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ECONOMIC APPRAISAL IN THE HEALTH SECTOR

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A B S T R A C T

This paper discusses the role of economic appraisal in the formulation of health sector policy in less developed countries. Specifically, it focuses on the application of economic analysis to public investment decisions in the health sector, that is to the design, selection and financing of projects which constitute the health component of a development plan. Topics covered include financial analysis of health projects with particular reference to the problem of recurrent cost financing, the techniques of cost-effectiveness and cost-benefit analysis, the treatment of uncertainty and shadow pricing in health project analysis, and alternative approaches to resource mobilization in the health sector. The underlying theme of the paper is the desirability of integrating the health sector more closely with the overall framework of development planning through a systematic process of project appraisal based on clearly specified objectives and resource constraints.

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by

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1. Introduction

This paper discusses the role of economic appraisal in the formulation of health sector policy in less developed countries (LDCs). Specifically, it focuses on the application of economic analysis to public investment decisions in the health sector, that is to the design, selection and financing of projects which constitute the health component of a development plan. The underlying theme is the desirability of integrating the health sector more closely with the overall framework of development planning through a systematic process of project appraisal based on clearly specified objectives and resource constraints.

Generalizations about LDCs as a group are inevitably heroic when - as described by the World Bank - they comprise countries as diverse as India, Lesotho, Fiji, Korea, Brazil and Chad. However, by definition, all of these countries share the characteristic of a relatively low level of per capita income (World Bank, 1981), typically associated with a limited tax base due to weak tax administration and low ratios of taxable surplus to GNP (Tait et al, 1979; Meerman, 1980). The combination of these factors produces an acute shortage of resources to finance public expenditure, thus emphasizing the importance of achieving efficient investment planning in the public sector. This is particularly true today when the prospects for per capita income growth in LDCs have deteriorated markedly (World Bank, 1981) and the adoption of structural adjustment policies is enforcing a more rigorous review of public investment programs (Balassa, 1982). Other characteristics commonly observed in LDCs include overvalued exchange rates, substantial unemployment

or underemployment and a skewed income distribution, together with a variety of constraints which limit the ability of their governments to increase private savings and redistribute income with the conventional instruments of fiscal and monetary policy.

These factors have important implications for project selection in the health sector. Resource allocation decisions have in the past been notoriously inefficient and inequitable, and are now reflected in an emphasis on expensive urban and hospital-based curative care which is not directed at the major causes of ill-health in the majority of LDC populations. Moreover, health has tended to claim a low and often declining share of public expenditure (IMF, 1981), and the prospects for a substantial increase in real budgetary allocations to the sector are poor. At the same time, recent interest in basic needs and the efforts by WHO and UNICEF to promote 'Health for All by the Year 2000' have created ambitious objectives for health improvement in LDCs. The Director-General of WHO has suggested that an infant mortality rate of less than 50 per thousand live births, and a life expectancy at birth greater than 60 years, should be minimum objectives for health improvement by the year 2000 (Mahler, 1977). These contrast with infant mortality rates higher than 200 per thousand, and life expectancies lower than 40 years, observed in some low-income LDCs. The financial implications of these objectives are enormous. A recent WHO estimate implies that their achievement would require up to an eight-fold increase over the present level of public expenditure on health in low-income LDCs of approximately \$2.5 per capita (WHO, 1981). However, the health sector continues to operate, to an extent that is unmatched in any other sector, without the guidance of systematic project appraisal criteria which could help to reconcile these health objectives with other development objectives in the face of increasingly severe resource constraints.

It is, therefore, essential to develop ways of improving the efficiency of public expenditure on health in LDCs, and also of mobilizing additional revenue to finance increased levels of expenditure. This paper examines these issues in the following framework. Section two discusses the basic elements of financial analysis which provide the starting point for analysis of efficiency and resource mobilization. Sections three and four review alternative forms of efficiency criteria, namely cost-effectiveness and cost-benefit analysis, with special attention to the treatment of uncertainty and shadow pricing in health projects (section five). Section six concludes with a consideration of cost recovery options to mobilize additional resources from outside the public sector.

