SOME CURRENT METHODOLOGICAL ISSUES
IN HEALTH SECTOR AND PROJECT ANALYSIS

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Population, Health and Nutrition Department

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views and opinions expressed in this paper do not neces-
sarily reflect those of the Bank.
ABSTRACT

The principal issues that arise when efforts are made to apply cost-benefit and cost-effectiveness analysis in the health sector are discussed. Possible approaches to enhancing practical methods for estimating the costs and effects of health interventions are suggested, and the difficulties in applying quantitative techniques are reviewed. Priorities for research and operational-support studies are also identified. It is concluded that although major breakthroughs in this area are unlikely soon, some important incremental advances might well be achieved in the next few years if sufficient resources are committed to the task.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Background</td>
<td>2</td>
</tr>
<tr>
<td>The Issues</td>
<td>6</td>
</tr>
<tr>
<td>2. RESOURCE ALLOCATION ISSUES</td>
<td>12</td>
</tr>
<tr>
<td>In Project Selection and Appraisal</td>
<td>12</td>
</tr>
<tr>
<td>Estimation of Benefits</td>
<td>12</td>
</tr>
<tr>
<td>Estimation of Costs</td>
<td>27</td>
</tr>
<tr>
<td>In Sector Assessment</td>
<td>38</td>
</tr>
<tr>
<td>Assessing the Overall Level of Health Expenditure</td>
<td>38</td>
</tr>
<tr>
<td>Assessing the Allocation of Expenditure within the Sector</td>
<td>46</td>
</tr>
<tr>
<td>3. FINANCING ISSUES</td>
<td>52</td>
</tr>
<tr>
<td>Affordability of Projects and Programs</td>
<td>52</td>
</tr>
<tr>
<td>Financing Options in Sectoral Planning</td>
<td>60</td>
</tr>
<tr>
<td>4. CONCLUSIONS</td>
<td>64</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>i - xii</td>
</tr>
<tr>
<td>ANNEX</td>
<td>1 - 10</td>
</tr>
</tbody>
</table>
1. **INTRODUCTION**

Much has been written about what methods ought to be used when proposed new investments (projects) in the health sector are analyzed or when the sector as a whole is assessed in developing countries.\(^1\) Considerable uncertainty and disagreement persist, however, about how much can actually be done in practice.\(^2\) As an aid to helping determine what next steps the Bank should take in developing policy in this area, the present paper begins by reviewing some of the principal difficulties that in the past have inhibited greater use of quantitative methods, especially cost-benefit and cost-effectiveness analysis. Priorities for research and operational studies are also identified, with the ultimate aim of enhancing existing approaches or developing new variants so as to reduce the gap between what can be done and what should be done. An underlying theme of the paper is that while major breakthroughs in this area are unlikely soon, some important incremental advances are possible during the next few years if sufficient resources are committed to the task.

Some background considerations are discussed first. A subsequent "Issues" section explains the organization of the rest of the paper.

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2/ OTA. (1980) gives some of the flavor of the current debate.
1.1 BACKGROUND

The Bank first adopted a formal policy on lending for health in 1974, after several years of informal experimentation. Since then, the Bank’s role in the sector has changed substantially, as mirrored in the evolution of views in subsequent policy statements.\(^3\) Lending operations, after initially being confined only to minor components of other sectors’ projects, have gradually been expanded to include direct loans primarily for health services. Eight such loans have now been approved, not including 22 population projects, many of which have health service improvements; another half dozen or more loans chiefly for health are currently in preparation. In addition, over 100 health components of projects in other sectors have been funded since 1970. In all, Bank financial assistance for improving health care has been provided to over 50 developing countries. Sector studies have been completed on over 15 countries.

Paralleling these developments, interest has increased in the fundamental problems of choice that arise in health sector planning and project design, and the analytic methods by which these problems can be effectively addressed. Three strands of thought have influenced discussions of such matters. The first, reflecting trends in the general health economics literature as well as project analysis concepts widely recognized in other sectors, stresses benefit-cost (and where that

is not feasible, cost-effectiveness) reasoning. This orientation also has tended to emphasize epidemiological analysis of interventions and diseases, on the grounds that such information is essential for better quantifying the effects of health services on health status (mortality and morbidity).

The second strand of thought is largely a reaction to the first. It asserts that reliable estimation of health effects and other benefits is not possible in practice at present, given the limited data available and the state of the art in analytical techniques. According to this view, cost-benefit and cost-effectiveness analysis, while perhaps useful for simple, narrowly defined problems (e.g., alternative immunization procedures for a single disease), cannot be effectively applied to the far more complex investment choices that are typically encountered in project design and sectoral planning (e.g., alternative strategies for extending primary health care facilities that handle many diverse diseases).

Justifications for investing in health, it is sometimes further argued, should be based simply on the proposition that achieving a minimum level of health care is a basic need requiring no further explanation.

On a different tack, a third perspective has focused on the mounting difficulties that many developing countries currently face in financing their health services, particularly the recurrent costs of

4/ See Drummond (1980a), for example.

5/ As in Shepard and Cash (1983), for instance.

publicly funded services. This concern notes that in the present climate of faltering budgetary support for health, burgeoning national debt, and poor economic performance, governments are under pressure to turn more to alternative financing mechanisms—including user charges and expanded roles for private and quasi-public providers—in order to achieve planned improvements in health status and prevent erosion of past gains. Furthermore, to arrive at sensible new financing policies, something must be known about existing sources of finance and the detailed allocation of expenditure (preferably in terms of unit costs by type of service, intervention and classes of beneficiaries). However, adequate information often is unavailable, presently, since financial data systems are of poor quality.

The Population, Health and Nutrition Department (PHND) has recently begun to explore this subject in greater detail. Two initial points became clear early on. First, because estimating benefits is extremely difficult in the health sector, the sorts of analysis that are currently feasible do indeed fall short of what would be ideal from the standpoint of generalized investment decisionmaking principles. Furthermore, this situation is not likely to be reversed soon: enough research has been done to indicate that certain aspects of benefit estimation in the health sector will remain problematic for some time to come. The second—and countervailing—point is that even with current methods, some quantitative analysis is possible. In fact, more can be done, with more effective impact on health planning and project design, than has frequently been believed possible in the past.

7/ "Quasi-public" refers in these pages to entities such as semi-autonomous social security systems and health plans of publicly owned commercial enterprises.
Recognition of these points has led to new efforts to examine the precise features of the available methods, with a view to improving and extending them. Since 1981, PHND has held two week-long departmental seminars on the subject and staff have helped lead two Economic Development Institute courses emphasizing it. Concomitantly, changes have begun to be apparent in sector and project work. Sector studies now routinely cover financing issues in sectoral planning, and consider program impact whenever possible; formerly, treatment of these areas was far more limited. Project designs reflect heightened awareness of the need to encourage more efficient use of resources in an environment where funds are scarce and the implications of each new investment must be considered carefully. One recently approved project loan for Malawi and another to be decided soon for Brazil are expected to reduce government outlays in the long run from what they would have been otherwise—while improving services—by using resources more efficiently. Another project now in preparation, for Lesotho, may focus almost entirely on strengthening financial management capabilities in the health sector. Two project appraisals, for Peru and Brazil, have tried new variants of methods leading to internal rate of return calculations.

Nevertheless, much still remains unresolved. There is little consensus yet, among those worldwide who prepare and make decisions about health investments, about which methods are ready for regular use and which should have priority for further development. A "how to" manual, if written today, would, like similar attempts in the past, be long on general ideas and short on specific, hands-on advice.

In an effort to press beyond this point, PHND has several initiatives now in process. As originally envisioned, two main topics
would be explored by the Department's Policy and Research Unit: (i) financing and expenditure issues and (ii) epidemiological and economic analysis techniques in health project design and selection. 8/ The first is covered in a separate issues paper, 9/ from which selected highlights are included below. On the second, it is now our view that a somewhat broader perspective is appropriate, so that alternatives to an epidemiologically based approach can also be considered. That perspective, and our proposed future steps, are the focus of remaining sections.

1.2 THE ISSUES

The general principles of project analysis and sector assessments are well known. 10/ As applied to the health sector, these principles imply the following "ideal" procedure, against which feasible second-best methods can be measured. Prior to making choices that might affect the current or future benefits that society obtains from its scarce resources, a thorough examination would be done of the country's health problems, their causes, the strengths and weaknesses of the existing health care system, and the country's priorities and objectives. In addition, this "sector assessment" would include an analysis of financing sources, the detailed allocation of expenditures, and the underlying unit costs of each intervention, not just for the current point in time but also in future allowing for projected

8/ A related topic--supply and distribution of pharmaceuticals--is being examined independently.

9/ de Ferranti (1983 a and b).

changes in demand (and using long run marginal cost—or as an approximation, average incremental cost—to determine the least-cost means of meeting future expansion requirements). Next, from the conclusions and recommendations of the sector assessment, appropriate objectives for new investments would be identified and all feasible project designs for achieving these objectives would be determined, taking into account the technical effectiveness\textsuperscript{11} of the proposed new interventions, their administrative requirements, and other attributes. The full costs (capital and recurrent, pre- and post-project, financial and economic—using, for economic costs, both efficiency and social shadow prices) of each feasible combination of interventions should be estimated. The expected effects of each option on health status, as reflected particularly in reductions in mortality and morbidity, should be determined, drawing on information about the target population, the disease agents, and again, the interventions' likely effectiveness. Finally, by developing estimates of the value to the country of the resulting health status improvements, the benefits of each option should be quantified; the types of benefits considered might include, but not necessarily be limited to, those listed on the following page. Only projects that meet established criteria (e.g., with a net present value of benefits minus costs that is positive, or an internal rate of return that exceeds the social opportunity cost of capital) should be funded.

\textsuperscript{11} "Technical effectiveness" refers here to the net result of (i) the efficacy of the intervention itself (i.e., the extent to which the treatment—vaccine, drug, surgical operation, etc.—ameliorates the problem under ideal clinical conditions) and (ii) the effectiveness of its implementation, which can be broken down into diagnostic accuracy, health provider compliance, and patient compliance.
EXAMPLES OF POTENTIAL BENEFITS FROM HEALTH PROJECTS

I. Effects of reduced morbidity on productivity
   (a) fewer days lost from acute stages of illness
      (i) from worker
      (ii) from members of family caring for the ill
   (b) fewer days of temporarily reduced productivity either through
       changed pace of work or failure to work
   (c) fewer days of lowered productivity from permanent disability

II. Effects of reduced mortality on productivity
   (a) loss of worker days through premature death
   (b) loss of family time

III. Consumption benefits
   (a) increased output of unmarketed household goods, such as house
       repairs, woodgathering, kitchen garden, pond cultivation, home
       made articles
   (b) increased leisure (note interaction of leisure and productive
       time use. The value of leisure time is the output foregone)
   (c) higher quality of leisure
   (d) intrinsic value of life and reduced suffering
      (i) to the individual
      (ii) to others

IV. Greater efficiency of the school system (i.e., more efficient
    learning)
   (a) resource saving -- less wasted education expenditure
   (b) higher future productivity due to better physical and mental
       development (Examples: INCAP research of Klein, Martorell and
       others)

V. Reduced expenditures by households on
   (a) medical care, drugs, traditional healers
   (b) supplementary food (example: malaria and diarrhea)

VI. Other benefits
   (a) externalities (example: herd effect of immunization)
   (b) fertility reduction following established increase in child
       survival (examples: work of Cochrane, Schultz)
   (c) new lands: (examples: outer islands of Indonesia, and
       malaria; Voltaic river basin, and oncho)

VII. Direct government resource savings resulting from internal
    efficiency improvements. (See, however, discussion in text implying
    that such savings usually should not be counted as a benefit in
    addition to items such as above.)
Finally the financing side of the most promising project design(s) would be analyzed. To begin with, a check would be done to assure that the new services would be "affordable." That is, it would be verified that each institution or group required to commit resources to implementing and sustaining the project will in fact be able and willing to do so.\textsuperscript{12/} For example, consideration would be given to: whether health ministries would have a reasonable likelihood of receiving sufficient budget allocations to be able to cover their share of both capital and recurrent costs; whether local government authorities and village committees would similarly be able to supply whatever resources—monetary, human, material—are expected of them; and whether the ultimate users of the services would be able and willing to bear the fees and other costs (travel, foregone earnings) which they will have to incur to use the new services.\textsuperscript{13/} To this end, the anticipated net resource position (projected access to resources, less requirements for other activities) of each category of suppliers and beneficiaries, and their propensity to participate\textsuperscript{14/} would be assessed.

\textsuperscript{12/} The need to consider this affordability issue in addition to the conventional cost-benefit criteria can be thought of from a theoretical perspective as arising from the fact that capital markets are not perfect. If capital markets were perfect, the required financing could be obtained through borrowing, assuming that the project has a positive net present value. Affordability would then be moot.

\textsuperscript{13/} Obviously, some users—the very poor—will be less able or willing to pay than others, in which case special arrangements for them may be deemed necessary. The issue here is whether the entire user group in some overall sense would have sufficient resources and propensity to participate.

