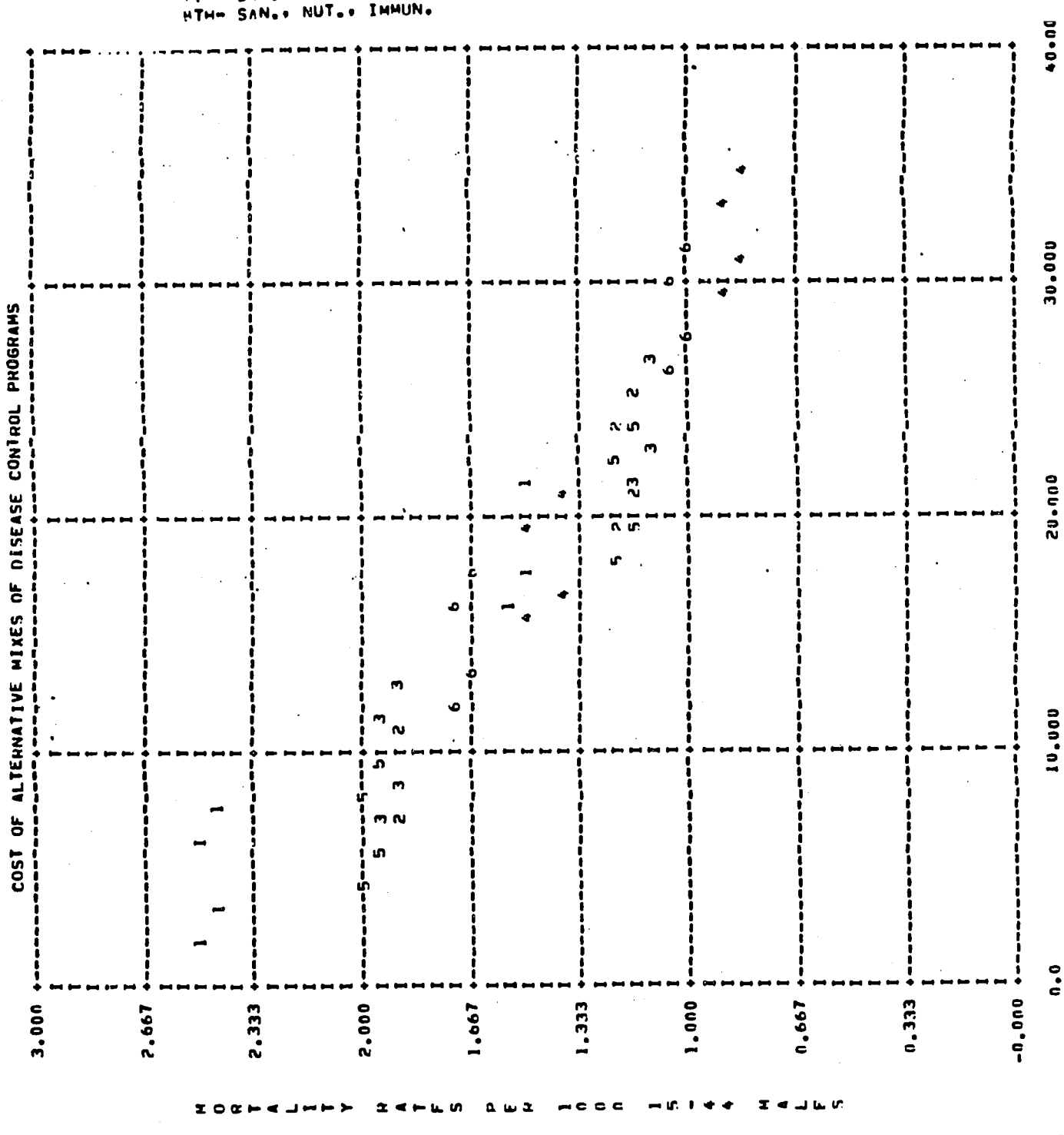

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6TH- SAN., IMMUN.
7TH- SAN., NUT.
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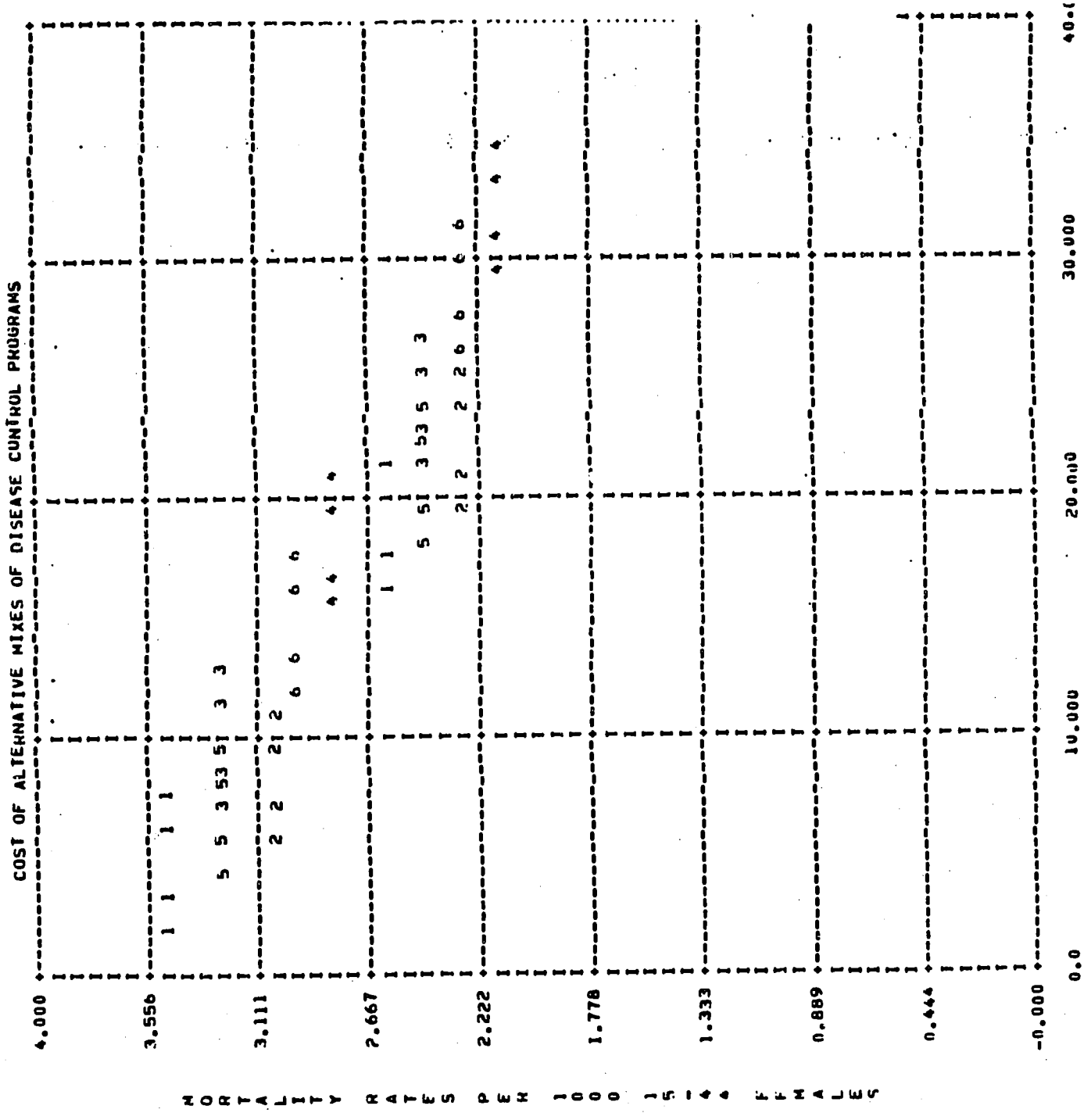