2. Financial Analysis

Health ministries, using conventional public accounting procedures in LDCs, are generally unaware in detail of the allocation of public resources between different interventions and its relationship to stated health objectives, or of the unit costs of different interventions, or of the full potential of available sources of finance. The situation is complicated by the activities of numerous other agencies, both public and private, that affect health, major examples being those agencies concerned with water supply, nutrition and pharmaceutical production and distribution. This lack of basic financial data severely limits the ability of health ministries to make systematic judgements about the merits of existing and proposed expenditure patterns and financing policies in the public sector, and reform of their financial accounting systems is clearly indicated. The starting point for economic analysis of investment decisions should be a detailed analysis of total public and private health-related expenditures in terms of expenditure patterns and sources of finance. Another paper is devoted to this set of issues, but it is appropriate here to highlight a few of the main features.

Expenditure patterns. Analysis of the allocation of public expenditure between different interventions indicates the extent to which the current expenditure pattern responds to a country's major health problems and proclaimed objectives. Thus, it helps to signal the desirability of reallocating existing expenditures or undertaking new investments. If, as rhetoric suggests, distributional objectives are also important, analysis of the distribution of expenditure by beneficiaries in different income classes (Meerman, 1979; Selowsky, 1979, Tan, 1975), or simply by region (Ofosu-Amaah, 1975), will be similarly revealing.

Estimates of the unit costs of different interventions, making an appropriate - if not scientific - allocation of joint costs, provide additional signals. Ideally, these should be estimated in terms of long-run marginal costs, which relate capital expansion and recurrent (i.e. operating and replacement) costs to the volume of additional services provided (Saunders et al, 1977). Differences in the unit cost of interventions suggest the possibility of efficiency gains by switching expenditure to lower cost interventions if these are equally effective. The same applies to unit cost differences for similar interventions delivered by different facilities. For example, a study in Malaysia found that the unit cost of outpatient services in rural clinics exceeded those provided by hospitals, suggesting the existence of significant excess capacity in the rural clinic system (Meerman, 1979). Similar comparisons can be made between the public and private sectors. Data collected in Lesotho (Smith, 1980) indicate that the public sector is a relatively inefficient producer of health services. The average cost per inpatient was almost three times higher in public than private hospitals, and similar differentials existed for hospital and clinic outpatients. Although unadjusted for case-mix and labor cost differences, it is improbable that these factors fully accounted for such high unit cost differ

entials. Finally, with the objective of cost containment in mind, trends in the unit costs of similar interventions at different points in time may be used to monitor efficiency in service provision.

Source of finance. In a similar way, analysis of the sources of finance of existing health expenditure patterns - by public revenues, external donors, private consumers, employers and charity organizations - can provide important signals to more efficient methods of mobilizing resources for the health sector. For example, available data showing that a major portion of total health expenditure is financed by private consumers (WHO 1977) suggests the existence of a high level of private willingness (and ability) to pay for health services which remains largely untapped by the public sector. This type of analysis relates intimately to the analysis of expenditure patterns since the potential role of various financing mechanisms, ranging from direct user charges at one extreme to full subsidy from public revenues at the other, tends to vary across different interventions.

Recurrent cost financing. A critically important aspect of the analysis of health sector financing, and one which emphasizes the importance of developing alternative cost recovery mechanisms, concerns the future availability of fiscal resources to subsidize the recurrent costs generated by new investment projects in the health sector. The availability of public funds to subsidize ongoing operating and maintenance costs is typically the binding constraint on health investments. The reason is that external finance from aid donors is often forthcoming to cover capital investment costs, while future recurrent costs have to be financed from domestic revenues after project implementation.

The problem of recurrent cost financing for social sector projects was recognized a long time ago (Stopler, 1966), and has recently attracted attention throughout the public sector in LDCs (Heller, Club du Sahel, 1979). There are a number of reasons why it is especially important in the health sector. First of all, the neglect of project analysis criteria for health projects has tended to preclude attention even to elementary financial appraisal. Second, the amount of recurrent expenditure generated per unit of investment in the health sector is typically higher than in most other sectors, principally because of the labor and pharmaceutical requirements of health facilities. Moreover, the amount of recurrent public subsidy paid per unit of recurrent expenditure is also relatively high in the health sector. Most public sector health projects are financed exclusively, or largely so, from public revenues. Health sector pricing policies are such that user charges are frequently nominal and recover only a low proportion of operating costs. In addition, the revenues generated by this or other cost recovery mechanisms usually accrue directly to the central government Treasury, without any earmarked allocation to the health sector or to the project itself. Thus the allocation of investment resources to health tends to have more onerous implications for recurrent expenditure financing in government than in other sectors.