\textsuperscript{14/} "Propensity to participate," in the case of households, refers to demand elasticities. For other entities—such as government agencies—it may be unity or close to it (i.e., participation is certain) if commitment is strong, or it may be much lower (nearer zero) if there is institutional weakness or budgetary constraints.
Particular attention would also be devoted to the long run sustainability of recurrent costs after project completion; the replicability of the project (i.e., would an extension of the same strategy and programs to the entire province or nation be sustainable?) would be examined too. Besides these affordability issues, a second—and more fundamental—aspect of financing would then be addressed: what sources of funding would support the project? Besides the obvious issue of assuring that stable funding will be available over the long term, the analysis of the planned sources would take into account their implications for (i) efficiency and equity (as influenced, for example, by increased user charges), (ii) the public, quasi-public, and private mix of services and facilities, and (iii) other structural matters (such as the degree of centralization or decentralization).

Clearly, this "ideal" procedure is not presently feasible in its entirety in routine sector and project work. However, as a conceptual starting point, it helps highlight certain key issues. For example, it underscores the role of financing issues which, until recently, were often overlooked or treated as much less important. The reasons for this oversight are unclear, although one possibility relates to the fact that project analysis techniques originated in the context of the productive sectors. In those sectors unlike certain social sectors, the financial viability of a project design is usually assumed to have been established before the main (i.e., cost-benefit) analysis begins. Tests for viability in the productive context naturally seem straightforward because there is an obvious criterion: either the proposed enterprise will be profitable or not. However, in the social sectors, and health in particular, standard profitability criteria are not applicable; comparatively little revenue is
collected and costs always exceed income. Furthermore, the sources of financing chosen for health programs can have significant feedback effects for future investment choices and for the prospects of (and appropriate strategies for) achieving national objectives in the health field. For instance, policies on user charges and insurance schemes can influence demand for services substantially, which may alter the types of facilities and interventions that should be funded. Thus, financing issues cannot, in the health sector, be relegated to the minor place they sometimes can have in other sectors.

The remainder of the paper takes each of the major conceptual elements in the "ideal" procedure and discusses the problems encountered in practical applications, as well as what might be done to address these problems. The sequence of topics covered is:

Resource Allocation Issues

In Project Selection and Appraisal
  Estimation of Benefits
  Estimation of Costs

In Sector Assessment
  Assessing The Overall Level of Health Expenditure
  Assessing the Allocation of Expenditure within the Sector

Financing Issues

Affordability of Projects and Programs

Financing Options in Sectoral Planning
2. RESOURCE ALLOCATION ISSUES

The topics covered in this section include benefit and cost questions that are the core of conventional project analysis, and some broader allocation questions that arise at the sector level. Although the underlying issues overlap considerably, the project context is discussed separately from the sector context because the practical problems that must be dealt with are somewhat different.

2.1 IN PROJECT SELECTION AND APPRAISAL

2.1.1 Estimation of Benefits

To estimate the benefits of a proposed project alternative, it is necessary, as indicated earlier, to know something about both:

(a) the expected effect on health status (mortality and morbidity) and,

(b) the value to society of these improvements in health status. Subsumed in (b) are all of the problems that arise in attempting to convert reductions in illness, disability and premature deaths into valid measures of social benefits, allowing for both productivity-related and other impacts of better health and longer life.

On (a)—the health effect—the primary evidence available is from a body of literature that focuses on particular diseases, generally analyzed singly and in isolation from broader program considerations. Studies in this vein have been done, for example, on malaria (Barlow, 1967; Cohn 1972 and 1973; Prescott 1979b; WHO, 1974), measles (Kasongo Project Team, 1981; Ponninghaus, 1979; Shepard, 1982), schistosomiasis (Cohen, 1974; Collins, 1976; Gateef, et al., 1971; Farooq, 1963; Foster, 1967; Prescott, 1979,
1979a; Rosenfield, 1977; and Weisbrod, et al., 1973), diarrheal diseases (Barnum, 1981; Barzgar et al., 1980; Chatterjee, 1978; Rahaman, 1979; Shepard and Cash, 1983; and WHO, 1980), onchocerciasis (Blanc, 1970; Bradley A., 1976; Prescott, 1979b; and Prost et al., 1983), and helminthiasis (Gateef, 1972; Jancloes and Prescott, 1983). The results of these studies provide some quantitative information, albeit limited and often uncertain, about the possible reductions in mortality and/or morbidity that might be obtained from particular types of interventions in particular circumstances. Where corresponding cost data have also been available, cost-effectiveness indicators have been estimated as well, such as the "cost per death prevented" figures shown in Table 1.

The findings from this literature, while interesting, have not been very useful for project design and appraisal so far, (or program planning either)—at least not directly. One problem is that few robust generalizations have emerged that could reliably be transported from the study sites to other, broader contexts. On immunizable diseases, for instance, it is still extremely unclear what the health effects of alternative program strategies are likely to be in areas other than the few that have been studied. Difficulties in measurement and data collection are partly responsible. Important components of health effects (e.g., interactions between disease and malnutrition) have frequently been either omitted or poorly estimated. Some of these difficulties may conceivably be overcome in future investigations; but after more than two decades of trying, it begins to appear as if certain obstacles may be inherently insurmountable.

Another, more fundamental problem with the disease-specific literature is that its findings do not really pertain to the design issues
## Table 1. Cost Per Death Prevented

<table>
<thead>
<tr>
<th>Author</th>
<th>Method</th>
<th>Country</th>
<th>Cost Per Death Prevented</th>
</tr>
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<tbody>
<tr>
<td>Shepard (1982)</td>
<td>Measles immunization</td>
<td>Ivory Coast</td>
<td>$490</td>
</tr>
<tr>
<td></td>
<td>(Includes all joint costs of a program</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>of polio, DPT, BCG and tetanus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barnum et al. (1980)</td>
<td>Total immunization program</td>
<td>Indonesia</td>
<td>$130</td>
</tr>
<tr>
<td></td>
<td>BCG program only</td>
<td></td>
<td>$445</td>
</tr>
<tr>
<td></td>
<td>DPTT program only</td>
<td></td>
<td>$135</td>
</tr>
<tr>
<td></td>
<td>BCG marginal</td>
<td></td>
<td>$101</td>
</tr>
<tr>
<td></td>
<td>DPTT marginal</td>
<td></td>
<td>$77</td>
</tr>
<tr>
<td>Barnum (1980)</td>
<td>Immunization total</td>
<td>India</td>
<td>$85</td>
</tr>
<tr>
<td></td>
<td>DPT, TT, BCG only</td>
<td></td>
<td>$274</td>
</tr>
<tr>
<td></td>
<td>Measles only</td>
<td></td>
<td>$50</td>
</tr>
<tr>
<td></td>
<td>Polio only</td>
<td></td>
<td>$6,357</td>
</tr>
<tr>
<td></td>
<td>DPT, TT, BCG</td>
<td></td>
<td>$69</td>
</tr>
<tr>
<td></td>
<td>Measles as marginal</td>
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<td>$26</td>
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<tr>
<td></td>
<td>Polio as marginal</td>
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<td>$568</td>
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<tr>
<td></td>
<td>New births only</td>
<td></td>
<td>$70</td>
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<td></td>
<td>Implementation marginal all immunization</td>
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<td>$1,133</td>
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<tr>
<td></td>
<td>Implementation marginal DPT, BCG, Polio</td>
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<td>Barnum (1979)</td>
<td>Health program separate</td>
<td>Nepal</td>
<td>$508</td>
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<tr>
<td></td>
<td>Integrated with family planning</td>
<td></td>
<td>$271</td>
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<tr>
<td>Faruqee &amp; Johnson</td>
<td>Nutrition program prenatal</td>
<td>Naranggul</td>
<td>$7.75</td>
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<tr>
<td>(1981)</td>
<td>Health care - Infant</td>
<td></td>
<td>$25.00</td>
</tr>
<tr>
<td></td>
<td>- Child</td>
<td></td>
<td>$31.00</td>
</tr>
<tr>
<td>Barlow (1976)</td>
<td>Hospital</td>
<td>Morocco, 1971</td>
<td></td>
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<tr>
<td></td>
<td>Large</td>
<td></td>
<td>$2,640</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td></td>
<td>$2,820</td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td></td>
<td>$2,360</td>
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<tr>
<td>Horton &amp; Claquin (1982)</td>
<td>Hospital treatment for diarrhea</td>
<td>Bangladesh</td>
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<tr>
<td></td>
<td>Sotaki</td>
<td></td>
<td>$187</td>
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<td></td>
<td>Matlab</td>
<td></td>
<td>$1,262-1,352</td>
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<tr>
<td>Prescott (1980)</td>
<td>Malaria eradication</td>
<td>Bangladesh</td>
<td>$809-25,090</td>
</tr>
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<td></td>
<td>Spraying and drugs</td>
<td></td>
<td></td>
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<tr>
<td>Walsh &amp; Warren (1979)</td>
<td>Mosquito control - Malaria</td>
<td>Cross-country analysis</td>
<td>$600</td>
</tr>
<tr>
<td></td>
<td>(infant and child)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Community water supply, sanitation</td>
<td></td>
<td>$3,500-4,300</td>
</tr>
<tr>
<td></td>
<td>Selective primary health care</td>
<td></td>
<td>$200-250</td>
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</tbody>
</table>

Source: Cochrane and Zachariah, 1983.
that project analysts must deal with. Projects rarely are targeted on one
disease alone, although there are exceptions such as vertical control
programs for malaria. More commonly, governments undertake multi-faceted
health projects that address a whole range of health problems at once.
Primary health care projects are prime examples. Results from studies that
consider only one disease, and select and rank interventions from that
perspective, can be misleading for evaluation of broader programs.
(Historically, the first single-disease studies were initiated at a time
when narrower, vertical programs were more in fashion. What has happened
is that program concepts have changed but the literature has continued
along earlier lines.)

Nevertheless, the evidence from the single-disease studies can
still play a helpful role in project analysis—in two distinct ways.
First, the findings do contribute positively to the general knowledge base
that project designers bring to the task. Precise prescriptions may not be
possible about which control techniques for, say, schistosomiasis (e.g.,
mollusciciding, chemotherapy, engineering measures, or a combination of
these) are best for a given area, but the available data at least suggest
the questions that need to be explored and some hypotheses about the pros
and cons of the principal options. Future studies, improving on past
efforts, should thus be encouraged. Considerable progress may be possible
particularly on the costs of alternative interventions—which would enhance
the value of the findings appreciably.

As to priorities on which diseases should be examined, a shift in
attention may now be in order. To date, tropical and preventable childhood
diseases have dominated the literature. This bias was—and still is—apt
for regions of the world where these problems are widespread, as part of the cycle of poverty, low life expectancy, inadequate water supply and sanitation, and related factors. Now, however, more countries are moving out of this first stage of the epidemiological transition.\footnote{See Evans, et al (1981) on the three stages of the epidemiological transition.} In the second stage, as income levels rise and the poverty-cycle health problems become less dominant, more people live long enough to experience, and to want to devote resources to doing something about, diseases of age and (relative) affluence. Chief among these are cardiovascular disorders, especially hypertension.\footnote{China is the obvious example, but other countries, such as Brazil, Korea, Mexico, the Philippines, and India, may be close behind.} A study of the economics of controlling cardiovascular problems in developing countries should be a leading candidate for new initiatives in this area. Tuberculosis might be another.

In addition, the findings from disease-specific studies can be useful in a special sort of analysis which, in selected instances, may provide at least a rough initial approximation of the relative health improvement effects of project alternatives. The essence of this analysis is the following. If certain key parameters (such as the incidence rate, case fatality rate, average age of onset, and likelihood and extent of disability) for each of the most important diseases in a given situation
were known, and if plausible assumptions could be made about the impact of a proposed intervention on these parameters, then good estimates of the effects of this intervention on mortality and morbidity could be obtained using a methodology that derives the "healthy days of life lost" or some similar indicator. Of course, the required inputs for such calculations usually are not known at least not precisely. However, something about their general range—the highest and lowest values they might have—can often be gleaned from other data. For example, the incidence rate for polio (new cases contracted per year as a fraction of the population at risk) in a given region may not be observable directly, but data from studies in other locales may suggest that it probably is not more than, say, .1 or less than .01. Sensitivity analyses, examining with the aid of a computer a large number of different combinations of the possible values for all parameters, can then indicate whether the ranking of the project alternatives in terms of their health effects is highly uncertain or, perhaps, fairly invariant. If the ranking is invariant, greater precision in the input data is unnecessary. If the ranking is uncertain, the analysis will at least have identified the parameters that most require further attention and their switching values—i.e., the values at which the ranking changes.

Application of this procedure is greatly hindered at present by the fact that the available data from the literature have not been assembled, organized and evaluated in a manner that would provide a good basis for selecting parameter estimates. A review and synthesis of the evidence are needed, compiled by disease and by country. Such an effort would not have

17/ Examples of applications of this methodology include Shepard and Zeckhauser (1980) and the Ghana Health Assessment Project Team (1981).
to be a large or lengthy undertaking, and could significantly reduce the current extent of uncertainty about key parameters.