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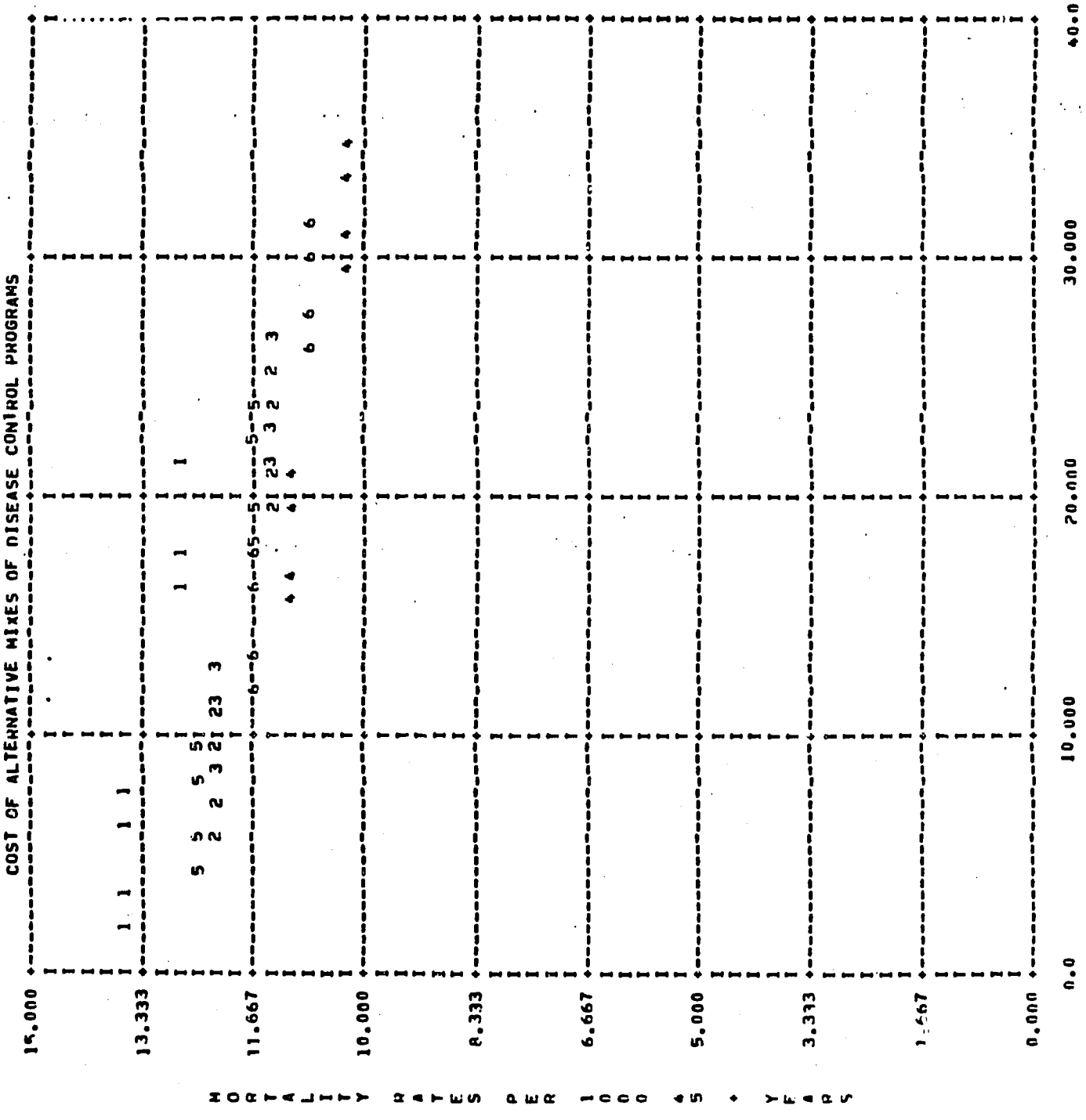

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APPENDIX I

Documentation of Computer Procedures

Operation and Programming Manual For The Michigan Cost Effectiveness Resource Allocation Disease Profile

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Research Associate II
Department of Health Planning and Administration

ABSTRACT

This section of the report discusses how to use a digital computer to calculate a disease profile for a specific community. How the Model is used on the Michigan Terminal System, as well as altering the disease profile to accommodate the effects of different types of medical care and health promotion are discussed and illustrated. How to operate the disease profile model on smaller computers or computers with different types of time sharing operating systems is also considered.

I Introduction

A) The Michigan Cost Effectiveness Resource Allocation Disease Profile Model (Michigan Model), is written in Fortran IV, a machine language that is multi-faceted, adaptable and can be used on most medium sized, and all large computers around the world. An early version of the Model was run and is still being used by the Health Planning Research Institute in Surabaya, Indonesia.

B) The Michigan Model looks at the effect of different types of medical care delivery and disease prevention programs on the disease patterns within a specific community. This is done by first establishing a disease profile of the community. A disease profile is a list of all important diseases, their associated age/sex specific attack

rate, associated days lost per episode of disease by source of treatment and case fatality rate of the disease by source of treatment, as well as what per cent of the population seeks care at different sources of care. By looking at the effect of the program against the spectrum of diseases that it will impact on, it is possible to establish health based effectiveness measures for different types of health programs. This section discusses the operation of the computerized disease profile model on all computers that have Fortran IV compilers.

C) The Michigan Cost-effectiveness Model was originally developed using analyst pads and a TI 30. When the mathematical operations are done by hand, it takes 8 hours to develop one disease profile. 15 different disease profiles representing different health effects of alternative medical care delivery and health promotion would then require at least 120 hours. The computer can calculate the same 15 disease profiles in less than 2 machine seconds (on the MTS System). The rapid speed at which feedback is received by a person developing a disease profile make this a very educational experience.

II. <u>System Overview of Disease Profile Calculation on MTS</u>

A) The Michigan computer (an Amdahl V-7), stores all its programs, data, and instruction in files. The

machine in the process of calculating a disease profile takes the program, written in Fortran IV, translates it into a binary machine code, addresses itself to the indicated data transforms the data as indicated in the machine code, and formats the results as it is instructed through the code to do.

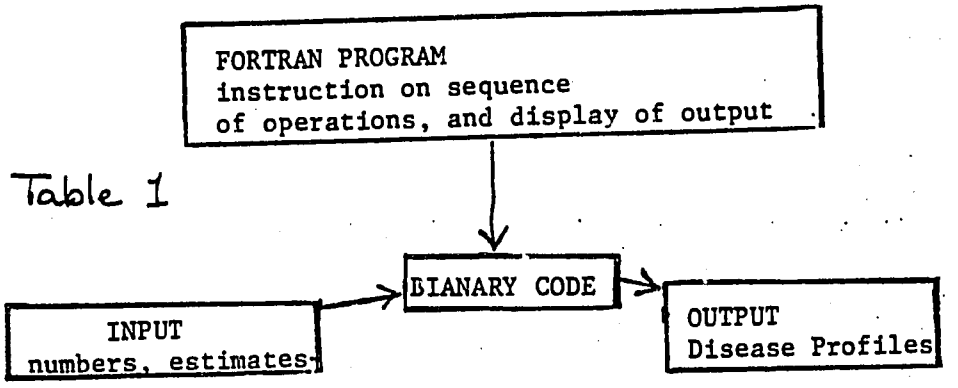

Table 1

B) The Input Data, Fortran Program, Binary Code and Output are all in the files at some time during the calculating process. The file with the output is released to a printer, which delivers the results of the this activity to the user.