Public finance constraints have clear implications for the analysis of project choice in the health sector. Whether partially or totally financed by public subsidy, every project requires a cash flow of revenues to cover its financial costs in order to operate at optimal scale. Analysis of expected future financial costs and revenues of the project is critically important to determine the feasibility of a project over its planned operating life. Indeed, analysis of long-run financial feasibility itself provides

a partial test of efficiency simply because future underfinancing of recurrent costs will result in the operation of the project at less than optimal scale and, hence, in a reduction in the net benefit of the investment.

A useful way of summarizing the recurrent expenditure implications of health projects is to estimate the ratio of annual recurrent costs to total investment costs, the so-called 'r-coefficient'. For example, \$1,000 invested in the health sector in Malawi is expected to generate, on average, \$250 of incremental recurrent costs per year, compared with only about \$100 resulting from the same investment in education or agriculture, and less than \$30 for roads (World Bank, 1982). Moreover, the recurrent cost implications of health investment are higher at lower levels of the health sector. Estimated recurrent cost ratios in Malawi average 0.5 for clinics and primary health care compared to 0.2 for hospitals. Similar patterns have been observed in Kenya and Malaysia (Heller, 1974, 1975) and the Sahel countries (Over, 1979).

Consideration of financial feasibility leads directly into the analysis of efficiency criteria. Clearly, the objective of planners is not just to ensure a financially feasible choice of health projects but the best choice from various possible alternatives. One approach, using cost-effectiveness analysis, is to select the mix of feasible projects which yields the largest expected improvement in health status, relative to cost. Ideally, the use of cost-benefit analysis would be preferable, to select those projects which have the largest net social benefit, defined in terms of a wider set of development objectives. Some of the key problems involved in cost-effectiveness and cost-benefit analysis are considered below.

Cost-effectiveness analysis

The least controversial efficiency criterion for health project selection, that of cost-effectiveness, is to choose projects which yield the maximum health improvement subject to available resources. Alternatively, the problem can be inverted to choose projects which minimize the cost of meeting a specified objective or objectives. Cost-effectiveness analysis (CEA) is frequently used in sectors where problems of benefit valuation occur. For example, electricity investment planning models are typically specified in cost-minimization form, to find the least-cost solution to meeting an exogenous future demand upon which a value may or may not be placed (Turvey and Anderson, 1977). The method lends itself naturally to the health sector where the concept of meeting basic needs suggests that quantifiable minimum standards exist and can serve as planning objectives. Unfortunately, the basic needs literature is still distinguished by an absence of concrete suggestions as to what these standards should be (see, for example, Streeten, 1978, or Richards & Leonor, 1982).

A fundamental problem in applying CEA to the health sector lies in the choice of an appropriate unit of effectiveness to measure the output of health projects. It may seem obvious that health improvement is the primary objective of public expenditure on health. Effectiveness measures framed in terms of intermediate service outputs, such as provision of MCH services, are therefore inadequate tests since they do not measure actual improvements in health status. However, a central difficulty in measuring health status is that it is not homogenous, since the health project outputs comprise reductions in both morbidity and mortality. These two types of health improvement can be measured in different ways or aggregated into a composite measure which can itself be constructed in different ways. Examples of alternative approaches are discussed below.