Ultimately, however, the central challenge in the assessment of health effects is to move beyond disease-specific analyses and into the more general problem of multi-faceted programs with effects on a broad range of diseases. One possible approach to this task is suggested by a child survival model developed by Barnum, et al. (1982), which essentially estimates health impacts for each of a large number of diseases individually (allowing, though, for interactions) and then aggregates the results. Both mortality and morbidity are considered, along with resource requirements including projected costs of alternative interventions. The epidemiological features of the diseases figure prominently in this approach. Consequently, a great deal of disease-related information and/or assumptions are required to apply the model—a potential drawback for operational work.

Another possible approach is to identify relationships between the health services available to a population and general indices of that population's health status, such as infant mortality rate, life expectancy, and degree of dysfunction (which can range from temporary loss of energy to loss of limbs). Unlike the previous approach, this one requires little epidemiological data, and instead concentrates on the combined effect of all illnesses on lifespan and ability to function normally. Tests for the existence of stable relationships of this kind and efforts to estimate the relevant parameter values could be carried out with data from specially designed surveys, in context where there is variation in the nature, quality and/or quantity of health services available and sufficient means of controlling for other factors (e.g., population differences across the
areas under study). While few studies have gone very far in this direction, some elements are visible in Fraser (1973) and studies summarized in Cochrane (1980).

There is not yet enough empirical basis for judging which of these two approaches (or, perhaps, a third—or none) might be most helpful in health project planning. There is a need, therefore, to try out alternative methodologies in a few (e.g., two or three) country settings to see how workable and informative they are. Preferably, all of the approaches chosen for testing would be applied in each country case study, so that their results and features could be compared directly. Part of this work would be research and part could most naturally be done in association with an actual project under development.

The second major aspect of benefit estimation noted above—i.e., quantifying the value to society of improvements in health status—raises a number of complex questions which have been alluded to in several sources, including Feldstein (1970), Paglin (1974), Barlow (1976, 1979), Grossman (1972), and Ram and Schultz (1979). Many of the benefits of better health (as in list above) cannot be observed or easily measured directly. For productivity increases, choice of an appropriate shadow wage is complicated by high un- and under-employment. Other benefits are even more elusive for analysts.

One possible approach to this valuation problem in effect turns it on its head in the following way. Suppose that a given project design has been estimated to have a stream of costs, \( C_t \), over time and a stream of health improvements, \( X_t \). The \( X_t \) might be reductions in healthy days lost or some other measure. If the average unit value, \( V \), to society of these health improvements were known, it would be straightforward to calculate
the net present value of $VX_t - C_t$ to determine the project's merit. However, since, in fact, $V$ is not known, consider instead the question:

What would $V$ have to be such that the net present value of $VX_t - C_t$ would exactly equal zero, or alternatively, such that the internal rate of return of $VX_t - C_t$ exactly equals the opportunity cost of capital?

The estimated $\hat{V}$ from this computation is in effect a switching value for the unit value of health effects.

Given $\hat{V}$, the next step would be to consider each of the possible sources of benefits in turn (productivity increases, returns to education, etc.). In some cases, virtually no information will be available about the unit value, $V_i$, of each individual source of benefits. In other cases, either a crude estimate of a particular source's $V_i$ or at least something about the range in which the $V_i$ lies may be known. For example, the $V_i$ for increased productive output would be the appropriate shadow wage, duly adjusted for seasonality considerations. If only an approximate range for the shadow range is known, the $V_i$ could be conservatively estimated at the lower bound for that range.

The sum, $\hat{V}$, of the available $V_i$ would then be compared to the switching value, $\hat{V}$. If $\hat{V}$ exceeds $\hat{V}$, then there is support for going ahead with the project, even though the full benefits cannot be estimated. If, on the other hand, $\hat{V}$ is less than $\hat{V}$, no conclusion can be drawn: the project might still be justified because some of the $V_i$ are not known. However, the amount of the shortfall ($\hat{V} - \hat{V}$) is of interest as a measure of how large the unknown $V_i$ would need to be in order for the project to be worthwhile. A large shortfall, in relation to any information—however limited—that may exist on the significance of the unestimated benefits in
other settings, would cast doubt on the worth of the project; a small shortfall would have the reverse connotation. For example, a large shortfall, insofar as some generalized notion of healthy life is considered a goal in its own right and is one of the missing $V_i$, implies a certain value-of-life estimate; this estimate can be compared with similar figures from other studies.

This procedure still needs to be tested thoroughly before its practical usefulness can be evaluated. A few trial applications in specific project applications would be helpful at this point. If indicated, more extended efforts could then be undertaken, possibly combined with the country case studies recommended earlier with respect to estimating health effects.

Ultimately, of course, improved understanding of and better evidence on the most important sources of benefits would be desirable. On productivity effects, for instance, a review and analysis on which shadow wages to use, with particular attention to un- and under-employment questions, would be valuable. However, such work will not be able to be used directly until progress has been made on the preceding points, and accordingly can be deferred for the present.

So far, it has been implicitly assumed that in order to assess potential projects properly, something must always be known about the expected health status changes and their implications (for production, etc.). This may not be the case, however, in some instances. The possibility that estimates of the cost savings generated by a project can be used in lieu of estimates of benefits per se, which are always more difficult to arrive at, has been explored by a number of studies including Klarman (1965, 1974), Weisbrod (1971), Linnerooth (1979), Culyer (1976),
Cullis and West (1979), Butler and Doessel (1981), and Steiner (1965). As has been clearly demonstrated by several of these papers, the substitution of cost savings in lieu of benefit estimation is not valid for the general case—that is, in all situations. Nevertheless, it is appropriate in particular circumstances. Determining whether a given choice problem under study satisfies these simplifying circumstances is therefore critical.

Many writers have suggested that few problems fit the requirements, and that attempts to rely solely on cost savings are often merely unwarranted avoidance of the tough job of projecting benefits. However, none of this literature has focused on the developing countries, or on the sorts of choice problems actually dealt with in project formulation and policy-making in those countries. Since the choice that developing country governments make often are much more narrowly constrained, due to political or institutional factors, than the general theoretical case, it is by no means clear that use of cost savings in place of benefit estimation is rarely justified. A brief investigation—leading to a short paper—clarifying this issue in the context of what really happens in the developing world is needed. Only then will it be evident how much effort on assessing benefits is in fact necessary.

Whatever that effort concludes, there will always be some situations where health effects and their value to society can safely be regarded as of secondary interest. Examples of such situations are given in the following table (items 1-3); also shown are examples of other circumstances where health effects and their value are important (items 4-7). A common feature of choice problems similar to items 1-3 is that several important decisions have been made already and hence the remaining issues to be resolved can be defined in relatively narrow terms. These
simplified problems arise in two different settings. First, they may come up in the preliminary or supporting analysis for some broader investment decision problem (such as items 4 through 7). In that context, cost-minimization (or service maximization for given cost) analysis can be a useful first step, identifying the least-cost (or greatest service) variation for each of the principal alternatives which will be examined in greater depth in the broader analysis. Second, the broader problem may itself be of a strictly cost-minimization or service maximization nature. This is possible if it is reasonable to accept as given the factors (e.g., political or institutional constraints) which account for why the government perceives the problem as already narrowed down in the way indicated, instead of being a general, unrestricted decision problem.

More generally, problems where the "choice space" has been simplified by pre-existing consideration arise often in practical health sector and project work, and are much easier to analyze than the general case. Curiously, though, readily applicable methodologies for these problems do not exist yet with anything like the level of sophistication one would expect—considering the techniques available in other sectors for essentially similar needs (e.g., for selecting appropriate sizes and locations of facilities in networks for road, power, or rural development services). Rapid progress in rectifying this deficiency should be possible now, building upon that experience plus modeling approaches suggested by Barlow (1976), Dunlop (1982), Heller (1975 and 1978) and others.
Table 2. CLASSIFICATION OF PROBLEMS ENCOUNTERED IN INVESTMENT DECISION-MAKING IN HEALTH SECTOR

<table>
<thead>
<tr>
<th>Type of Problem</th>
<th>Example and Comments</th>
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</thead>
<tbody>
<tr>
<td>1. Simple cost minimization</td>
<td>Example: The central government health ministry in country X is interested in improving its drug supply system. Based on a preliminary analysis of a wide range of possible changes to the system, three alternative courses of action have been proposed. One of these options involves expanding regional storage facilities; another emphasizes increasing local production of pharmaceuticals; the third stresses better vehicle maintenance. There is general agreement that the three options would have roughly the same effects in terms of improved quantity, quality and distribution (by geographic area, income groups, etc.) of drugs throughout the health services network. (In part, this is because each was designed to satisfy the same set of minimum “requirements” for the various facilities served.) A fourth possibility—do nothing—has already been eliminated by the government, on the grounds that the current drug supply situation is too serious to be allowed to continue. The government now wants to know which of the three alternative improvement plans it should select. Second example: The health authorities of a given province in country Y have decided to expand their services to rural areas. A primary health care strategy has been adopted, calling for increased numbers of village health workers and the upgrading of supporting facilities and programs. Two alternative organizational schemes have been developed concerning the roles of health centers, which are positioned between the village workers and the district hospitals in the province’s health care hierarchy. Under one scheme, centers would have relatively limited capabilities, but would be regularly augmented by mobile teams based at the district hospitals. Under the other scheme, centers would be better equipped and staffed but there would be few visits from mobile teams. It is generally accepted that because of the way these...</td>
</tr>
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</table>
In the context of health service delivery, it is crucial to:

1. Understand the nature of care provided in different settings.
2. Analyze the impact of resource allocation on service quality.
3. Evaluate the effectiveness of different interventions.

Table 2: Classification of Health Care Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Health centers</td>
</tr>
<tr>
<td>Secondary</td>
<td>Hospitals</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Medical colleges</td>
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</tbody>
</table>

Challenges include:

- Access to services
- Resource constraints
- Quality assurance
Table 2. CLASSIFICATION OF PROBLEMS ENCOUNTERED IN INVESTMENT DECISIONMAKING IN HEALTH SECTOR

<table>
<thead>
<tr>
<th>Type of Problem</th>
<th>Examples and Comments</th>
</tr>
</thead>
</table>
| 4. Maximization of reduction in the prevalence or incidence of a disease. | Example: Three different approaches to malaria control have been proposed. The problem is to choose the one that will result in the largest reduction in the prevalence of malaria within the target area, subject to given funding limitations.  
Comment: Here, unlike in the previous cases, it is possible to consider simultaneously the effects of more than one service, or more than one aspect of a service (e.g., quality as well as quantity), since there is a common denominator—number of malaria cases. However, the analysis is limited to a single disease, because there is no way of adding prevalence (or incidence) reductions in several diseases without expanding the problem into the types below. Also, mortality is ignored. |
| 5. Maximization of reduction in mortality. | Example: Two alternative strategies for a maternal and child health program are being contemplated. The problem is to choose the one that is likely to lead to the greatest reduction in infant child and maternal deaths, subject to given funding constraints.  
Comment: Multiple diseases can now be incorporated, along with multiple services and multiple aspects of services. This is because a death is a death, regardless of which disease causes it. However, morbidity effects are not taken into account. |
| 6. Maximization of reduction in "disability days" or other composite measures of morbidity and mortality. | Example: Several proposals have been made about how the village health workers in province 2 should spend their time. Choose the one that will result in the largest total reduction in the composite measure "quality adjusted years of life lost"—subject to given funding constraints.  
Comment: Now both mortality and morbidity are included, and any combination of interventions and diseases can be considered. However, numerous assumptions are required regarding the weighting of sickness relative to death, and days lost early in life relative to days lost later. |
| 7. Full cost-benefit analysis. | Example: Same as above (in 6) except the problem is to choose a proposal which maximizes the net present value of benefits minus costs. |
2.1.2 Estimation of Costs

The health sector has lagged far behind many other sectors in developing sound practices for project costing. The principal problems of current practices can be grouped under the headings: omissions and underestimation, mishandling of the capital/recurrent issue, absence of shadow pricing, inadequate treatment of joint cost allocation, lack of cost models, and failure to derive and effectively examine unit costs. The last is especially important since, as will be seen, unit costs are likely to play a critical role in practical efforts to improve analytic methods for project and sector work.

Omissions and Underestimation. A review of past cost studies suggests that large errors are often introduced simply by not counting certain costs attributable to the project or by substantially underestimating them. The chief areas of difficulty appear to be those listed on the following page. Sometimes the errors are merely careless: for instance, annual replenishments of drug supplies were counted in one study but not the initial stocking. In other cases, a token effort is made to include an item, but the estimate provided is clearly too low.