C) The computer is a very large input-output device. The computer receives input from cards, magnetic tape, by terminal, and output is received through the terminal, lineprinter, cards, magnetic tape, or paper tape. The most common ways that the computer was accessed during the development of the Michigan Model was through cards, or from the terminal.

D) The Fortran IV program, which the machine changes into a binary machine language, is a list of instructions, which tells the computer what

mathematical functions to perform, and in what order to do them. It gives the number of digits behind the decimal, the headings, and other information that will make the data easier to interpret. A listing of the program is given in Listing 1 at the end of this appendix along with a variable dictionary.

E) An input file contains the base data. In the Michigan Model these are:age specific attack rate, % seeking care, Days lost for treated and untreated, the Case Fatality Rate for treated and untreated and the number of visits per case for those treated. The Input file also contains population figures, disease names, age groups names, and control information. This allows the input file to be edited using the systems editor. The input file for a health center serving 50,000 people in rural Java is shown in Listing 2.

F) Any of the the control numbers such as number of diseases, or the numbers themselves can be altered using the editor on MTS. To edit the Input Data which is stored in the file IT1D", the words "EDIT IT1D are typed in. When the Michigan computer is in the edit mode it responds with a colon(:) rather than the pound sign(#) that it normally responds with while in the MTS operating mode. Changes can only be made while in the editor. Changes are made

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in the input file by using the alter command. The general structure of the command in the MTS editor is :alter'old number'newnumber' (alter'24'35'). The machine then changes the first sequence in the line that corresponds to the old number to the new number. Alphanumeric characters such as disease names can also be changed using the same process. The command: (alter'severe diarrhea'mild diarrhea') would change the name of severe diarrhea to mild diarrhea. The editing process can also be used to change the Fortran Program.

3) For proper operation of the program the information in the input file must be in the correct sequential order, and the input numbers in the correct columns. Table 2 gives the seven variables input numbers and the appropriated column numbers that they must be in.

Variable	Column Numbers	Number of spaces Behind Decimal
Rate (annual attack rate)	1-7	5
Xpsc (per cent seeking care)	8-11	3
Vc (visits per case)	12-18	2
Dlrx (days lost for treated)	19-25	2
Dlnrx (days lost for not treated)	26-32	2
Cfrx (Case fatality rate for treated)	33-39	2
Cfnrx (case fatality rate for not treated)	40-46	2

Table 2

III. Program Logic

a) Chart 1 shows the sequence of activities that go into the computation of the disease profile and how disease profiles for alternative mixes of medical care organization and health promotion are calculated. The exact operations are listed in Fortran IV in Listing 1. Even without extensive training fortran is a logical enough language that one may understand the nature of the operations by going through the program listing and read the command statements using the dictionary of variable names that are also in listing 1. Although to use the disease profile model creatively, one must have a working knowledge of Fortran IV.

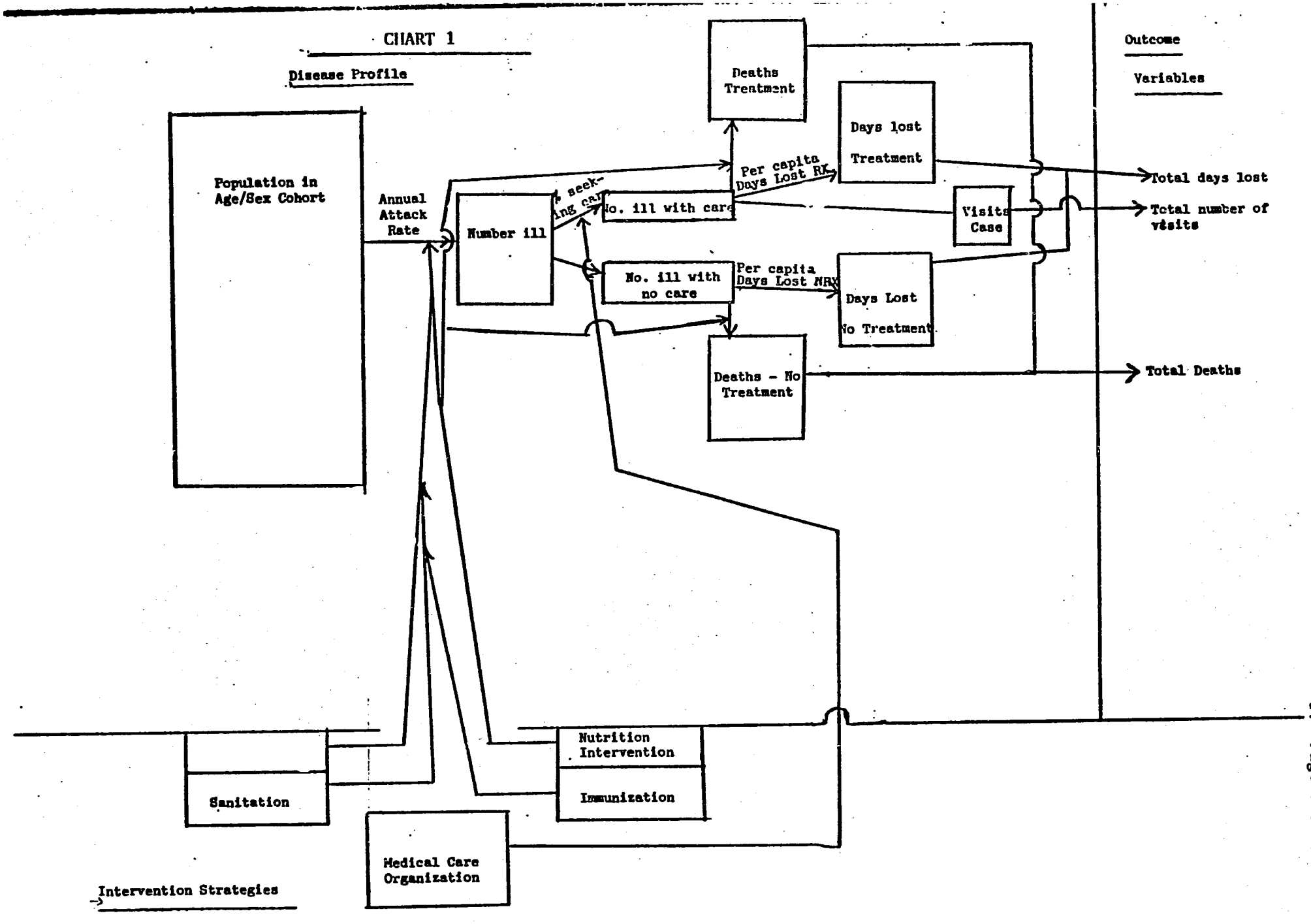
CHART 1
Disease Profile
Population in Age/Sex Cohort
Annual Attack Rate
Number ill
% seeking care
No. ill with care
No. ill with no care
Deaths Treatment
Per capita Days Lost RX
Days lost Treatment
Visits Case
Per capita Days Lost NRX
Days Lost No Treatment
Deaths - No Treatment
Outcome Variables
Total days lost
Total number of visits
Total Deaths
Sanitation
Nutrition Intervention
Immunization
Medical Care Organization
Intervention Strategies

B) Most of the variables in the program are indexed using I or J or both letters. The I number of the subscript indicates which disease is being considered. I=1 is indicative of Upper Respiratory Infection, I=18 is Parasitic Disease. J=1 is for the age group 0-1 years, while J=6 would stand for the 45+ year age group. If more disease groups are to be considered, or age groups are to be considered then the maximum number of I's or J's can be increased. One can add subscripts for where the person ill with a disease in a particular age group sought care(K), whether or not they were rural or urban (L), or what their social or income class was (M). In the disease profile the variables are only subscripted by disease and age groups. In more complicated programs they are also subscripted by type of medical care and health promotional activities.