Morbidity reduction. The most straightforward, but limited, measure of health impact is the reduction in the prevalence or incidence of a specific disease. An example is provided by Rosenfield et al (1977), who used a simple model of schistosomiasis transmission to simulate the effectiveness in Iran of different control techniques (mollusciciding, engineering measures, chemotherapy, and a combination of these) subject to a given resource constraint over seven years. Maximum output, specified in terms of the greatest reduction in the prevalence rate obtained by the end of the seven year period, was achieved with a combination of chemotherapy and mollusciciding. This intervention reduced the prevalence rate from 64% to 20%, whereas the next best alternative, chemotherapy, achieved a terminal prevalence rate of 60%. This measure of effectiveness did not take into account the prevalence reductions achieved during the period. A more appropriate measure, in terms of the total number of cases of schistosomiasis prevented over the period, changed the ranking of alternatives. Chemotherapy yielded the greatest output at a cost per case prevented of \$1.26, followed by the combination of controls with a unit cost of \$1.29.

Measures of effectiveness specified in terms of cases of a disease prevented tend to limit the application of CEA to the choice between different methods of controlling that disease, and preclude its use to evaluate the choice between interventions directed at different diseases. This is so because different diseases have different effects on the duration and extent of morbidity, and also mortality, which are not obviously captured by measures of cases prevented.

A more useful measure which would permit comparison of the morbidity effects of the prevention of different types of diseases is the number of days of disability prevented. This can be expressed as the number of days on which individuals would have experienced some degree of dysfunction due to the relevant disease, and can be weighted to reflect the degree of impairment. Paqueo (1975) illustrates the use of a weighted measure to show higher morbidity rates below the poverty line in the Philippines. An unweighted measure has been used in Indonesia by Grosse et al (1979) and Grosse (1980) in a detailed simulation of the effectiveness of alternative health interventions directed at 31 diseases, and subject to seven alternative resource constraints. The choice of activities comprised 48 possible combinations of curative and preventive interventions based on health centers, health sub-centers and village health workers, and sanitation, immunization and nutrition programs. Resource constraints varied from \$2.06 to \$30.00 per capita year. Simulations at each level of resource availability identified the mix of interventions which minimized the number of days of incapacitating illness per person per year from all causes. At all resource levels health centers were selected but with varying combinations of other inputs. At \$5.00 per capita these included village health workers and an immunization program; at \$15.00 a sanitation program only; and at \$30.00 village health workers together with sanitation, immunization and nutrition programs.

Mortality reduction. As is the case with morbidity, mortality reduction can be quantified in different ways. The simplest measure, the number of deaths prevented, has the advantage of not being disease-specific and therefore can be used to compare interventions against different diseases. However, in the aggregation of deaths prevented it implicitly assigns the same

weight to all deaths regardless of the age at death, whereas a social premium may be attached to the productive age groups. Social preferences of this kind can be introduced by using methods which weight deaths prevented at different ages by the additional years of life accruing to the survivors.

One approach is to assume that all survivors live to some arbitrarily determined age. For example, Romeder and McWhinnie (1977) suggest a measure of potential years of life lost (gained) given by taking the difference between age at death and 70 years. Other methods take the terminal year as life expectancy at birth, or the life table age at which fewer than arbitrary proportion, such as 10%, of the original radix are survivors. These methods are unsatisfactory because they do not take account of the probability of survival from the age at death to the hypothetical terminal year. It is more appropriate to measure the potential years of life gained by the expectation of life at the age at which death is averted, estimated from the relevant life table. Other refinements have also been suggested, particularly to take account of selective biases which cause the survival changes of survivors from some causes of death to differ from the cohort average (Shepard and Zeckhauser, 1980), as may be the case with measles vaccination in LDCs (The Kasongo project Team, 1981). Preferential weighting for specific age groups can be made even more extreme by simply giving zero weight to certain age groups. Thus planners may be interested exclusively in minimizing infant and child mortality, or adult mortality. The conventional arguments for population control in LDCs could, of course, imply a very low weight for infant and child mortality reductions (depending on one's view of the child survival hypothesis).

The optimal choice of interventions indicated by mortality-based effectiveness measures tends to be different from that resulting from morbidity criteria. For instance, the Grosse model also simulated the effectiveness of intervention alternatives in reducing mortality. For five of the seven different resource constraints the optimal combination of inputs differed substantially according to the choice of objective. For example at \$15.00 per capita, the minimum crude death rate was obtained with a health center combined with village health workers and nutrition and immunization programs; this compared to the health center plus sanitation program choice which minimized days of illness. Adopting the minimization of infant mortality instead of total mortality as the planning objective apparently altered the choice of interventions by introducing nutrition programs more frequently into the optimal solutions. A similar analysis using a programming model to determine the optimal mix of activities to minimize infant and child mortality has been carried out by Barnum et al (1980) with data from Colombia.