To illustrate the sizeable impact that these ostensibly minor shortcomings can have, two alternative costings of the same hypothetical project are presented in an Annex. The project consists simply of building and running 30 health centers. The first costing overlooks a number of less obvious, but still important ramifications, including (i) the necessary upgrading of the higher level facilities required to support the new centers and (ii) the fact that the average cost per center will rise as more distant and difficult sites are brought in. The second, or "correct," costing is 78% higher than the first in total costs prior to project completion; and it is 96% higher for the first year after project completion.
FREQUENTLY OVERLOOKED OR UNDERESTIMATED ITEMS IN ESTIMATING HEALTH PROJECT COSTS

- Training (initial and refresher; training of trainers; orientation for higher level staffs and local committees; local "promotion")
- supervision (travel and per diem costs; also salaries for extra staff needed)
- supplies other than drugs
- initial stocks of supplies (both drugs and other)
- utilities
- maintenance and repair
  - vehicles
  - building and equipment
- unanswered question about
  - where rural staffs will live
  - how supervisory staff will get to villages
- Upgrading of support structure
  - includes
    - Correcting deficiencies at higher level facilities (e.g., if project will create new health posts, the centers above them must be adequate)
    - increasing capacity where needed (if higher level facilities will have greater patient load)
    - special services: improving vehicle maintenance capabilities, revamping drug supply, etc.
      - often allowed for in capital costs, but not recurrent
      - can be substantial (e.g., 30% or more of recurrent costs)
- Costs borne by entities other than those executing the project
  - other central government institutions (e.g., contributions to staff retirement fund, subsidies for housing)
  - private sector (e.g., value of time expended by users of clinics)
- Need to
  - show all costs, broken down by entity bearing them (so financial feasibility can be examined for each entity)
  - be sure all transfer payments among entities are noted.
There is no reason why serious omissions and underestimation should have to persist in health project costing. The challenges faced and steps required are no worse than in other sectors; in fact, costing may even be easier in health since there are rarely any extremely large capital items to factor in—like a new type of chemical processing plant or a hydroelectric dam. Moreover, the basic principles are utterly straightforward: any item is a cost of the project if it would not have been incurred otherwise, provided that (i) some resources would actually be consumed in the sense of no longer being available for other uses now or even again, and (ii) the item is not already a "sunk cost" at the time the decision on the project is made.

The Capital/Recurrent Issue. Most cost studies now estimate

- capital costs for each year before project completion
  (when all the new services are first fully operational)
  and
- recurrent costs for a single "typical" year after completion.

While this practice is an improvement over some earlier approaches (in which recurrent costs sometimes were omitted completely), it still is deficient in several respects.

First, capital costs exist not only before completion, but after as well—in the form of replacement costs for buildings, vehicles and major equipment as the initial items eventually wear out. The concept of an annual replacement allowance, reflecting the annuitized capital cost, provides a convenient method of incorporating post-completion capital costs without the tedious task of projecting year by year when replacements will occur.
Second, recurrent costs generally begin before project completion and do not build up to their final full level until several years after completion. Thus, instead of just one "typical" yearly figure, a stream of estimates over time is required. The consequences of incorporating these points are illustrated in the Annex (where, however, for reasons of space only one year after completion is shown).

**Shadow Pricing.** All but a few studies to date have relied solely on market prices (or the best available proxy for them) and thus have estimated only financial costs. As is well known, financial costs generally do not accurately reflect the true economic costs to society of devoting resources to a particular activity in lieu of the next best alternative; and consequently decisions made on the basis of financial costs may result in misallocation of resources. The principal areas where financial and economic costs differ—in health as in most other sectors—are (i) the value assigned to foreign exchange and (ii) wages and salaries. Observed foreign exchange rates often underestimate the true scarcity value of foreign exchange in developing countries, while observed wage rates frequently overestimate the true opportunity cost of labor. The use of shadow prices (shadow foreign exchange rates and shadow wages) corrects for these distortions, raising the cost of foreign exchange and reducing the cost of labor. The effective result is to discourage selection of projects which require large amounts of foreign exchange and to favor selection of those which are labor intensive.

Where possible, other corrections through appropriate shadow pricing may also be called for in some situations. For example, good managerial talent—often a scarce resource in the health sector—may require a shadow wage well above nominal levels. Also, a country’s
distributional goals, reflecting its growth and equity objectives, can be incorporated through social weighting (Squire and van der Tak, 1975). The use of social weighting typically enhances the attractiveness of projects which redistribute income to the poor or which conserve public funds, either by not relying heavily on public financing (e.g., projects that promote increased privatization of the health sector) or by generating additional public revenue (e.g., through user charges). In addition, insofar as growth goals are emphasized, projects are favored which stimulate high rates of saving and reinvestment.

In the health sector, shadow pricing is particularly pertinent for a number of further reasons, noted in Prescott and Warford (1983). Certain facets of health delivery systems are extremely foreign-exchange intensive, especially the tendency to depend extensively on imported pharmaceuticals. Correction for the undervaluing of foreign exchange places in proper perspective the merits of projects and policies aimed at increasing domestic production of pharmaceuticals. Other facets of the sector are extremely labor intensive and offer opportunities to provide employment to lower income groups in lieu of higher paid labor. Primary health care, as an alternative to increasing hospital services, is a prime example. Shadow pricing of labor is needed to clarify these features appropriately.

Joint Cost Allocation. Many inputs used in the health sector contribute simultaneously to production of several distinctly different kinds of outputs. For example, a given subsystem of vehicles, buildings and staff may be engaged in both curative inpatient care, preventive outpatient services for mothers and infants, and prophylactic measures against a particular disease such as malaria. It is often not immediately obvious how much of the total expenditure on each input should be included
in the costing of each output. Several alternative allocation procedures are conceivable, none of which is universally best for all circumstances. In some cases, the fact that one activity is clearly marginal with respect to another (in the sense that the former is an optional addition whereas the latter would be ongoing no matter what) provides a possible guide. A proposed new project, for instance, is, in its entirety, an add-on to already existing services, and thus all new expenditures occasioned by the project should be attributed to it at the time of appraisal. In other cases, though, it is unclear which activity is marginal to which (e.g., when considering different components of the same new project).

One allocation procedure useful in many situations, particularly in the health sector, takes advantage of the fact that some inputs can be broken down by function to a greater extent than aggregate data typically suggest. Staff costs, for example, can be allocated among different outputs on the basis of time spent in various functions. Even if—as is usually the case—data from direct observation of time use are not available, information from recall questions or weekly assignment schedules can provide at least an approximate indication, as has been successfully demonstrated in studies in Malaysia (Heller, 1982) and Malawi (Malawi Ministry of Health, 1983). Similarly, vehicle costs can be allocated on the basis of information on distances travelled and destinations visited; drug distribution can be determined from shipment reports. In each instance, sample results can be used where complete data are unavailable. Once efforts along these lines have allocated as many costs as possible to the appropriate outputs, the remaining true joint costs (e.g., maintenance and administration) often will be relatively small—perhaps under 20%—compared to the total costs. A rough and ready rule for dealing with
them is to assign them among the various outputs in the same proportions as the already allocated costs taken collectively. An alternative rule sometimes suggested for other sectors allocates joint costs in proportion to the value of the volume of outputs produced. This option, however, is less apt for the health sector where outputs can be difficult to value in comparable terms, as noted in earlier remarks on estimating benefits.

**Cost Models.** One possible inference from preceding remarks is that good costing requires good "detail work." This is so, but methods can still be devised—as has been demonstrated in other sectors—to help simplify the calculations and make the work more manageable. One commonly suggested shortcut, but not recommended by this author, involves relying on r-coefficients.

An r-coefficient is just the ratio of a project's annual recurrent cost of its total investment cost. Health projects normally have higher r-coefficients than projects in other sectors, because health programs are relatively recurrent-cost-intensive (staff, equipment, and vehicle operating costs are major items) and health facilities are comparatively less investment-cost-intensive than, say, a road system, dam, or power plant. R-coefficients in the health sector typically exceed 0.2, whereas they are below 0.1 in many other fields. Furthermore, lower levels of the health system have greater r-coefficients than higher levels do. The r-coefficients for clinics and primary health care are approximately double those for hospitals (World Bank, 1982). Similar patterns have been found in Kenya and Malaysia (Heller, 1974 and 1975) and the Sahel countries (Club du Sahel, 1980).

To obtain an estimate of project costs using r-coefficients, one first estimates the total investment cost of the project and then
multiplies that figure by an r-coefficient derived for some prior project, or by some presumed "average" r-coefficient. Unfortunately, the recurrent cost estimates obtained by this procedure can be very far from the true value. Because r-coefficients vary enormously from project to project (e.g., from under .1 to over .6 for primary health care), these shortcut estimates can be wrong by a factor of three or more. Thus, while r-coefficients still are useful for the original purpose for which they were intended—namely, for rough general comparisons across sectors—they are not recommended as a substitute for direct detailed estimation of recurrent costs.

A more promising possibility to ease the burden of itemized costing and improve the quality of the results may be the development of cost models that can combine country-specific information with known general relationships. Health is far behind other sectors in cost modeling, although health systems are not inherently more difficult to model than some processes in, say, agriculture or power production. Of course, cost models have their limitations. At the very least, however, they can provide "first-cut" approximations, to which more detailed estimates can be compared; and they can help in verifying the internal consistency of a set of estimates.

Future efforts to develop cost models for the health sector may need to proceed in stages. A necessary first step—especially now in view of how little has been done to date—should be to assemble and assess critically the existing project cost data, with emphasis on identifying generalizable features. Once this has been done, estimation procedures might be prepared for four levels of facilities (village post, small health center, large health center, and district hospital) and a few programs
(malaria control, expanded immunization program), for each of three or four hypothetical country settings roughly corresponding to actual situations encountered in recent project work. The final step would then be to seek methods for adapting these procedures for "standard cases" to other facilities, programs, or country settings.

**Unit Costs.** There is as yet far too little recognition of the crucial role that estimation of unit costs can play in analyses of projects (and programs too, in sector assessments). Several distinct types of unit costs can in principle be derived including:

- cost per unit of input (e.g., per bed, per dose of vaccine, per day of physician's time, or per square meter of floor space);
- cost per unit of intermediate output (e.g., per outpatient visit, per inpatient day, per vaccination, per delivery, or per surgical operation);
- cost per unit of change in disease-specific incidence or prevalence indicators (e.g., per case averted of malaria);
- cost per unit of reduction in mortality and morbidity (e.g., per death averted, or per healthy days of life gained);
- cost per unit of other final benefits (e.g., per extra unit of production, or per extra level of achievement in schooling).

In practice, the available data are never sufficient to calculate all of these items, but an attempt can be made to proceed as far down the list as possible.

One reason why unit cost estimates have not been prepared more frequently in the past is that the rationale for utilizing them apparently has not been widely appreciated in the health field. Unit costs provide insights on the relative cost of one intervention or strategy in comparison
with others, controlling for differences in effects and scale; they also highlight the least-cost means of achieving given objectives. While informative in any situation, unit cost data are especially helpful in the usual case where the full array of benefits generated cannot be adequately estimated. In such circumstances, because investment choices often cannot be based directly or exclusively on present value or internal rate of return calculations, unit cost figures can serve as the next-best alternative method of quantitatively linking cost information and whatever is known about benefits or effects. The result—cost-effectiveness analysis—of course has limitations, which have been well documented.\(^{18/}\)

However, knowing something about which of several different investment options would yield the largest impact per dollar (or peso or rupee) is clearly preferable to knowing nothing at all.

Of course, not all types of unit costs are equally useful in this respect. The simplest types, toward the top of the list above (especially costs per unit of input) indicate little about impact per dollar, and can in fact lead to poor investment choices if not interpreted properly. Their chief value lies in helping resolve straightforward cost-minimization problems of the sort described earlier. On the other hand, the more subtle

\(^{18/}\) See, for instance, Little and Mirrlees (1974).
types of unit costs, further down the list (e.g., per unit of reduction in mortality and morbidity), can be much more informative.19/

Two different methods of deriving unit costs have been proposed. The easier but less satisfactory method takes estimates of costs and effects corresponding to some hypothetical year after project completion and then simply divides one into the other. This approach implicitly considers only one point in time, presumed to reflect a steady-state level achieved once the project is fully operational. Such computations may be acceptable for investments that reach a steady-state quickly and remain firmly there indefinitely. However, many investments are not likely to fit that mold. New services take time to work out problems. Users require time to learn about the changes and adjust their behavior. Furthermore, the new services may stimulate new patterns of demand that evolve over a decade or more and have important feedback effects for future health system planning.