C) The Model is presently organized and constructed so that changes in population base, attack rates or number of disease states can be changed by altering the disease profile input data. Thus the program need be compiled only once to do several runs with different number of diseases, different number of age cohorts, or different population mixes.

D) As indicated in the flow diagram of program logic the computer has the capability of doing any number of

disease profiles, and then compare the health benefits of the alternative programs at a fixed budget(or several fixed budgets) within the same computer run. In order to make this comparison another set of inputs must be developed, that is the cost of the activities that are assumed to reduce the attack rate, change the case fatality rate or reduce the days lost. Along with development of a disease profile, it is necessary to specify and stipulate the costs of alternative programs.

IV Summary

A) The computational procedures are series of steps of multiplication division, and addition that allow the comparison of health care activities on the disease patterns within communities. In order to fully understand this procedure, it is necessary that the operator be familiar with Fortran IV. An overview of how the computational procedures take place has been sketched in the preceding pages. The actual procedure on the Michigan Terminal System (MTS) is as follows:

```
ZEnter terminal type: TY#

ZEnter terminal type: TTY43

  MTS Ann Arbor (TTY43,LF32-CD29,00292)
$SIG SMQ3
##ENTER USER PASSWORD.
?
#TERM,LOW,UNIV
#**LAST SIGNON WAS: 17:14:38
# USER "SMQ3" SIGNED ON AT  20:52:49 ON TUE OCT 30/79

#$CONTROL *PRINT* HOLD ROUTE=SOPH
#*PRINT* ASSIGNED RECEIPT NUMBER 688419
#
#
#R *FTN SCARDS=MICHMODEL
#EXECUTION BEGINS
 No errors in MAIN
#EXECUTION TERMINATED

#R -LOAD 5=IT1D 6=*PRINT*
#EXECUTION BEGINS
#EXECUTION TERMINATED
#
#
#
#$SIG $
#*PRINT* 688419 RELEASED TO SOPH, 3 PAGES.
#SMQ3 20:52:49-21:01:23 TUE OCT 30/79
#    $.39
```

Sign On

Take care of collectin output (if on terminal

Compile Program into Binary Code

Run Input data into port 5
collect Output from port 6

Signoff and recieve output

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B) The Michigan Cost-effectiveness Model is an attempt to address efficient use of health resources in reducing the mortality and days of illness in Indonesia. Even though there is some uncertainty as to the some of the input values, the model has shown some interesting and useful results. The model could be used without the computer, but its integration into the model has allowed some activities, such as detailed sensitivity analysis to take place that might not have been feasible otherwise.

```
C MICHMODEL FOR CALCULATION OF MORTALITY AND MORBIDITY RATES WRITTEN BY
C ROBERT TILDEN AND DONALD CHEN  THIS VERSION UPDATED AUG 1 1979
      DIMENSION POP(10),RATE(50,10),IMC(50,10),XPSC(50,10),
     1          NUSC(50,10),VC(50,10),TOVT(50,10),DLRX(50,10),
     2          DLNRX(50,10),X(50,10),Y(50,10),XY(50,10),CFRX(50,10),
     3          CFNRX(50,10),S(50,10),R(50,10),SR(50,10),NNSC(50,10),
     4          GRX(50,10),GRNX(50,10),DRX(50,10),DNRX(50,10),
     8          DISNAM(50,20),AGNAM(10,2),CTNAM(8),DATE(4),B(10),
     9          BA(10),AVA(10),AVA1(10),BB(50,10),BBA(50,10),CW(50,10),
     1          CV(50,10),CB(10),CT1(10)
C READ NAME OF COUNTRY FROM INPUT FILE 5
      READ(5,13)(CTNAM(K2),K2=1,8)
 13   FORMAT(8A4)
C READ DATE FROM INPUT FILE 5
      READ(5,13)(DATE(K3),KJ=1,4)
C READ IN NUMBER OF DISEASE STATES MAX NU 50
      READ(5,1)N
    1 FORMAT(I2)
C READ NUMBER OF AGE GROUPS
      READ(5,4)N1
 4    FORMAT(I1)
      POPT=0
      DO 5 J=1,N1
C READ NU OF PEOPLE IN EACH AGE GROUP
      READ(5,7)POP(J)
 7    FORMAT(F7.0)
      POPT=POPT+POP(J)
C READ NAMES OF AGE GROUPS
 5    READ(5,6)(AGNAM(J,K1),K1=1,2)
 6    FORMAT(2A4)
      N3=N+1
      N4=N1+1
      DO 10 I = 1, N
      READ(5,3)(DISNAM(I,K),K=1,20)
 3    FORMAT(20A4)
        DO 10 J = 1, N1
C READ IN AGE/DISEASE SPECIFIC ATTACK RATES,UTILIZATION RATES,VISITS
C PER CASE DAYS LOST FOR TREATED, DAYS LOST FOR NOT TREATED, CASE
C FATALTY RATE FOR TREATED AND UNTREATED
   10 READ (5,20) (RATE(I,J),XPSC(I,J),VC(I,J),DLRX(I,J),DLNRX(I,J),
     1CFRX(I,J),CFNRX(I,J))
 20   FORMAT(F7.5,F4.3,5F7.2)
      DDG = 0
      WRITE (6,50) (CTNAM(K2),K2=1,8),POPT
   50 FORMAT ('1', ' DISEASE PROFILE FOR  ',8A4, /,
     1        10X, F10.0,2X,' POEPLE',///)
      CAT = 0
      DDP = 0
      TOT = 0
      CALL HEAD1
      WRITE(6,23)(DATE(K3),K3=1,4)
 23   FORMAT(/,1X,4A4,/)
      CALL COLIST
C PRECEEDING COMMANDS LAYS OUT HEADING, DATE, TOTAL POPULATION,
C AND COUNTRY NAME
      DO 460 I = 1, N
C THIS DO LOOP CALCULATES AND PRINTS FIRST TABLE
      CALL DIS(DISNAM,1,K)
        ZA = 0
```