Composite measures. Since morbidity and mortality objectives tend to have different implications for the best choice of health interventions, it seems preferable to construct a composite measure of health improvement, that is one which aggregates morbidity and mortality reductions. Attempts to construct a so-called health status index have generated a considerable literature relating to developed countries (Culyer et al, 1979; Berg, 1973) but very little concerning LDCs. The central concept underlying this approach is that at any point in time an individual occupies one of a continuum of possible health states ranging from good health to death. For estimation purposes the continuum is divided into discrete health states, $j = 1 \dots n$. Each state is assigned a value U_j on a utility scale ranging from 0 to 1. Health

interventions alter the probability of occupying different health states. The effectiveness of an intervention is measured in terms of the increment in health status units, defined as the discounted sum over all years of the number of days changed from state j to k in each year, multiplied by the utility weight of state k net of the utility weight of state j (Torrance, 1976). Methods which have been used in attempts to derive utility weights on the basis of individual preferences, including the Von Neumann-Morgenstern standard gamble approach, are reviewed in Culyer (1978). Effectiveness measures of this type are sometimes called quality-adjusted life years. An illustration of the application of this approach to measurement of the health benefits of the reduction in schistosomiasis and cholera prevalence attributable to water supply improvement in LDCs is presented in Saunders and Warford (1976).

A variant of the health status index approach has been developed and applied in Ghana by the Ghana Health Assessment Project Team (1981). Prevention of death from a specific cause results in a gain of healthy days of life: this gain is computed as the life expectancy at age at death from that cause, converted to the equivalent in days. Prevention of disability from a given cause yields an increase in healthy days equivalent to the expected duration of disability in days weighted by the degree of disability per day (assigned arbitrarily). The sum of both the mortality and morbidity components then provides a measure of effectiveness in terms of healthy days of life saved. An empirical application of this method of ranking 48 causes of morbidity and mortality in Ghana showed the dominant effect of mortality on the selection of disease priorities.

These experiments with different approaches to cost-effectiveness analysis in LDCs suggest two important observations. First, since the most effective choice of health interventions appears to be quite sensitive to changes in resource constraints, however health objectives are formulated, accurate specification of these constraints is critically important to avoid getting locked into inefficient strategies. As noted previously, an assessment of the future availability of recurrent cost financing is especially critical. Second, because the optimal mix of interventions is also sensitive to the choice of health objectives, it is equally important that these should be clearly articulated. This presents particularly formidable problems in practice. Most health plans formulate health objectives in terms of desired resource inputs or intermediate outputs rather than health improvement targets, in part because the health impact of particular inputs and interventions is often not known with any certainty. Moreover, specification of the trade-off between morbidity and mortality objectives necessarily raises fundamental questions about the relative value of different types of health improvement which policy-makers are notoriously reluctant to confront explicitly, even though such trade-offs are implicit in all resource allocation decisions they make. Yet those value judgements have to be made explicit in order to determine, through CEA, an efficient allocation of resources between the full range of potential interventions.

4. Cost-benefit analysis

The usefulness of CEA in project selection is strictly limited by its measurement of project outputs in physical units which cannot be compared directly with costs. The fact that a least-cost solution exists to meeting a given health objective says nothing about the desirability of achieving that

objective in terms of the relationship between social benefits and costs. Moreover its necessarily limited focus on health benefits alone implies that other objectives are unimportant, whereas policy-makers typically seek to pursue several social objectives of which health improvement is only one. The idea that the social benefits of a health improvement project should be measured in terms of its contribution to different social objectives such as increased per capita income and equity in addition to health improvement is advocated by Feldstein (1970, 1972), Paglin (1974) and Barlow (1976, 1980), though a dissenting note is offered by Loucks (1975) who excludes health improvement from a long list of development policy objectives. This section examines in the context of LDCs the distinctive problem which arises in applying the CBA approach to health projects, namely the choice of an appropriate measure of the value of health benefits.