19/ Even with comprehensive unit cost data, though, wrong choices are possible unless caution is exercised. This is because cost-effectiveness analysis is susceptible to the same problems that can arise if the ratio of benefits to costs were erroneously used in cost-benefit analysis, instead of the difference. This difficulty, familiar to economists, is illustrated by the following example. Suppose two alternative project designs, I and II, are being considered, whose projected benefits and costs, discounted to present value terms, are

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
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</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Costs</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

Option I should be preferred, because its net present value is \((10 - 5 =)\) 5, whereas II's is only \((5 - 1 =)\) 4. However, if a cost-effectiveness approach were followed, the unit cost for I would be found to be \((5 : 10 =)\) 0.5, while II's is \((1 : 5 =)\) 0.2. By this approach, II would be selected, although in fact I is better. Incorrect choices of this kind can only be avoided in practice by careful consideration of the context, the non-quantified benefits, the target population, and the country's objectives.
Ideally, these problems could be dealt with by deriving a stream of unit costs over time, representing the relation between the given costs and effects for each year until some arbitrary future cut-off point. Since, though, most practical applications require a single summary figure instead of a sequence, a related approximation approach has been suggested, based on the average incremental cost concept.

Under this second method, streams of costs and effects are separately reduced to present value sums using the same discount rate (e.g., the opportunity cost of capital). Then the cost sum is divided by the effects sum, yielding a unit cost figure that in effect incorporates change over time in costs and effects weighted by the discount rate.

This second method is generally preferable to the first. Nevertheless, more frequent efforts to obtain unit cost estimates by either method would be a major step forward, and needs to be encouraged.
2.2 SECTOR ASSESSMENT

Many of the above-mentioned issues in project selection and appraisal pertain as well to sector assessments and sectoral planning. For example, the problems of benefit and cost estimation for projects arise again in identical form, but at a higher level of aggregation, when programs are examined. Furthermore, the initiatives proposed in the preceding section to aid project analysis will also bear fruit in sector work. Therefore, the following remarks skip over topics already covered and directly consider two general questions that figure centrally in sector work:

1. How much should be spent on the health sector overall?
2. How much of the total health spending should be allocated to each component (facilities and programs) of the sector?

Ideally, it would be preferable to reverse the order of this thinking, by first examining each component individually to determine the optimal level of expenditure on that component, in terms of marginal benefit equalling marginal cost. Then, by aggregating the component results (with adjustments, where needed, for complementarities among components), the appropriate total expenditure level would fall out automatically. However, because that procedure would be too complex and time-consuming, few countries are more likely in practice to focus on the two issues as originally stated.

2.2.1 The Overall Level of Health Expenditure.

When this issue has been considered in the past in project and sector documents, it has always been approached through cross-country

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20/ See, for example, recent PHN reports on Botswana, Brazil, Colombia, Lesotho, Malawi, Pakistan, Peru, Philippines, Senegal, Thailand, Upper Volta, and Zimbabwe.
comparisons. The precise question addressed has usually been whether, and to what degree, a country's expenditure level is too low, too high, or about right relative to other countries with similar characteristics (e.g., income per capita). Both in Bank studies and elsewhere, it has generally been recognized that the related but more ambitious question of what is the optimal spending level is not answerable in concrete, practical terms within the time and data constraints of operational work.

The cross-country comparisons approach has many variations. While useful for describing a country's past trends in broad, approximate terms, and while still the only readily applicable procedure available (with the result that it will probably continue to be used for some time to come), cross-country comparisons do have significant shortcomings. The primary lessons learned from this sort of analysis, as well as its shortcomings are discussed in Golladay and Liese (1980) and de Ferranti (1983). Briefly, the chief shortcomings are: enormous disparities in the quality and definitional conventions of the underlying data, partially obscuring the real differences among countries; absence of appropriate adjustments for differences in purchasing power among countries; the inherent problem that data on what a group of countries together do spend is not necessarily a good indicator of what any one country ought to spend; and inadequate allowance for complementarities between health and other sectors' expenditures, or for country differences in population composition, disease profiles, and the costs of appropriate technologies for prevention and cure.

Important new methodological improvements in the cross-country comparisons approach do not appear likely soon, although periodic future updates should be done of the available statistics on each country's health.
expenditure (i) per capita, (ii) as a percent of GNP and (iii) as a percent of total government expenditure, considering public and private, as well as recurrent and capital breakdowns. What is needed most now is, instead, development of a completely different—and better—approach.

Beginning again from the question "When is a country spending too little, too much or about enough on health?," the appropriate answer is simple in theory:

additional resources should be expended in the health sector as long as the extra net benefit to society exceeds the foregone benefit from the best alternative use of the same resources.

Clearly, though, there is not at present, nor is likely to be in the near future, a practical procedure that health sector and project teams can routinely apply in country studies to determine whether this point has been reached and if not, how far away the country is from it. Cost-benefit analysis would offer one possible route, were it not for the difficulties noted above in quantifying the benefits.21/ Generalized models (e.g., Schlenker, 1968) remain too abstract or also have impossible data requirements. Attempts to start from a "medically-based" statement of health needs and then estimate the minimal cost of meeting those needs falter on disagreement about what "needs" are and what can—and should—be done about them.

21/ Even if cost-benefit analysis were a viable option here, the objection could be raised that the question being addressed requires a general equilibrium framework, for which the essentially marginal approach of cost-benefit analysis is ill-suited.
Given this state of affairs, one possible approach is to start by concentrating instead on a slightly different question--namely, how much would a country have to spend in order to achieve its stated planning objectives for the health sector? This is an answerable question for project and sector teams, albeit with numerous assumptions and extensive computations. Answering it will not resolve how much the country ideally ought to allocate to health in the broadest possible sense, but will at least provide a benchmark reflecting what the nation itself regards as desirable.

Once this "full funding benchmark" has been estimated, two further steps can be performed. First, the difference between the full funding figure and the likely availability of funds for the health sector can be computed. This difference is a measure of the amount of anticipated under- or overfunding for health, relative to the country's present objectives. Second, the degree to which the objectives—and hence the full funding figure—appear inappropriate for any reason can at least be described qualitatively, even though quantitative assessment may be difficult. Where time permits, sensitivity analysis can be done exploring the effect, on anticipated under- or overfunding, of revising the full funding estimate in line with alternative sets of country's objectives. In this way, all of the issues relevant for drawing normative inferences can be touched on in one manner or another, although not with the rigor that would be attainable in ideal circumstances.

Some project and sector documents already contain the essential elements of this line of reasoning, though often in informal, abbreviated form. Additional developmental efforts are still required, however, to elaborate the details more formally and test the approach thoroughly in
practice. For example, a number of issues concerning projections calculations (such as which price indices to use) appear to be a source of considerable interest among project staffs. This additional developmental work would not have to be in the form of research; most of it could be carried out as operational support in project and sector work. Suggestions for how to proceed have been made in a few sources (e.g., Abel-Smith, 1978; Zachock, 1979; de Ferranti, 1983). In general, the following points need to be considered with respect to the critical first two steps—estimating the "full funding benchmark" and comparing it with the likely availability of funds. (These remarks also are needed for discussion of another topic below—affordability.)

At the outset of the analysis, decisions must be made about (i) how broadly "health sector" should be defined (e.g., should it include programs for water supply and sanitation?), (ii) what length of planning period (5 years? 10?) should be used for the projections, and (iii) how much attention should be devoted to each of the public, quasi-public, and private facets of the sector. The task taken on these matters should depend on the ultimate purposes of the analysis. The public/quasi-public/private issue is especially important. Ideally, the entire sector should always be examined; but in practice, information on the private and to a lesser extent the quasi-public components is typically extremely limited. In addition, there may be sound methodological reasons for devoting less attention to those components, if the resource allocation choices under study would mostly concern public programs and facilities.

Of the two sets of projections that must be prepared—for the full funding benchmark and for the expected availability of funds—the latter
are simpler. For the availability of public funds, assumptions must be made about:

- the health sector's share in total government spending
- the level of total government spending (this assumption, in turn, may be decomposed into two others: government spending as a percentage of GNP, and the level of GNP)
- revenue generated within public health facilities (e.g., fees in certain instances), to the extent these sums are not already included in the first assumption.

Where large quasi-public providers such as social security systems must be treated in detail, the relevant assumptions are:

- the number of enrolled members (as elsewhere, prevailing policies should be presumed to persist, unless new initiatives have already been accepted and will be implemented during the planning period)
- the average payment into the system per member
- net transfers to or from the government, and any other revenues.

For private services administered by institutions such as religious charities or for-profit enterprises, rough projections may have to be prepared for each as a group.

To estimate the full-funding benchmark, it is usually not possible to cost out each program and service from scratch. An incremental approach will therefore often be necessary, in which the first step is to project forward in time the actual expenditure in the most recent year for which complete data exist. (If the analysis is done in constant currency
Funds Required to Sustain Planned Objectives

Funds Available

$ Total Health Expenditure

1982 1985 1990

- - - - = Actual expenditure in 1982

- - - - = Funds required to sustain present commitments
terms, this will simply be a horizontal line as in Fig. 1.) Then estimates must be derived for the additional expenditure required to:

- correct for any implicit underfunding of existing services in the current outlays (e.g., insufficient spending on maintenance and repair, a common problem, reflected in drastically shortened usable lifespans for vehicles, equipment, and buildings),
- cover the recurrent costs for development projects in process (approved and budgetted for, but not yet completed), and
- keep up with population growth, so that the same per capita standard of health services is maintained (to the extent that this is assumed in the country's objectives).

Finally, a decision must be made about which, if any, other planned development projects, not yet in process, should be included. The resulting total (the dotted line in Fig. 1) is the benchmark.

While not ideal, this procedure can nevertheless provide valuable information for planning. For instance, in the case shown, which may not be atypical for many countries now, financial requirements exceed expected availability of funds, and the gap increased over time. Clearly, action is needed either to curtail planned requirements or to mobilize more resources--and the analysis indicates the amount of the adjustment necessary.

22/ See recent PHN sector studies.
2.2.2 Allocation of Expenditure within the Sector.

The question of how much of the resources available to the health sector should be allocated to each of its various components arises often in project and sector documents. The dominant—indeed practically the only—general conclusion usually drawn is that resources are now substantially misallocated in the direction of curative, urban, hospital-based care, to the detriment of preventive, rural, primary-level services.\(^23\) While this conclusion is probably correct, the analysis supporting it has had serious limitations. To be sure, the underlying evidence is highly suggestive.\(^24\) However, an assertion that resources are being misallocated requires not only information on how funds are being spent but also some notion of how they ought to be spent. Furthermore, to say that the misallocation is "substantial" implies some measure of the magnitude of the difference between what is and what should be. On these points, existing methods have much room for improvement.

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\(^{23}\) See, e.g., Health Sector Policy Paper (1980), Evans, et al. (1981), Colladay and Liase (1980), Fendall (1972), and PHN project and sector reports.

\(^{24}\) For example, Abel-Smith (1978) has estimated that in a number of countries, only 10-20% of the rural population have access to modern health services. de Ferranti (1983) notes that hospital services typically absorb more than half—and sometimes over two thirds—of public health expenditure. Several studies (e.g., Sharpston (1972) for Ghana) have documented the extreme urban bias in the distribution of health professionals, especially doctors.
More broadly, allocation questions frequently come up on a variety of dimensions including: geographic distribution of services (regions, districts, as well as urban/rural); nature of service provided (outpatient, inpatient, immunizations, vector control); level or type of delivery vehicle (hospitals, health centers, village health workers, vertical disease control programs); specific diseases or health problems; inputs (personnel, drugs, vehicles, other) and the population groups served (income level, age). Past analyses have been able only to describe current trends—and even that is usually difficult due to data gaps. Adequate techniques have not been available to compare current trends to some appropriate normative standard and to assess the extent of discrepancy.

Conceptually, the basic rule that should be followed is simple and essentially the same as the one noted above for optimizing aggregate expenditure—except of course that the focus here is on distribution within the sector:

additional resources should be allocated to a given activity within the health sector as long as the extra net benefit to society exceeds the foregone benefit from the best alternative use, either within or outside the sector, of the same resources. However, as in the aggregate case, it is rarely possible in practice to be certain when this point has been reached.

Most studies have in effect sidestepped the issue by assuming that whatever the unknown optimal allocation is, it must be more in the direction of preventive and rural services than the current allocation. However, considering that some services intrinsically cost more to provide than others, it is by no means certain that an optimal budgetary
commitment to primary health care is inconsistent with devoting the majority of a health ministry's funds to curative programs. Heller (1978), examining Tunisia data, showed that an apparently skewed allocation can be both efficient and equitable in some circumstances.

Much work is needed in this area to develop and test improved methods suitable for practical applications. Several studies (e.g., Barlow, 1976; Dunlop, 1982; Heller, 1975 and 1978, IASA, n.d.) contain possible approaches that could be explored further, along with entirely new procedures. In general, three main strategies have been suggested, of which only the third appears promising presently. The first is to rely on cross-country comparisons to see, for example, if a country's percentage allocation to outpatient as against inpatient services seems high or low relative to practices in similar other countries. All of the problems encountered in cross-country comparisons of aggregate expenditure levels apply here as well—even more strongly. In particular, if, as is generally thought, most countries currently have inappropriate allocations, then any norms based on such data will merely perpetuate existing inefficiencies and inequities.