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```
      ZA = 0
      ZC = 0
      ZD = 0
      DO 450 J = 1, N4
        INC(I,J) = RATE(I,J) * POP(J)
        NUSC(I,J) = INC(I,J) * XPSC(I,J)
        TOVT(I,J) = (NUSC(I,J)*VC(I,J))
        NNSC(I,J) = INC(I,J) - NUSC(I,J)
        X(I,J) = ((NUSC(I,J))*DLRX(I,J))
        Y(I,J) = (NNSC(I,J)*DLNRX(I,J))
        XY(I,J) = X(I,J) + Y(I,J)
        S(I,J) = (NUSC(I,J)*CFRX(I,J)/100)
        R(I,J) = ((CFNRX(I,J)/100)*NNSC(I,J))
        SR(I,J) = S(I,J) + R(I,J)
        DOG = DOG + XY(I,J)
        CAT = CAT + SR(I,J)
        DUP = DUP + TOVT(I,J)
        TOT = TOT + INC(I,J)
        ZA = ZA + TOVT(I,J)
        ZB = ZB + XY(I,J)
        ZC = ZC + SR(I,J)
        ZD = ZD + INC(I,J)
        WRITE (6,390) (AGNAM(J,K1),K1=1,2),RATE(I,J),INC(I,J),XPSC(I,J),
     1  NUSC(I,J),VC(I,J),TOVT(I,J),DLRX(I,J),DLNRX(I,J),X(I,J),
     2  Y(I,J),XY(I,J),CFRX(I,J),CFNRX(I,J),S(I,J),R(I,J),
     3  SR(I,J)
  390   FORMAT (1X,2A4, 2X, F6.4, 1X, I6, 1X, F6.2, 1X, I6, 1X,
     1          F4.0, F8.0,3(F6.0,1X), 2(F8.0,1X), 4(F6.1,1X), 2(F6.1))
  450 CONTINUE
      WRITE (6,470) ZD, ZA, ZB, ZC
  460 CONTINUE
      CALL COLIST
      WRITE (6,470) TOT, DUP, DOG, CAT
  470 FORMAT (19X, F8.0, 18X, F8.0, 30X, F9.0, 29X, F6.1)
C HEADING FOR SECOND TABLE LAYED OUT
      CALL HEAD2
      B(1)=0
      BA(1)=0
      BB(1,2)=0
      BBA(1,2)=0
      TT = 0
      TTA = 0
C THIS DO LOOP CALCULATES SECOND TABLE
      DO 500 I = 2, N3
      T=0
      TA=0
        DO 490 J = 2, N4
      B(J)=XY(I-1,J-1)
      BA(J)=SR(I-1,J-1)
      BB(I,J)=BB(I-1,J)+B(J)
      BBA(I,J)=BBA(I-1,J)+BA(J)
      T=T+B(J)
      TA=TA+BA(J)
  490   CONTINUE
        TT = TT + T
        TTA = TTA + TA
      WRITE(6,4)(B(I-1,K),K=1,20)
    4 FORMAT(20A4)
  500 WRITE(6,520)(B(J),BA(J),J=2,N4),T,TA
      WRITE(6,510)(BB(N3,J),BBA(N3,J),J=2,N4),TT,TTA
```

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```
510 FORMAT (/, 14(F4.0,1X))
520 FORMAT (14(F4.0,1X))
THIS DO LOOP CALCULATES RATES
    DO 149 J=1,N1
    AVA(J)=HR(N3,J+1)/POP(J)
    AVA1(J)=HRA(N3,J+1)/(POP(J)/1000)
    WRITE (6,540) (AGNAM(J,K2),K2=1,2),AVA(J)
149 WRITE (6,550) (AGNAM(J,K2),K2=1,2),AVA1(J)
540 FORMAT (/, ' D.D.I. ',2A4, F7.3)
550 FORMAT (/, ' MORT ',2A4,1X, F7.3, ' PER 1000 IN AGE GROUP')
    AVA10=TT/POPT
    AVA11=TTA/(POPT/1000)
    WRITE (6,660) AVA10
    WRITE (6,670) AVA11
660 FORMAT (/, 'D.I.I. ALL', F7.3)
670 FORMAT (/'MORT ALL', F7.3)
    DOPE = DOP / POPT
    WRITE (6,530) DOPE
530 FORMAT (/, 1X, F6.4, ' VISTS PER PERSON A YEAR')
CALLS HEADING FOR THIRD TABLE
    CALL HEAD3
    CT = 0
    CW(1,1)=0
    CV(1,1)=0
    CTA = 0
    CTB = 0
    CTC=0
    CTD=0
    CTE = 0
THIS DO LOOP CALCULATES THIRD TABLE
    DO 710 I = 2, N3
      CO = 0
      CXO = 0
      CWO = 0
      CUO = 0
      C7O = 0
      CVO = 0
      DO 690 J = 2, N4
        AMT = 0
        AMB = 0
        GRX(I-1,J-1) = INC(I-1,J-1) * DLRX(I-1,J-1)
        GRNX(I-1,J-1) = INC(I-1,J-1) * DLNRX(I-1,J-1)
        DRX(I-1,J-1) = INC(I-1,J-1) * (CFRX(I-1,J-1)/100)
        DNRX(I-1,J-1) = INC(I-1,J-1) * (CFNRX(I-1,J-1)/100)
        CO = CO + XY(I-1,J-1)
        CXO = CXO + GRX(I-1,J-1)
        CWO = CWO + GRNX(I-1,J-1)
        AMB = GRNX(I-1,J-1)
        AMT = DNRX(I-1,J-1)
        CZO = C7O + SR(I-1,J-1)
        CUO = CUO + DRX(I-1,J-1)
    CVO=CVO+DNRX(I-1,J-1)
    CW(I,J)=CW(I-1,J)+AMB
    CV(I,J)=CV(I-1,J)+AMT
690   CONTINUE
      CT = CT + CO
      CTA = CTA + CXO
      CTB = CTB + CWO
      CTC = CTC + CUO
      CTD = CTD + C7O
```