The conventional approach to benefit valuation in project analysis is to rely on individual valuations as revealed by consumer behavior. In a perfectly competitive economy, consumers' willingness to pay for a project output is equal to the prevailing market price. Thus in many cases project outputs can be valued directly at market prices. However, health projects generally cannot be handled in this way. First, the prevalence of zero or heavily subsidized market prices in health sector results in an absence of observable market data from which to deduce willingness-to-pay. Second, where such data are available they may underestimate the true social benefits of intervention if, because of externalities, the consumer is not the sole beneficiary of the output. Preventive interventions directed at communicable diseases, such as immunizations, present a classic example of where the benefits to society are greater than those which accrue to their immediate consumers. Third, market

price data may also be unsatisfactory if consumers are not well informed about the benefit to themselves of health services. This again may be especially true of preventive interventions. Finally, even if acceptable measures of private valuations are available from market data, consumer preferences might be rejected in favor of socially-determined consumption patterns, not least because the consumption patterns of individuals will reflect a particular distribution of income and wealth. The notion that health and certain other goods such as nutrition and education merit higher levels of consumption than would normally occur without public intervention underlies the basic needs approach to development planning.

Consideration of these conceptual and empirical difficulties has necessitated resort to indirect methods of the valuation of health improvement. At least five major alternatives have been attempted: human capital valuation, implicit and explicit private valuations, and implicit and explicit public valuations. It should be noted parenthetically that the savings in costs that would have been incurred if a proposed project was not undertaken has often been recommended as a measure of benefits additional to the value of the health improvement provided by the project. This recommendation is strictly incorrect since a consistent analytical treatment would also require setting out the benefits which are foregone as a result of saving the costs that would have been incurred under the without-project alternative. Although this elementary point has long been recognized in the general case (Steiner, 1965) the error is surprisingly persistent in the health economics literature. For a more detailed analysis, see Butler & Doessel (1981).

The most common method is the human capital approach. Health improvement is treated as an investment in human capital formation which yields an incremental flow of future income or output (Grossman, 1972).

Health improvement exerts both quantity and quality effects on the effective supply of labor. Mortality reduction increases the stock of potential workers and hence the potential flow of labor services. Morbidity reduction increases the potential number or efficiency of the flow of labor services. This increment in labor units over time can be estimated and multiplied by their marginal product in order to provide an estimate of the incremental output attributable to any given health improvement (Mushkin, 1962). Classic applications of this method are estimates of the economic cost of disease in the United States by Weisbrod (1961), and Rice (1966). In the context of LDCs, the theme of the output-augmenting effects of disease control has been expanded to include its impact on the effective supply of land (attributable to migration induced by the elimination of disease vectors) and accumulation of the capital stock (resulting from a reallocation of private and public expenditure from consumption to savings and investment). For a general review, see Barlow (1979) and Ram and Schultz (1979).

Application of the human capital approach faces certain empirical difficulties, notably in estimating the increment in effective labor supply resulting from morbidity reduction and the marginal product which should be assigned to it. As it is rather easy to apply compared with other approaches it has been used extensively, although there is widespread dissatisfaction with it on conceptual grounds. The method values health only to the extent that it is an investment good which increases aggregate output; it assigns no value to health as a consumption good. Accordingly, it implies that the value of health is greater for those with higher earnings and therefore can be said to discriminate against the young, the aged, females and the poor.

Two alternatives to the human capital approach reflect a desire to base health benefit valuation on consumer preferences. Implicit private valuations have been sought in analyses of revealed market preferences in the

United States. Blomquist (1979) derived a value of life equal to \$378,000 from an analysis of the use of automobile seat belts which yielded a small reduction in the statistical probability of death. In an analysis of risk-compensating wage differentials in the labor market, Thaler and Rosen (1975) estimated the implicit value of life at \$176,000. An alternative approach using questionnaire surveys designed to elicit an explicit private valuation of mortality reduction has been applied by Acton (1973) to changes in the risk of cardiovascular mortality. He obtained a value of life ranging between \$28,000 and \$43,000. For a review of these and other consumer preference models see Linnerooth (1979). This approach has not yet applied to changes in morbidity or in an LDC context.