The second possibility might be called a from-the-ground-up, requirements-based approach. From an assessment of the size, composition, and geographical dispersion of the population, as well as the nature and virulence of diseases and other health problems present, the service "needs" of each planning area would be derived, based on pre-determined standards for the kinds, intensity, and quality of services to be provided. For instance, given that a certain average number of deliveries, cases of malaria, and so on can be expected for a particular area, and given that a certain fraction of the deliveries and patients
requiring inpatient or outpatient care are to be provided basic medical care as a matter of public policy, the least-cost configuration of hospitals, centers, posts and other facilities could in theory be determined, along with estimates of staff, drugs, vehicles and other inputs.

This approach has been applied successfully in project design, but has some significant drawbacks for sector assessments. In project work, it is best suited to situations where a number of key policy choices have been made already, leaving only second-order questions still to be worked out. For example, once a decision has been made that a certain system of hospitals and supporting centers and posts are to be built, this approach can help determine how large each facility should be and how far apart they should be located. However, it is less useful on the broader question of whether such a system of facilities should be constructed at all or whether the same sources should be used for some entirely different purpose. This is because a requirements-based approach cannot allow for tradeoffs among competing objectives. Everything flows from the assumed requirements, which can be thought of as supply-side factors rigidly determining the final outcome. No consideration is given to demand—the people’s preferences and ability to pay (e.g., for the time and travel costs of receiving services). Furthermore, the requirements assumptions are essentially arbitrary: even health professionals cannot always agree on what they should be. In sector assessments, all of these problems arise, plus another—the sheer magnitude of the task of estimating “from the ground up” the services needed to meet the requirements.

The third approach is to develop a resource allocation optimization model that accommodates tradeoffs between requirements
concepts on the supply side and demand considerations. Dunlop (1982) has proposed a programming model. Heller (1978), in a framework that also could be applied in programming terms, focuses on referral relationships within the "pyramid" of public health facilities. The general features of this approach can be illustrated by describing Heller's piece, although other applications might be quite different in some respects. His criterion for an optimum allocation is that

the number of patients that should be referred from lower to higher-level institutions must equal both (i) the number that can be referred (i.e., the number that the higher-level institutions can effectively handle) and (ii) the number actually referred.

When these conditions are not met, various sorts of reallocations are called for. For instance, if the number that should be referred is less than the absorptive capacity of higher level institutions, the latter are receiving too large an allocation and should be cut back some. Alternatively, if the number that should be referred is too great for the higher level institutions to cope with, then either (a) those institutions should be expanded or (b) lower level facilities should be upgraded so that they will be able to treat more cases locally. One consequence of the above conditions is that at an optimal allocation, the actual standard of care provided to any patient does not exceed the pre-determined minimally acceptable standard. If some patient were receiving care above the minimum, this would be an indication that resources could be diverted from some facilities and/or levels to others with new social gain.

Models such as this are still a long way from being readily applicable on a routine basis in project and sector work. Nevertheless, they have potential worthy of further development.
3. FINANCING

Besides the issues discussed in the preceding sections, project analyses and sector assessments must also, as was noted at the outset, consider financing issues. Two main questions must be addressed: (i) Are present and proposed programs and projects affordable? and (ii) What policies are appropriate with respect to sources of financing (e.g., user charges and insurance, as well as a number of structural issues such as the public/private mix in health services)?

3.1 AFFORDABILITY OF PROJECTS AND PROGRAMS

The chief concern here, as noted at the outset, is that for any project or program to be viable, those who will be expected to commit resources to it must be able and willing to do so. This must be true not only in some overall sense but also for each institution or group individually that participates in or is affected by the activity (e.g., the health ministry, municipal authorities, village committees, and the ultimate users of the services) and for each phase of implementation and operation, including both the capital-cost-intensive start-up period and the recurrent-cost-intensive long run. Furthermore, each institution or group must have both access to sufficient resources (net of requirements for other activities) and a propensity to want to participate if, as in the case of the ultimate users of health services, participation is not automatic.

Often this concern arises at two levels. First, the project or program itself, covering a particular geographic area and having a given implementation schedule, must be affordable. Second, insofar as the current initiative is intended to be a step toward extending the same activities to other areas or perhaps the nation as a whole, it is important to ask whether the expanded program would be affordable. If projects are
not replicable (affordable when extended) in this sense, then a case can be made that they ought not to be undertaken because, as "white elephants," they establish precedents that the country cannot sustain and absorb resources that might be more beneficially used, from the standpoint of the society as a whole, in some other way. In situations where time targets have been specified for phasing in the extended program, analysis of replicability can focus on whether each phase is affordable. If no dates have been set, a different formulation is required, since virtually any program might eventually be affordable if phased in slowly enough. In the undated case, one tries to determine how long it would be before the complete program (or some important next phase, if the final phase would have to be so distant that projections become too uncertain) could be fully implemented.

Affordability analysis is, by nature, as much art as science—or more precisely, as much judgment as calculation. Estimates must first be prepared, for the primary institutions or groups involved, of (i) the costs they would bear as a result of the project or program, (ii) the funds (or, where relevant other resources—such as volunteer laborers) available to them, and (iii) other demands on those resources, for other projects or programs. By comparing projections of these figures forward in time, it is possible to determine whether sufficient funds will be available and, if not, how large the shortfall is relative to the requirements and total resources. Beyond that point, however, some degree of subjective judgment is inescapable. If the funds available will be sufficient, the only remaining question is whether they will in fact be committed to this undertaking, in cases where there may be some doubt. While that may be partially illuminated by certain other information (e.g., on the price
elasticity of demand for health services, in the case of the ultimate users), the evidence will seldom be clearcut. If, on the other hand, there will be a shortfall, something—whether the given project or some other—obviously must be curtailed or eliminated, by default if not by overt choice. In situations where the given project is judged to be of lower priority than the others, it should in this case, be deemed to be unaffordable and should not be funded. Where it is thought to be of higher priority, an argument could be made for implementing it even though the available funds are short; in that event, some other activity would need to be scaled back.

The essence of affordability analysis is thus to assemble the necessary data from which informed choices can be made. In principle, if a careful and comprehensive evaluation of all the social benefits and social costs were possible of every activity to which the resources in the health sector could be allocated, these choices could be deduced rigorously. However, because, as discussed above, full cost-benefit analyses for the entire sector are not feasible, decisions about affordability cannot be reduced to a straightforward rule or formula.

In studies to date, experience has begun to develop in examining affordability for the most obvious institution involved in health projects—the health ministry, or more broadly, the central government as a whole. An example of one approach to this aspect is given in Table 3. There, the costs that would be borne by central government agencies, jointly, for two alternative project designs are shown in lines 12 and 16. These are compared with the funds expected to be available for the project (net of other financial requirements) under both a "base" scenario (lines 8 or 10) and an alternative scenario (lines 9 or 11). Lines 8 through 11 have been
derived from estimates of gross availability of funds (lines 6 and 7) and other requirements (line 5, which is the result of line 1 through 4).

An important link exists between this approach and the earlier discussion of assessing the aggregate level of health sector spending. The projections required in that context are very similar to the information needed in the entire first part of Table 3, through line 11. Hence, one set of calculations can serve both purposes. Furthermore, here, as before, it is assumed that only future development plans, that have already been approved in the budgeting process should be counted as part of "requirements," on the grounds that other proposals are still too "iffy" to treat as certain. Of course, in settings where the potential impact of implementing a complete plan including as yet unapproved projects is of interest, they should be added in as well (e.g., as line 2(c) in the table).

At the same time, there are some noteworthy differences between the figures necessary for sectoral work and for project affordability analysis. Sectoral assessments focus on the sector in entirety, but affordability data should be specific to institutions or groups—i.e., in the case of Table 3, the central government. Accordingly, lines 1 through 5 reflect requirements for central government expenditure only. Lines 1 through 3 pertain to activities which central government agencies currently are responsible for. Lines 4(a) through 4(c) show the additional costs that the central government will have to bear in order to maintain the "status quo" in the level of services per capita for the whole sector—in the face of expected changes in the services provided by other institutions. When this objective is not part of the government's policies, the adjustments in lines 4(a) through 4(c) can be deleted.
Table 3. DATA FOR AFFORDABILITY ANALYSIS OF A HYPOTHETICAL HEALTH PROJECT
(US$ thousands)

<table>
<thead>
<tr>
<th></th>
<th>Project Implementation</th>
<th>Post Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Financial requirements simply to sustain the per capita level of health services implied by present &quot;budgeted commitments&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. 1981 expenditure on existing services (public plus private)</td>
<td>36,700</td>
<td>36,700</td>
</tr>
<tr>
<td>2. additional amounts needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) to correct for underfunding of existing services</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>(b) to cover recurrent costs of development projects now underway</td>
<td>10</td>
<td>240</td>
</tr>
<tr>
<td>(c) to keep up with population growth (2.5% p.a.)</td>
<td>-</td>
<td>1,090</td>
</tr>
<tr>
<td>(d) to correct for difference in inflation rate for health sector relative to general price index</td>
<td>-</td>
<td>560</td>
</tr>
<tr>
<td>3. subtotal (1 + 2)</td>
<td>37,460</td>
<td>39,340</td>
</tr>
<tr>
<td>4. funds from sources other than central government</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1981 level</td>
<td>22,240</td>
<td>22,240</td>
</tr>
<tr>
<td>(b) changes from 1981 level:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) local government</td>
<td>-</td>
<td>-110</td>
</tr>
<tr>
<td>(ii) foreign aid, private</td>
<td>-</td>
<td>-80</td>
</tr>
<tr>
<td>(iii) other</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>(c) subtotal (a + b)</td>
<td>22,240</td>
<td>22,050</td>
</tr>
<tr>
<td>5. net requirements for central government funding (3 minus 4c)</td>
<td>15,220</td>
<td>17,290</td>
</tr>
<tr>
<td>B. Funds Available (central government)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. from Finance Ministry</td>
<td>15,220</td>
<td>14,590</td>
</tr>
<tr>
<td>7. alternative scenario</td>
<td>15,220</td>
<td>14,590</td>
</tr>
<tr>
<td>C. Difference (funds available minus requirements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. using Finance Ministry figures (6 minus 5)</td>
<td>-</td>
<td>-2,700</td>
</tr>
<tr>
<td>9. using alternative scenario (7 minus 5)</td>
<td>-</td>
<td>-2,700</td>
</tr>
</tbody>
</table>
Table 3. Data for Affordability Analysis of a Hypothetical Health Project — con’d.

<table>
<thead>
<tr>
<th></th>
<th>Pre-Project</th>
<th>Project</th>
<th>Post Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Difference as % of requirements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. using Finance Ministry figures (8 as % of 5)</td>
<td>-</td>
<td>-16%</td>
<td>-25%</td>
</tr>
<tr>
<td>11. using alternative scenario (9 as % of 5)</td>
<td>-</td>
<td>-16%</td>
<td>-25%</td>
</tr>
<tr>
<td>E. Project Cost: for Plan A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. central government contribution</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13. foreign aid</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14. other</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15. total (12 + 13 + 14)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>F. Project Cost: for Plan B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. central government contribution</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>17. foreign aid</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>18. other</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>19. total (16 + 17 + 18)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
The accompanying replicability analysis for the project is given, in abbreviated form, in Table 4, where it is assumed that time targets have been set out in government policies for the phasing in of a nationwide program. Here capital and recurrent costs have been broken out separately, whereas in Table 3, it was more convenient to combine them.

Lacking in these examples are corresponding analyses for institutions and groups apart from the central government which will be involved in or affected by the project. (Although the costs borne by such entities are referred to in lines 13, 14, 17 and 18 of Table 3, information on their resources and other requirements is not provided.) Acquiring adequate data on these institutions and groups is often difficult. Fortunately, though, the conclusions are obvious in some cases. The group requiring the most consideration is usually the ultimate users—households.

Future work to improve methods of affordability analysis is needed most in two areas. First, as in the case of sectoral assessment of aggregate spending, investigation and codification of projection techniques would be valuable. The type and level of effort proposed in Section 1.2.1 above could also encompass what is needed here. Second, some attempts to evaluate whether households can and would bear the costs required to obtain services should be encouraged.
Table 4. DATA FOR AFFORDABILITY ANALYSIS: HYPOTHETICAL NATIONAL PRIMARY HEALTH CARE PROGRAM (US$ thousands)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Net financial requirements</strong>&lt;br&gt;for central government, to sustain the per capita level of health services implied by present &quot;budgeted commitments&quot;</td>
<td>15.2</td>
<td>26.1</td>
<td>37.3</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td><strong>2. Funds Available (central government)</strong></td>
<td>15.2</td>
<td>13.9</td>
<td>15.4</td>
<td>17.0</td>
<td>18.8</td>
</tr>
<tr>
<td><strong>3. Difference (funds available minus requirements)</strong></td>
<td>-12.2</td>
<td>-21.9</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td><strong>4. PHC Plan A</strong>&lt;br&gt;(a) capital</td>
<td>←6.0→</td>
<td>←7.5→</td>
<td>←2.5→</td>
<td>←2.0→</td>
<td></td>
</tr>
<tr>
<td>(b) recurrent</td>
<td>0.3</td>
<td>5.3</td>
<td>11.4</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td><strong>5. PHC Plan B</strong>&lt;br&gt;(a) capital</td>
<td>←6.0→</td>
<td>←7.5→</td>
<td>←2.5→</td>
<td>←2.0→</td>
<td></td>
</tr>
<tr>
<td>(b) recurrent</td>
<td>0.2</td>
<td>3.5</td>
<td>7.6</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td><strong>6. Medical School</strong>&lt;br&gt;(a) capital</td>
<td>←60→</td>
<td>←52→</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>(b) recurrent</td>
<td>-</td>
<td>-</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
3.2 FINANCING OPTIONS IN SECTORAL PLANNING

Because this topic is discussed at length in a companion paper, only a brief overview is presented here, summarizing that paper's main conclusions from a review of country studies and the general literature. The principal issues that must be addressed in formulating policies on the sources of financing for the health sector include not only the role of user charges and the scope for cost recovery, but also other broader questions with implications for the overall structure of the sector. The following issues emerged from the review of the available evidence as particularly important at present:

- What should be the role of government (and hence the roles of quasi-public and private providers and intermediaries)?
- Which services should have user charges and what should be the level of the charges?