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```
140          CTE = CTE + CVU
141     700  FORMAT (/, ' TOTAL', 7X, 6(F9.0,1X))
142     710 CONTINUE
143         WRITE (6,700) CT, CTA, CTB, CAT, CTC, CTE
144         ARG = CTB / POPT
145         ARG1 = CTE / (POPT/1000)
146   : THIS DO LOOP CALCULATES RATES WITH NO TREATMENT
147         DO 492 J=2,N4
148         CB(J)=CW(N3,J)/POP(J-1)
149         CT1(J)=CV(N3,J)/(POP(J-1)/1000)
200         WRITE(6,720)CB(J),(AGNAM(J-1),K1),K1=1,2)
201     492 WRITE(6,730)CT1(J),(AGNAM(J-1,K1),K1=1,2)
202     720 FORMAT(/,2X,'D.D.I.-NO TREAT.',2X,F7.2,2X,2A4)
203     730 FORMAT(/,2X,'MORT.  NO TREAT.',2X,F7.2,2X,2A4)
204         WRITE (6,840) ARG
205         WRITE (6,850) ARG1
206     840 FORMAT (/, 'D.D.I.-NO TREATMENT', 2X, F6.3)
207     850 FORMAT (/, 'MORT-NO TREATMENT', 2X, F6.3)
210    1069 CONTINUE
211         STOP
212         END
213         SUBROUTINE DIS(DISNAM,I,K)
214         DIMENSION DISNAM(50,20)
215         WRITE(6,9)(DISNAM(I,K),K=1,20)
216         FORMAT(20A4)
217         RETURN
218         END
219         SUBROUTINE HEAD1
220         WRITE (6,60)
221      60 FORMAT (' RATE=ANNUAL RATE                    ', 'INC.=ANNUAL INCIDENCE
222        1     ', 'NUSC=NU.SEEKING CARE              ', /, 'XPSC=PROPORTION SEEKING
223        2 CARE', 'VC=VISITS PER CASE                 ', 'TOVT=TOTAL NU. VISITS
224        3    ', /, 'DLNRX=DAYS LOST PER CAPNRX  ', 'X=TOTAL DAYS LOST RX
225        4    ', ' GOT=NU. NONEFFECTIVE PICKED UP HC, SHC ', /, 'Y=TOTAL DAY
226        5S LOST NRX        ', 'X+Y=TOTAL DAYS LOST          ', 'CFRX=CASE FAT
227        6ALITY RATE RX  ', /, 'CFNRX=CASE FATAL. RATE NRX  ', 'S=DEATHS RX
228        7                  ', 'R=DEATHS NRX                  ', /, 'S+R=DEATHS
229        8TOTAL',//)
230         RETURN
231         END
232         SUBROUTINE COLIST
233         WRITE (6,70)
234      70 FORMAT (14X, 'RATE', 5X, 'INC.', 2X, 'XPSC', 1X, 'NUSC', 5X, 'VC',
235        1        3X, 'TOVT', 3X, 'DLRX', 2X, 'DLNRX', 5X, 'X', 8X, 'Y', 4X,
236        2        'X+Y', 4X, 'CFRX', 3X, 'CFNRX', 4X, 'S', 4X, 'R', 5X, ' S+R
237        3', /)
238         RETURN
239         END
240         SUBROUTINE HEAD2
241         WRITE (6,480)
242     480 FORMAT(////////,'--------0-
243        &'--------1-4 YR---I',
244        &'--------5-14 YR--I',
245        &'--------15-44 YR.-',
246        &'--------15-44 YR.-',
247        &'I--------45 + YR.-I',
248        &'--------TOTAL-----I',/,
249        &'     MORB     MORT  ',
250        &'     MORB     MORT  ',
251        &'     MORB     MORT  ',
```

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```
:   252          &'    MORB    MORT  ',
:   253          &'    MORB    MORT  ',
:   254          &'    MORB    MORT  ',
:   255          &'    MORB    MORT  ')
:   256           RETURN
:   257           END
:   258           SUBROUTINE HEAD3
:   259           WRITE (6,680)
:   260       680 FORMAT (////, ' MORBIDITY AND MORTALITY AT DIFFERENT LEVELS OF', '
:   261          1 HEALTH CENTER UTILIZATION', /, 18X, ' MORBIDITY-------------I', '
:   262          2-------------MORTALITY', /, 12X, ' EST MORB', 3X, ' 100 %', 8X, '
:   263          30 %', 3X, ' EST MORT', 3X, ' 100 %', 8X, '0 %')
:   264           RETURN
:   265           END
:
```

Part I Variable Dictionary

I= Index number for diseases

J= Index numbers for age groups

Pop(J)= population in each age cohort

Popt= Total population in all age groups

N= number of disease

nl= number of age groups

agnam(J)= name of age cohort

disnam(I)= name of disease state

date= date of run

cnam= name of country

rate(I,J)= attack rate for each age/disease

inc(I,J)= number of people ill in each age/disease state

xpsc(I,J)= proportion of ill seeking care in each age/disease state

nnsc(I,J)= number of ill seeking care in each age/disease state

vc(I,J)= visits per case in each age/disease state

tovt(I,J)= Total visits for each age/disease state

dlrx(I,J)= days lost per case in each age/disease state for those seeking treatment

dlnrx(I,J)= days lost per case in each age/disease state for those not treated

x(I,J)= total days lost for each age/disease state for those that seek treatment

y(I,J)= total days lost for each age/disease state for those that don't seek treatment

xy(I,J)= total days lost for each age/disease state

cfrx(I,J)= case fatality rate for each age/disease state for those that seek treatment

cfnrx(I,J)= case fatality rate for each age/disease state for those that do not seek treatment

s(I,J)= number dead for those that seek care for each age/disease state

r(I,J)= number dead for those that do not seek care for each age/disease state

sr(I,J)= number dead for each age/disease state

nnsc(I,J)= number not seeking care for each age/disease state

dog= counter variable for total days lost all ages all diseases

zb= counter variable for total days lost all ages each disease

cat= counter variable for total lives lost all ages all diseases

zc= counter variable for total lives lost all ages each disease

dup= counter variable for total visits all ages all diseases

za= counter variable for total visits all ages each disease

tot= counter variable for total disease episodes all ages all diseases

zd= counter variable for total disease episodes all ages each disease

b(J)= days lost for each age/disease group 2nd table in profile(2tip)

bb(J)= days lost for each age group all diseases(2tip)

ba(J)= deaths for each age/disease group(2tip)

bba(j)= deaths for each age group all diseases(2tip)

t= counter variable for total days lost all ages for each disease(2tip)

ta= counter variable for total deaths all ages for each disease(2tip)

tt= counter variable for total days lost all ages all diseases(2tip)

tta= counter variable for total deaths all ages all diseases(2tip)

ava(J)= age specific days lost per person per year

aval(j)= age specific death rate

aval0= days lost per person per year for all ages

avall= crude death rate all ages

dope= visits per person per year

grx(I,J)= days lost with 100% utilization each age/disease cohort 3rd table in in profile(3tip)

grnx(I,J)= days lost with 0% utilization for each age/disease cohort(3tip)

drx(I,J)= deaths with 100% utilization for each age/disease cohort(3tip)

drnx(I,J)= deaths with 0% utilization for each age/disease cohort(3tip)

co= counter variable for days lost under assumed utilization rate(3tip)

ct= counter variable for days lost under assumed utilization rate(3tip)

cxo= counter variable for 100% utilization days lost(3tip)

cta= " " " " " " " "

cwo= counter variable for days lost 0% utilization(3tip)

ctb= " " " " " " " "

amb= counter variable for age specific days lost per person per year with 0% utilization(3tip)

amt= counter variable for age specific death rate per person with 0% utilization(3tip)

cz0= counter variable for assumed level of utilization for deaths(3tip)

ctd= " " " " " " " " " "

cuo= counter variable for deaths with 100% utilization(3tip)

ctc= " " " " " " " "

cvo= counter variable for deaths with 0% utilization(3tip)

cte= " " " " " " " "

cw(I,J)= counter variable for calculation for age specific days lost at 0% utilization(3tip)

cv(I,J)= counter variable for calculation for age specific death rate at 0% utilization(3tip)

arg= days lost per person all ages 0% utilization (3tip)

arg1= crude death rate with 0% utilization(3tip)