Other approaches attempt to replace individual valuations by social preferences. A number of attempts to elicit implicit public values, as revealed by government choices in the UK, are summarized by Card and Mooney (1977). The range of implicit values placed on human life by various programs or regulations were as follows: £50 in screening maternal oestriol concentration to prevent stillbirths; £1,000 in the provision of child-proof drug containers; £100,000 in legislation on tractor cabs; £20,000,000 in building regulations for high-rise apartment blocks. The extreme inconsistency revealed in implicit values across these different public policy areas clearly suggests that this approach serves more as an indicator of the undesirable consequences of ad hoc decision-making rather than as a reliable guide to valuing benefits. Feldstein (1970) has suggested instead that explicit public values could be obtained by direct questioning of public policy-makers. This idea is similar to the general procedure proposed by Dasgupta et al (1972) for the derivation of social weights in project ap-

praisal. A variation of this approach, involving social specification of a basic needs standard for calorie consumption, has been developed by Scandizzo and Knudsen (1980).

The health economics literature offers many examples of cost-benefit analysis (Culyer et al, 1977, Griffiths et al, 1980; Drummond, 1980a,b), but there have been few applications to LDCs. All of these concern communicable disease control projects, mainly immunization programs or parasitic disease control. Such analyses, especially of parasitic disease control, exemplify many of the empirical difficulties encountered in benefit valuation. For example, various studies have assumed that schistosomiasis entails, on average, an impairment of working efficiency ranging from between 4% to 100%. This upper limit is inconsistent with epidemiological evidence that only a minority of infected cases sustain infections of sufficient intensity to provoke clinically severe morbidity, and corroborative physiological evidence from Sudan that significant reductions in physical performance capacity (up to 20% of maximum aerobic power output) are obtained only at very high levels of infection intensity (2,000 eggs/g faeces in S. Mansoni infections) (Prescott, 1979a). Similarly, analyses of malaria control have included assumptions about the duration of disability associated with the acute clinical attack (varying from 6 to 44 days) in excess of that which has been observed empirically (2.4 to 5.7 days depending on the species of parasite and the level of host immunity). Such studies have also generally failed to recognize the zero marginal product of additional labor inputs at seasonal periods of labor surplus (Prescott, 1979b, 1980). Most fundamentally, these analyses have not made realistic predictions of the epidemiological effectiveness of disease control interventions. Like many estimates of the economic cost of disease in developed countries, they are really abstract measures of the gain that could be attributed to hypothetical elimination of a given disease for a

single year. Thus they have not addressed the policy-relevant question of what benefits could be generated over time with the application of feasible control techniques.

It is clear that the issue of benefit valuation in health projects has not been resolved satisfactorily, and no single 'correct' method exists which can be recommended to project analysts in LDCs. All of the approaches reviewed have some merits and the choice of a benefit measure will vary in different circumstances. At a minimum, efforts should be made to estimate the unit cost of achieving health improvements with different interventions, so that at least some sensible judgements may be made in the choice between alternative expenditures. Even this needs refinement of basic epidemiological data and analysis, and is but a first step to more powerful analysis involving benefit valuations.

5. Uncertainty and shadow pricing

The need to take account of uncertainty and to use appropriate 'shadow' prices applies to project analysis, both CEA and CBA, in all sectors but these techniques deserve special mention in the context of health project investment appraisal.

Uncertainty. Uncertainty over the true value of basic parameters in CEA or CBA calculations is inherent in project analysis, partly because by definition the future is unknown and partly because of practical limitations in the quality of relevant data. For instance, a special feature of health projects is the degree of uncertainty about the technology of health improvement. Not enough is known about the relevant production functions, that is the relationship between inputs and outputs, to predict with confidence the health outputs that will result from health project inputs. This fact partly stems from the unusual complexity of health sector production functions.

With the exception of preventive interventions which have the characteristic of 'public' goods, improvements in health are produced jointly by health service providers and consumers. Consumer demand is therefore one of the determinants of improved health but knowledge about its characteristics is limited by a lack of empirical data on consumer demand functions for health services and health-related activities.