1/ de Ferranti, 1983a.

What should be the role of other financing mechanisms besides direct charges and general taxation (particularly, social insurance, employer-based schemes, cooperative-based schemes, and community financing)?

How much of the funds available to the sector should be allocated to each major activity (especially to primary health care)?

How much should be devoted to health in general (relative to other sectors)?

Much is known about many of these issues, but at the same time many aspects remain uncertain, requiring further investigation. About what is known, the review concluded that: (i) certain services (disease control programs, sanitation, health education and promotion, control of pests and zoonotic diseases and monitoring for disease outbreaks) should in most instances be wholly a public responsibility and not subject to user charges; (ii) a transition, often necessarily gradual, toward a lessened government role in direct administration—but typically not in planning, oversight and regulation—should in general be considered for certain other services (urban water supply, drug sales, and in some circumstances, curative outpatient and inpatient care); (iii) for still other services, a similar transition or at least a partial shift toward greater roles for quasi-public and private providers, may ultimately be beneficial, but for the time being strong public involvement should continue to be preferred in many situations (these services include maternal and child health outpatient care, family planning, village health care, and rural water supply); (iv) extended application of user charges, including raising existing fees, would also be beneficial, but should be introduced
cautiously, focusing at present only on services where the case is strongest, where satisfactory allowances have been made for equity concerns, and where fee levels can be adjusted periodically in modest increments. In addition, promising opportunities for realizing the potential of financing vehicles based on an insurance or pre-payment concept with a co-payment provision should be actively sought and nurtured, without losing sight of the failings of existing schemes.

About what is not yet known, the review also had much to say. On the roles of public, quasi-public, and private entities, it is not yet possible to specify precise conditions for determining where and when a transition should take place, or how far it should go, how fast, or which services should be included. On user charges, there is still considerable uncertainty about ability and willingness to pay, the implications of users' imperfect knowledge about health services, the consequences of intrahousehold decisionmaking patterns, equity effects, and the actual extent to which higher user charges would increase revenue or improve efficiency of resource use.

Illuminating these areas will require a combination of new research and more country studies; also, countries where major policy changes are adopted can be a valuable additional source, insofar as they provide "natural experiments" of particular alternatives. Of course, some parts of this work will proceed more quickly than others. Some questions are inherently difficult to research well, others need a long time for data collection and analysis, and still others can only be elucidated if governments commit themselves to exploring subjects that often are politically sensitive. With these considerations in mind, the following suggested priorities for next steps are suggested.
First and foremost, something must be done as soon as possible about the serious lack of reliable cost data in sufficiently disaggregated form to support at least rudimentary types of cost analysis. In several countries (including many in Africa), the sum total of all cost information routinely tabulated consists of the few pages of planned expenditures used in preparing the national budgets; actual expenditure accounts, where they exist in usable form, often are years behind, highly aggregated, and marred by inconsistencies. In other countries (e.g., in Latin America), detailed cost categories have been defined, but the numbers obtained are universally regarded as without much meaning, so poor is their quality. Progress on this problem must start with recognition by the relevant health ministry officials that a problem exists, and must be followed by a sustained effort from within the ministry to improve matters. Where those prerequisites exist, a variety of approaches (in terms of techniques, staffing, funding, timing, organization, and management) are possible, in which the Bank can be useful through technical assistance in project leading, sector and project preparation missions, and other means. The Population, Health and Nutrition Department is now raising the issue of improving financial management (of which cost data is a central part) in most of the countries where it is working; but country interest is not always strong. There is not, at this point, a need for further research in the area. A suggested strategy for upgrading financial systems (including reporting, recordkeeping, accounting, budgeting, and financial control processes) is detailed in de Ferranti (1983 b).

Second, to identify more precisely the critical elements and potential of insurance-type and pre-payment vehicles, studies should be encouraged which examine existing schemes in greater depth than has been
possible from present data. Both the practical workings of functioning schemes and the implications for equity and efficiency should be analyzed, with the aim of gaining better understanding of generalizable features that account for success or failure. Contrasting the experiences of a carefully chosen small group of countries could be useful here.

Third, a similar approach—looking at selected country experience more rigorously than has been possible from current evidence, and focusing on both "how things work" and "who benefits, who loses?"—should be pursued in studies of mixed public/quasi-public/private systems. All systems, in a sense, have this mixed nature; what is needed is analysis of cases where quasi-public and private services not only exist but have a recognized place in the government’s health planning, complementing in some particularly noteworthy way the publicly administered services.

Fourth, on user charges, additional demand studies should be initiated, drawing on household survey evidence to investigate ability and willingness to pay and other issues. One study—on Mali—has already been funded with Bank support, and another—on Peru—is in preparation. These, however, will be unable to resolve several key issues which are not directly related to price, such as the implications of users’ imperfect knowledge about medical services. Special studies are needed to address those issues, which are as important to understand as price effects. Also, results for a greater range of different country situations would strengthen the base of information beginning to become available.

4. CONCLUSIONS

At the outset, an "ideal" procedure for analyzing proposed new health projects and conducting sector assessments was suggested involving
(i) a thorough review of the country's health problems, their causes, the strengths and weaknesses of the existing health services system, the country's priorities and objectives, the sources of health sector financing, the allocation of expenditures, and the underlying unit costs of each service, (ii) a full costing of all feasible new project designs that would meet the needs identified in the sector review, (iii) estimation of the health status improvements (reductions in mortality and morbidity) that would result from each project design, (iv) estimation of the value to the country of these improvements, as reflected in such benefits as increased productivity and increased returns to investments in education, (v) selection of the best project design(s) on the basis of net present value or internal rate of return computations utilizing the cost and benefit estimates, (vi) a determination of whether the preferred design(s) would be affordable in the sense that each institution or group required to commit resources to the project would in fact be able and willing to do so, (vii) a determination of whether the project would be replicable in the sense of being affordable if and when extended province-wide or nationwide and, (viii) an assessment of whether existing financing policies for the sector are adequate or need to be revised in order to accommodate current trends plus the proposed new investments.

The practical difficulties encountered in trying to implement this "ideal" procedure were also discussed, including (i) the shortcomings of the available information and methods for predicting health status improvements, particularly for projects and programs that address numerous diseases and health problems simultaneously, (ii) the even greater uncertainties inherent in attempting to estimate the value to society of health status improvements (e.g., increased productivity), (iii) the
weaknesses of past approaches to cost estimation, especially concerning the handling of the capital/recurrent distinction, shadow pricing, joint cost allocation, and the temporal pattern of costs (requiring the use of long run marginal cost concepts or, as an approximation, average incremental cost), (iv) the dearth of appropriate techniques (e.g., cost models) to aid not only in project costing but also in assessing the allocation of expenditures within the health sector and the overall level of sectoral spending, (v) the need for more experience examining affordability and replicability issues, and (vi) the shortage of conclusive information on a multitude of financing issues relating to the role of government in developing country health sectors, the role of user charges, and the pros and cons of various social insurance, employer-based, cooperative-based, and community-based health care schemes.

Yet it was additionally noted that in spite of these obstacles, several significant opportunities exist now to enhance the amount and usefulness of quantitative analysis done to assist in sectoral assessments and investment decisionmaking. Toward that end, priorities and approaches were suggested for future research efforts and operationally related studies. Overall, the conclusions of preceding sections imply that while attainment of the "ideal" procedure may still be a long way off, prospects are promising for at least some concrete incremental progress in the next few years toward more complete and effective analyses.

Given all this, the broad outlines of an alternative or second-best framework—not as appealing theoretically as the "ideal" procedure but within reach of applied work—are now becoming clearer. Such a framework will necessarily rely heavily on cost-effectiveness reasoning insofar as cost-benefit calculations are not possible. As a consequence, unit cost
estimates will play a pivotal role on the cost side, while better estimation of the mortality and morbidity effects of interventions will be crucial on the effectiveness side.

To facilitate the increased use of unit cost figures and health improvement data, more attention will have to be given to the information and financial management systems of government agencies responsible for the health sector. Many of these agencies, having only conventional public accounting processes, are unaware in detail of the allocation of resources among different activities. Basic statistics on the costs, intermediate outputs (e.g., vaccinations given), and effects (change in disease incidence rates) of services are not known with a sufficient degree of disaggregation to permit systematic judgments to be made about resource allocation.

The Bank's Role. The Bank should initiate research and operational support activities aimed at achieving progress in the priority areas identified earlier. It should recognize that development of improved methods and data bases in these areas requires a multi-year effort, and should take into account the fact that important contributions can be made by other institutions and researchers. Accordingly, the Bank should concentrate especially on areas where it can have the most impact. These should be:

- Improved estimation of the health impacts of interventions, with emphasis on the kinds of interventions typically encountered in Bank operational work (i.e., projects addressing many diseases simultaneously). Initiatives are needed in both (i) research
(WHO has expressed an interest in cooperating in this area, along with leading experts elsewhere) and (ii) shorter term studies drawing on country-specific data obtained in operational support activities. These initiatives should consider and compare new approaches as well as extensions or variations of existing methods (e.g., calculating healthy days of life lost).

Synthesis of current knowledge about the most cost-effective means of controlling certain salient disease groups in developing country contexts. This could include (i) updates on disease groups extensively studied in the past (e.g., parasitic or immunizable childhood diseases) and/or (ii) reviews on diseases that become particularly important in the second stage of the epidemiological transition (that is, after the major sources of low life expectancy characteristic of a low level of economic development have been controlled). The latter, for example, could entail an evaluation of alternative means of dealing with cardiovascular diseases in countries with per capita income of $300 or more. Special topics might also be examined, such as the cost-effectiveness of health services, relative to other investments, in urban areas (e.g., health care vs. better housing in the struggle against Chagas' disease).

Exploration and assessment of techniques for dealing with the issue of estimating the ultimate benefits to society of health improvements. Emphasis should be placed on (i) testing and evaluating the switching-value approach described earlier and (ii) clarifying under what conditions averted costs can and cannot be used in lieu of benefits, in the case of developing
country health systems. Parallels with related sectors should be examined too (e.g., the use of the switching-value approach for water supply projects).

- Development and testing of new methods to aid in project costing (e.g., cost models). Country examples from operational project work could be used to demonstrate the properties of prospective procedures, and how easy—or difficult—they are to apply in practice.

- Elaboration and extension of procedures to aid in assessing sectoral expenditure allocations and project affordability questions. Here, too, data from country examples could provide the basis for the analysis, after an appropriate framework has been established.

- Analysis of household demand and other issues related to health financing, as previously discussed. While some of this work can be done relying on available information, a significant portion requires new primary data collection and research.

For further details on the content of and rationale for these proposed efforts, readers should refer to earlier sections.

In closing, it should be stressed again that a complete revolution in how health programs and proposed interventions are analyzed is not likely soon. However, a concerted effort begun now might well have important incremental payoffs in the not too distant future.
ANNEX

A COMPARISON OF TWO ALTERNATIVE COSTINGS FOR A HYPOTHETICAL HEALTH SECTOR INVESTMENT (THE "MEDZA" PROJECT)

A description of the project is provided on the next page. Subsequent pages present calculations of (i) "initial" and (ii) "revised" cost estimates. The "initial" estimates are typical of the computations in several past studies. The "revised" figures reflect numerous improvements.