cb(J)= age specific days lost per person 0% utilization

ct1(J)= age specific death rate with 0% utilization

Computer Listing 2

```
 1   INDONESIA TULONG AGUNG EAST JAVA - Country name
 2   SEPT 20 1979------------------------- Date
 3   31----------------------------------- Number of disease
 4   6------------------------------------ Number of age groups
 5   1500.--------------------------------- Number of people in age cohort 1
 6   0-1 YEAR----------------------------- Name of 1st age group
 7   7000.--------------------------------- Number of people in 2nd age cohort
 8   1-4 YEAR----------------------------- Name of 2nd age cohort
 9   13000.------------------------------- Number of people in 3rd age cohort
10   5-14 YEAR---------------------------- Name of 3rd age cohort
11   10500.------------------------------- Number of people in 4th age cohort
12   15-44 MALE--------------------------- Name of 4th age cohort
13   11000.------------------------------- Number of people in 5th age cohort
14   15-44 FEMALE------------------------- Name of 5th age cohort
15   7000.--------------------------------- Number of people in 6th age cohort
16   45+ YEAR----------------------------- Name of 6th age cohort
17   LOWER RESPIRATORY INFECTION---------- Name of disease 1
18   0.10000.100   2.00  10.00  25.00   0.20  20.00
19   0.05000.100   2.00  10.00  25.00   0.20  10.00
20   0.01000.100   2.00  10.00  20.00   0.20   5.00
21   0.00500.100   1.50  10.00  15.00   0.05   3.00
22   0.01000.100   1.50  10.00  15.00   0.05   2.00
23   0.03000.100   1.50  10.00  15.00   0.05   5.00
24   UPPER RESPIRATORY INFECTION
25   3.00000.100   1.30   0.0    0.0    0.0    0.0
26   2.00000.100   1.20   0.0    0.0    0.0    0.0
27   0.50000.050   1.20   0.0    0.0    0.0    0.0
28   0.50000.0     1.10   0.0    0.0    0.0    0.0
29   1.00000.0     1.10   0.0    0.0    0.0    0.0
30   1.00000.0     1.10   0.0    0.0    0.0    0.0
31   OTITIS MEDIA
32   0.02000.100   1.20  15.00  30.00   0.0    0.0
33   0.10000.100   1.20  15.00  30.00   0.0    0.0
34   0.0     .0    0.0    0.0    0.0    0.0    0.0
35   0.0     .0    0.0    0.0    0.0    0.0    0.0
36   0.0     .0    0.0    0.0    0.0    0.0    0.0
37   0.0     .0    0.0    0.0    0.0    0.0    0.0
38   SKIN DISEASE
39   0.05000.010   1.10   0.0    0.0    0.0    0.0
40   0.10000.050   1.10   0.0    0.0    0.0    0.0
41   0.05000.100   1.10   0.0    0.0    0.0    0.0
42   0.05000.100   1.10   0.0    0.0    0.0    0.0
43   0.02000.100   1.10   0.0    0.0    0.0    0.0
44   0.02000.100   1.10   0.0    0.0    0.0    0.0
45   MILD DIARRHEA
46   3.00000.040   1.40   3.00   4.00   0.0    0.0
47   3.00000.040   1.40   3.00   5.00   0.0    0.0
48   1.00000.040   1.40   3.00   5.00   0.0    0.0
49   1.00000.040   1.40   1.00   1.00   0.0    0.0
50   1.00000.040   1.40   1.00   1.00   0.0    0.0
51   1.00000.040   1.40   1.00   1.00   0.0    0.0
52   SEVERE DIARRHEA
53   0.40000.300   2.00   5.00   7.00   1.50  14.00
54   0.30000.350   2.00   5.00  10.00   1.00   8.00
55   0.08000.150   1.80   5.00  10.00   0.50   1.50
56   0.08000.150   1.80   5.00   7.00   0.50   1.00
57   0.08000.150   1.80   5.00   7.00   0.50   1.00
58   0.08000.150   1.80   5.00   7.00   0.50   1.00
59   TUBERCULOSIS
60   0.00100.100  12.00   0.0    0.0    0.0    0.0
```

Rate, XPSC, VC, DLRX, DLNRX, CFRX, CFNRX for each age group

for each of the 31 diseases

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Figure 1 continued

61	0.00200.100	12.00	0.0	0.0	0.0	0.0
62	0.00300.100	12.00	26.00	60.00	0.0	0.0
63	0.00500.100	12.00	26.00	60.00	5.00	10.00
64	0.00400.100	12.00	26.00	90.00	5.00	10.00
65	0.01000.100	12.00	26.00	90.00	10.00	20.00
66	MALARIA					
67	0.00500.050	1.20	5.00	20.00	0.05	1.00
68	0.02000.050	1.20	5.00	20.00	0.05	1.00
69	0.05000.050	1.20	3.00	10.00	0.01	0.50
70	0.05000.050	1.20	2.00	5.00	0.00	0.50
71	0.05000.050	1.20	2.00	5.00	0.00	0.50
72	0.05000.050	1.20	2.00	5.00	0.00	0.50
73	DIPTHERIA					
74	0.0 .500	2.00	21.00	21.00	10.00	20.00
75	0.0 .500	2.00	21.00	21.00	10.00	20.00
76	0.0 .500	2.00	21.00	21.00	10.00	20.00
77	0.0 .0	0.0	0.0	0.0	0.0	0.0
78	0.0 .0	0.0	0.0	0.0	0.0	0.0
79	0.0 .0	0.0	0.0	0.0	0.0	0.0
80	TETANUS					
81	0.02130.300	2.50	10.00	10.00	60.00	90.00
82	0.00100.300	2.50	10.00	15.00	20.00	60.00
83	0.00060.300	2.50	10.00	15.00	20.00	60.00
84	0.00010.300	2.50	10.00	20.00	20.00	60.00
85	0.00010.300	2.50	10.00	20.00	20.00	60.00
86	0.00010.300	2.50	10.00	20.00	20.00	60.00
87	WHOPPING COUGH					
88	0.01000.100	3.00	60.00	60.00	5.00	25.00
89	0.05000.100	3.00	60.00	60.00	0.05	1.00
90	0.01000.100	3.00	40.00	40.00	0.01	0.05
91	0.0 .0	0.0	0.0	0.0	0.0	0.0
92	0.0 .0	0.0	0.0	0.0	0.0	0.0
93	0.0 .0	0.0	0.0	0.0	0.0	0.0
94	MEASLES					
95	0.00000.100	2.00	20.00	20.00	5.00	20.00
96	0.20000.200	2.00	20.00	20.00	0.50	3.50
97	0.010 .100	1.50	20.00	20.00	0.50	1.00
98	0.0 .0	0.0	0.0	0.0	0.0	0.0
99	0.0 .0	0.0	0.0	0.0	0.0	0.0
100	0.0 .0	0.0	0.0	0.0	0.0	0.0
101	BURNS					
102	0.00010.100	1.10	10.00	10.00	1.00	0.50
103	0.00200.100	1.10	10.00	14.00	0.01	0.10
104	0.00500.100	1.10	10.00	12.00	0.01	0.20
105	0.00500.100	1.10	8.00	8.00	0.01	0.01
106	0.01000.100	1.10	5.00	5.00	0.01	0.01
107	0.01000.100	1.10	5.00	5.00	0.01	0.01
108	FRACTURES					
109	0.0 .750	3.00	20.00	40.00	0.10	1.00
110	0.00050.750	3.00	25.00	40.00	0.10	0.50
111	0.00100.750	3.00	25.00	40.00	0.10	1.00
112	0.00200.750	3.00	25.00	50.00	0.50	1.00
113	0.00010.750	3.00	25.00	50.00	1.00	2.00
114	0.00010.750	3.00	25.00	50.00	1.00	2.00
115	CUTS					
116	0.0 .100	1.50	10.00	10.00	0.01	0.05
117	0.02000.050	1.50	7.00	14.00	0.01	0.10
118	0.01000.100	1.50	7.00	10.00	0.00	0.05
119	0.02000.100	1.50	3.00	5.00	0.0	0.01
120	0.01000.100	1.50	3.00	5.00	0.0	0.01

Figure 1 continued

121	0.01000.100	1.50	3.00	5.00	0.0	0.01
122	ANEMIA					
123	0.25000.050	0.0	0.0	0.0	0.0	0.0
124	0.50000.050	0.0	0.0	0.0	0.0	0.0
125	0.20000.050	0.0	0.0	0.0	0.0	0.0
126	0.20000.050	0.0	0.0	0.0	0.0	0.0
127	0.60000.050	0.0	0.0	0.0	0.0	0.0
128	0.20000.050	0.0	0.0	0.0	0.0	0.0
129	MALNUTRITION					
130	0.50000.050	3.00	0.0	0.0	0.0	2.0
131	0.50000.050	3.00	0.0	0.0	0.0	0.0
132	0.30000.100	3.00	0.0	0.0	0.0	0.0
133	0.20000.0	3.00	0.0	0.0	0.0	0.0
134	0.20000.0	3.00	0.0	0.0	0.0	0.0
135	0.20000.0	3.00	0.0	0.0	0.0	0.0
136	INTESTINAL PARASITES					
137	0.01000.010	1.10	5.00	7.00	0.0	0.0
138	1.00000.010	1.10	3.00	5.00	0.0	0.0
139	1.00000.010	1.10	2.00	3.00	0.0	0.0
140	0.20000.030	1.10	2.00	3.00	0.0	0.0
141	0.20000.030	1.10	2.00	3.00	0.0	0.0
142	0.20000.030	1.10	2.00	3.00	0.0	0.0
143	HEART DISEASE					
144	0.0 .0	0.0	0.0	0.0	0.0	0.0
145	0.0 .0	0.0	0.0	0.0	0.0	0.0
146	0.00010.050	5.00	10.00	21.00	2.00	5.00
147	0.00200.200	5.00	10.00	21.00	5.00	8.00
148	0.00100.150	5.00	10.00	21.00	5.00	8.00
149	0.05000.150	5.00	10.00	21.00	10.00	10.00
150	CERREBRO VASCULAR DISEASE					
151	0.0 .0	0.0	0.0	0.0	0.0	0.0
152	0.0 .0	0.0	0.0	0.0	0.0	0.0
153	0.0 .0	0.0	0.0	0.0	0.0	0.0
154	0.00300.500	5.00	21.00	30.00	5.00	10.00
155	0.00200.300	5.00	21.00	30.00	5.00	10.00
156	0.02000.300	5.00	21.00	30.00	20.00	20.00
157	COMPLICATIONS OF CHILDBIRTH AND PREGNANCY					
158	0.09000.100	1.00	0.0	0.0	1.00	20.00
159	0.0 .0	0.0	0.0	0.0	0.0	0.0
160	0.00150.450	5.00	14.00	24.00	3.00	9.00
161	0.0 .0	0.0	0.0	0.0	0.0	0.0
162	0.02400.400	5.00	10.00	20.00	2.00	7.00
163	0.0 .0	0.0	0.0	0.0	0.0	0.0
164	TYPHOID					
165	0.0 .0	0.0	0.0	0.0	0.0	0.0
166	0.02000.100	1.00	10.00	15.00	0.0	1.00
167	0.01000.200	1.00	10.00	20.00	1.00	5.00
168	0.00500.200	1.00	10.00	30.00	2.00	10.00
169	0.00500.200	2.00	10.00	30.00	3.00	10.00
170	0.00500.200	2.00	10.00	30.00	3.00	10.00
171	HEPATITIS					
172	0.0 .0	0.0	0.0	0.0	0.0	0.0
173	0.00600.0	0.0	5.00	5.00	0.0	0.0
174	0.01000.100	1.00	10.00	10.00	0.0	0.0
175	0.00400.200	2.00	15.00	15.00	0.50	0.50
176	0.00400.200	2.00	15.00	15.00	0.50	0.50
177	0.00400.200	2.00	15.00	15.00	0.50	0.50
178	CONJUNCTIVITIS					
179	0.02000.050	1.00	0.0	0.0	0.0	0.0
180	0.04000.100	1.00	0.0	0.0	0.0	0.0

Figure 1 continued

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181   0.06000.100   1.00   0.0    0.0    0.0    0.0
182   0.01000.050   1.00   0.0    0.0    0.0    0.0
183   0.01000.050   1.00   0.0    0.0    0.0    0.0
184   0.01000.050   1.00   0.0    0.0    0.0    0.0
185   RHEUMATIC FEVER
186   0.0     .0    0.0    0.0    0.0    0.0    0.0
187   0.0     .0    0.0    0.0    0.0    0.0    0.0
188   0.0     .0    0.0    0.0    0.0    0.0    0.0
189   0.00500.100   2.00  14.00   7.00   0.10   0.20
190   0.00500.100   2.00  14.00   7.00   0.10   0.20
191   0.00500.100   2.00  14.00   7.00   0.10   0.20
192   VARICELLA
193   0.0     .0    0.0    0.0    0.0    0.0    0.0
194   0.20000.150   1.00  10.00  14.00   0.0    0.0
195   0.10000.150   1.00   7.00  10.00   0.0    0.0
196   0.0     .0    0.0    0.0    0.0    0.0    0.0
197   0.0     .0    0.0    0.0    0.0    0.0    0.0
198   0.0     .0    0.0    0.0    0.0    0.0    0.0
199   MUMPS
200   0.0     .0    0.0    0.0    0.0    0.0    0.0
201   0.20000.100   1.00   7.00   7.00   0.0    0.0
202   0.10000.100   1.00   7.00   7.00   0.0    0.0
203   0.0     .0    0.0    0.0    0.0    0.0    0.0
204   0.0     .0    0.0    0.0    0.0    0.0    0.0
205   0.0     .0    0.0    0.0    0.0    0.0    0.0
206   GONORRHEA
207   0.0     .0    0.0    0.0    0.0    0.0    0.0
208   0.0     .0    0.0    0.0    0.0    0.0    0.0
209   0.0     .0    0.0    0.0    0.0    0.0    0.0
210   0.00200.200   1.00   0.0    0.0    0.0    0.0
211   0.00200.200   1.00   0.0    0.0    0.0    0.0
212   0.00200.200   1.00   0.0    0.0    0.0    0.0
213   GOITER
214   0.0     .0    0.0    0.0    0.0    0.0    0.0
215   0.0     .0    0.0    0.0    0.0    0.0    0.0
216   0.0     .0    0.0    0.0    0.0    0.0    0.0
217   0.00400.050   1.00   0.0    0.0    0.0    0.0
218   0.00400.050   1.00   0.0    0.0    0.0    0.0
219   0.00400.050   1.00   0.0    0.0    0.0    0.0
220   VITAMIN A DEFICIENCY
221   0.0     .0    0.0    0.0    0.0    0.0    0.0
222   0.02000.010   1.00   0.0    0.0    0.0    0.0
223   0.00500.005   1.00   1.00   0.0    0.0    0.0
224   0.0     .0    0.0    0.0    0.0    0.0    0.0
225   0.0     .0    0.0    0.0    0.0    0.0    0.0
226   0.0     .0    0.0    0.0    0.0    0.0    0.0
227   DENTAL PROBLEM
228   0.0     .0    0.0    0.0    0.0    0.0    0.0
229   0.05000.005   0.0    1.00   0.0    0.0    0.0
230   0.03000.010   1.00   0.0    0.0    0.0    0.0
231   0.10000.050   2.00   0.0    0.0    0.0    0.0
232   0.10000.050   2.00   0.0    0.0    0.0    0.0
233   0.20000.050   2.00   0.0    0.0    0.0    0.0
END OF FILE
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