Overall, the two costings differ as follows:

<table>
<thead>
<tr>
<th></th>
<th>Initial Estimates</th>
<th>Revised Estimates</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total costs prior to</td>
<td>4,260,000</td>
<td>7,567,250</td>
<td>+78%</td>
</tr>
<tr>
<td>project completion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total annual costs</td>
<td>473,265</td>
<td>929,283</td>
<td>+96%</td>
</tr>
<tr>
<td>after completion</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DESCRIPTION OF PROPOSED MEDZA PROJECT

Where?
- In country of 12 million people with a GNP/capita of US$180
- At 3 rural areas
  - 1 near capital city (short distances, good roads)
  - 1 in hilly South (population more dispersed)
  - 1 in remote mountainous North (very dispersed)
- Each area has
  - 250,000 population
  - no access at present to any health services (other than traditional practitioners)

What?
- Project would build 30 health centers (10 in each area)
- All centers same size, staffing, etc.
  - designed to serve 25,000 population each
- Each center will get
  - 1 "Moped" (for visiting surrounding villages)
  - 1 staff house

When?
- Implementation to take 3 years, beginning January 1, 1984

How?
- Central government to execute
  - with some external assistance (1 donor)
INITIAL COST ESTIMATES FOR MEDZA PROJECT

A. CAPITAL COSTS

1. Construction
   1.1 30 centers ( @ $100,000) $3,000,000
   1.2 30 staff houses ( @ $30,000) 900,000

2. Vehicles
   2.1 30 motor-assisted bicycles ( @ $2,000) 60,000

3. Equipment
   3.1 For 30 centers ( @ $10,000 per center) 300,000

TOTAL CAPITAL COSTS $4,260,000

B. OPERATING COSTS

1. Staff emoluments
   1.1 salaries 345,000

   - for centers: each will have
     2 medical officers ( @ $3,000/year)
     2 nurses ( @ $2,000)
     3 attendants ( @ $500)

2. Supplies
   2.1 drugs

   - for centers: each will have
     (a) 75,000 outpatient visits per center per year @ $0.05 per visit 112,500
     (b) 500 inpatient days per center -per year @ $0.5 per day 7,500
3. Vehicle operating costs

3.1 for travel between district hospitals and centers (1 visit by Landrover to each center per fortnight; 40 miles round trip).

   - petrol and oil ( @ $0.2 per mile) 6,240

3.2 for travel between centers and villages (18 visits per year by motor-assisted bicycle to each village; 12.5 villages per center; 15 miles round trip).

   - petrol and oil ( @ $0.02 per mile) 2,025

TOTAL OPERATING COSTS $473,265 /yr.
### I. Costs Prior to Project "Completion"

#### A. Capital Costs

<table>
<thead>
<tr>
<th></th>
<th>1984</th>
<th>1985</th>
<th>1986</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Construction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 30 centers (@ $100,000)</td>
<td>1,000,000</td>
<td>1,500,000</td>
<td>500,000</td>
<td>3,000,000</td>
</tr>
<tr>
<td>1.2 30 staff houses (@ $30,000)</td>
<td>300,000</td>
<td>450,000</td>
<td>150,000</td>
<td>900,000</td>
</tr>
</tbody>
</table>
| 1.3 upgrading of district hospitals  
  - renovation of in- and outpatient facilities at 2 hospitals | 600,000 | 600,000 | 0 | 1,200,000 |
  - expansion of drug storage rooms and training facilities to all 3 hospitals | 20,000 | 20,000 | 0 | 40,000 |
| **Subtotal on construction** | 1,920,000 | 2,570,000 | 650,000 | 5,140,000 |
| *adjustment for difficulty factors* | (1.2) | (1.2) | (1.2) | (1.2) |
| **Adjusted subtotal** | 2,304,000 | 3,084,000 | 80,000 | 6,168,000 |

|                      |        |        |        |        |
| **2. Vehicles**      |        |        |        |        |
| 2.1 30 motor-assisted bicycles (@ $2,000) | 15,000 | 30,000 | 15,000 | 60,000 |
| 2.2 Landrovers for district hospitals (@ $20,000) | 20,000 | 20,000 | 0 | 40,000 |
| **Subtotal on vehicles** | 35,000 | 50,000 | 15,000 | 100,000 |

|                      |        |        |        |        |
| **3. Equipment**     |        |        |        |        |
| 3.1 for 30 centers (@ $10,000) per center | 30,000 | 200,000 | 50,000 | 300,000 |
| 3.2 for upgraded district hospital facilities | 30,000 | 40,000 | 0 | 70,000 |
| **Subtotal on equipment** | 80,000 | 240,000 | 50,000 | 370,000 |
| *adjustment for difficulty factors* | (1.1) | (1.1) | (1.1) | (1.1) |
| **Adjusted subtotal** | 88,000 | 254,000 | 55,000 | 407,000 |

|                      |        |        |        |        |
| **4. Supplies (initial stocks)** |        |        |        |        |
| 4.1 drugs  
  - for centers (@ $1,333 per center) | 7,000 | 25,000 | 7,000 | 40,000 |
| 4.2 other  
  - for centers (@ $250 per center) | 1,250 | 5,000 | 1,250 | 7,500 |
| **Subtotal for supplies** | 8,250 | 31,000 | 8,250 | 47,500 |
| *adjustment for difficulty factors* | (1.1) | (1.1) | (1.1) | (1.1) |
| **Adjusted subtotal** | 9,075 | 34,100 | 9,075 | 52,250 |

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1/ All figures are in local currency (Barsoonian $).

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REvised Cost Estimates for MECCA Project
(Page 1 of 6)
### Costs Prior to Project Completion (Cont'd)

<table>
<thead>
<tr>
<th></th>
<th>1984</th>
<th>1985</th>
<th>1986</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5. Training (initial)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 for staff of centers</td>
<td>8,000</td>
<td>7,000</td>
<td>0</td>
<td>15,000</td>
</tr>
<tr>
<td>(at $500 per center)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 for district hospital staff</td>
<td>200</td>
<td>100</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>(at $100 per hospital)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3 for headquarters staff ($300)</td>
<td>300</td>
<td>0</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal on training (initial)</strong></td>
<td>8,500</td>
<td>7,100</td>
<td>0</td>
<td>15,600</td>
</tr>
<tr>
<td><strong>TOTAL CAPITAL COSTS</strong></td>
<td>2,444,575</td>
<td>3,439,200</td>
<td>859,075</td>
<td>6,742,850</td>
</tr>
</tbody>
</table>

### B. Operating Costs

<table>
<thead>
<tr>
<th></th>
<th>1984</th>
<th>1985</th>
<th>1986</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salaries</td>
<td>0</td>
<td>93,700</td>
<td>345,700</td>
<td>439,400</td>
</tr>
<tr>
<td>2. Supplies</td>
<td>0</td>
<td>52,600</td>
<td>193,700</td>
<td>246,300</td>
</tr>
<tr>
<td>3. Utilities</td>
<td>0</td>
<td>1,100</td>
<td>4,200</td>
<td>5,300</td>
</tr>
<tr>
<td>4. Vehicle operating costs</td>
<td>0</td>
<td>3,500</td>
<td>12,800</td>
<td>16,300</td>
</tr>
<tr>
<td>5. Training (refresher)</td>
<td>0</td>
<td>0</td>
<td>1,500</td>
<td>1,500</td>
</tr>
<tr>
<td>6. Supervision</td>
<td>0</td>
<td>800</td>
<td>2,900</td>
<td>3,700</td>
</tr>
<tr>
<td>7. Maintenance and repair of buildings and equipment</td>
<td>0</td>
<td>23,900</td>
<td>88,000</td>
<td>111,900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL OPERATING COSTS</strong></td>
<td>0</td>
<td>175,600</td>
<td>648,800</td>
<td>824,400</td>
</tr>
</tbody>
</table>

### C. TOTAL COSTS PRIOR TO PROJECT COMPLETION (AHS = CAPITAL PLUS OPERATING COSTS)

<table>
<thead>
<tr>
<th></th>
<th>1984</th>
<th>1985</th>
<th>1986</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,444,575</td>
<td></td>
<td>3,614,800</td>
<td>1,507,875</td>
<td>7,567,250</td>
</tr>
</tbody>
</table>

---

2/ For details on underlying assumptions, see "Operating Costs" under "Costs After Completion" below. The distribution of costs here across years reflects the following assumed implementation schedule. The first five centers to be completed will become operational on January 1, 1985, a year after the start of the project. An additional 5 will commence operations every six months after then, except that on July 1, 1986 there will be 10 instead of 5 new centers coming on line. Given this schedule, operating costs will be

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>Zero</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>25% of the eventual full year level</td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>92% of the eventual full year level</td>
<td></td>
</tr>
</tbody>
</table>

Staff houses will be completed on the same schedule as centers. The timing of capital costs also reflect some peculiarities of procurement and construction scheduling requirements.
II. Cost After Project Completion

A. Operating Costs

1. Staff emoluments

1.1 Salaries

- for centers: each will have
  2 medical officers
    ( @ $3,000)
  2 nurses ( @ $2,000)
  3 attendants ( @ $500)

- for additional district
  hospital staff
  3 senior nurses
    ( @ $3,000)
  2 drivers ( @ $1,500)

1.2 Retirement pensions (5% of salaries)

Subtotal on salaries

2. Supplies

2.1 drugs

- for centers:
  (a) 75,000 outpatient
    visits per center
    per year @ $0.05 per visit
    112,500
  (b) 500 inpatient days
    per center per year
    @ $0.5 per day
    7,500

- for district hospitals
  (a) 40,000 additional outpatient visits per hospital per year
    @ $0.1 per visit
    36,000
  (b) 12,000 additional inpatient days per hospital
    per year @ $1 per day
    12,000

2.2 other

- for centers ( @ $750 per center)
  22,500
- for district hospitals ( @ $300
  per hospital)
  900

Subtotal on supplies

x adjustment for difficulty factors

Adjusted Subtotal

Annual Costs after Completion

374,850

374,850

191,400

(1.1)

210,540
### Cost After Project Completion (Cont'd)

#### 3. Utilities (electricity, gas, water)
- 3.1 for centers ( @$100 per center)  
  - Cost: 3,000
- 3.2 for staff houses ( @$50 per house, net of staff payments)  
  - Cost: 1,500
- 3.3 for district hospitals ( @$25 per hospital)  
  - Cost: 75

Subtotal: 4,575

#### 4. Vehicle operating costs
- 4.1 for travel between district hospitals and centers (1 visit by Landrover to each center per fortnight; 40 miles round trip)  
  - Petrol and oil ( @$0.2 per mile)  
    - Cost: 6,240
  - Extra maintenance, repairs, insurance, etc. ( @$300 for each district)/3  
    - Cost: 900

- 4.2 for travel between centers and villages (18 visits per year by motor-assisted bicycle to each village; 12.5 villages per center; 15 miles round trip)  
  - Petrol and oil ( @$0.02 per mile)  
    - Cost: 2,025
  - Maintenance, etc. ( @$50 per vehicle)  
    - Cost: 1,500

Subtotal on vehicle operating costs: 10,665

\[\text{X adjustment for difficulty factors} \times 1.3\]

Adjusted subtotal: 13,665

\[/3\] Extra salary costs for drivers are counted under staff emoluments and thus not included here.
Cost After Project Completion (Cont'd)

5. Training (refresher courses and continuing education)
   5.1 for staff of centers (@$200 per center)
   5.2 for district hospital staff (@$300 per hospital)

Subtotal on training

6. Supervision (one half day visit per week by senior staff officer of district hospital to each center)/4

7. Maintenance and repair of buildings and equipment
   7.1 buildings (@$1.5% per year of construction cost)
      — centers (@$1,500)
      — staff houses (@$450)
      — improvements to hospitals
   7.2 equipment (@$5% per year of purchase price)
      — for centers (@$500)
      — for improvements to hospitals

Subtotal on maintenance and repair of buildings and equipment

TOTAL OPERATING COSTS AFTER PROJECT COMPLETION

---

/4 Supervision costs include transport, staff emoluments, and per diem expenses (for meals, overnight accommodation if necessary, etc. for the travelling supervisory personnel and drivers). However, only the per diem expenses are shown here, to avoid double-counting. Here is why:

- It is assumed that supervision visits are combined with delivery of drugs and other supplies from district hospitals to centers. Since the transport costs for delivery of supplies are included under vehicle operating costs, they should not be counted a second time.
- Additional staff would have to be hired at the district hospitals because senior staff there will now be spending more time on supervision visits. However, these costs have already been counted under staff emolument costs above.
REVISION COST ESTIMATES FOR MEIZA PROJECT
(Page 6 of 6)

Cost After Project Completion (Cont’d)

B. Capital Replacement Costs
1. Buildings (assume 30 year lifespan
   if properly maintained as provided
   for above)
   1.1 centers (@ $3,333/year per center) 100,000
   1.2 staff houses (@ $1,000/year per
       house) 30,000
   1.3 improvements to hospitals 41,333

2. Vehicles
   2.1 motor-assisted bicycles
       (@ 8 year lifespan; @ $250/year) 7,500
   2.2 Landrovers (10 year lifespan)
       if properly maintained; @ $2,000/
       year) 4,000

3. Equipment (10 year lifespan)
   3.1 for centers (@ $1,000/year per
       center) 30,000
   3.2 Improvements to hospitals 7,000

TOTAL CAPITAL REPLACEMENT COSTS 219,833

C. TOTAL COSTS AFTER PROJECT COMPLETION
(A + B = OPERATING COSTS PLUS
   REPLACEMENT ALLOWANCE) 929,283
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