Another source of uncertainty relates to the technical efficacy of some health interventions in compliant populations, for example BCG vaccination against tuberculosis (Tuberculosis Prevention Trial, 1979), or improved water supply and sanitation facilities (World Bank, 1975; Saunders and Warford, 1976). In addition, uncertainty exists about the accuracy of much of the basic epidemiological data on the incidence or prevalence of morbidity and mortality due to specific causes against which project interventions are directed. For example, estimates of the health benefits of schistosomiasis control are sensitive to assumptions about the morbidity and mortality which it causes, a matter which continues to be the subject of controversy. Apart from such uncertainty about quantifying the benefits of health projects, further uncertainty arises over the value which should be placed on them.

In practice, this problem of uncertainty should be handled by basing the project analysis on best estimates of the basic project parameters, and then analyzing the sensitivity of the conclusions to plausible variations of the parameter values around their expected values. The sensitivity analysis will indicate which, if any, of the basic assumptions have a significant effect on the acceptability of a project. The converse approach is to estimate how much different parameter values would have to change before the project switches from being acceptable to unacceptable (or vice versa), and to check whether these are plausible. Such an approach is especially well suited to

handling the pervasive uncertainty in health sector projects. Given that in some projects only costs may be known with any confidence, the minimum health output (such as lives saved) required to make the project acceptable can still be estimated and then checked to see whether it is plausible. These estimates can be done within either a CEA or CBA framework.

Shadow pricing. The idea of 'shadow' pricing is to determine the 'real' price of a good or service either where no market price exists or where such a market price is considered to be an incorrect indicator of its 'real' value. In the analysis of health investments, two kinds of shadow prices need to be considered: economic (or efficiency) prices which correct for distortions in factor and product market prices; and social (or distributional) prices which reflect a government's growth and equity objectives. The two main systems of shadow pricing are those developed by Dasgupta et al (1972) and Little and Mirrlees (1974), later refined by Squire and Van der Tak (1975). A full account of the justification for, and derivation of, shadow prices is available in these original sources; only the major points are summarized here.

The use of economic prices mainly affects the value of foreign exchange and labor inputs used by projects. In most LDCs it is common to encounter exchange rates which tend to underestimate the scarcity value of foreign exchange. Conversely, market wage rates often to overestimate the opportunity cost of labor. In these circumstances, the effect of the use of 'shadow' prices will be to increase the cost of foreign exchange and reduce the cost of labor. These adjustments will discourage projects which use scarce foreign exchange and favor those which are labor intensive. Likewise, if faster economic growth or income redistribution are key social objectives, then shadow prices in the form of social prices may be used to bias project selection against investment projects which rely heavily on public sector financ-

ing, in favor of those which generate high rates of saving and reinvestment by, for example, generating additional public revenues from user charges and those which redistribute income to the poor.

Some features of the health sector make consideration of shadow pricing of special interest, and the use of economic and social prices has important implications for the choice of health projects. The penalty attached to foreign exchange intensive projects, as a result of the use of economic prices, gives particular importance to pharmaceuticals and increasing domestic production, including primary manufacture which may not rely on imported inputs. The mutually reinforcing incentives to employ labor with a low opportunity cost (for efficiency reasons) and to favor employment of the poor (for distributional reasons) emphasize the desirability of substituting lower for higher grade health workers where technically feasible. The disincentive to using scarce public resources to finance health projects directs attention to exploring methods of self-financing. It is pertinent to observe that all of these concerns - pharmaceutical policy, the use of village health workers and community participation in project financing - are currently the subject of intense policy debate and can each be accommodated through a straightforward application of shadow pricing in project selection.

6. Resource mobilization

Existing and prospective financial constraints in LDCs indicate a need to re-evaluate the traditional approach to health sector financing which relies heavily on public subsidies from central government revenues. A significant increase in the allocation of public revenues to the health sector is unlikely to be a realistic option, given the traditional strength of competing sectoral demands and the continuing difficulty of demonstrating that the marginal social rate of return on health expenditure exceeds the returns

yielded in other sectors. Expansion of the health sector in many countries may, therefore, depend largely on the implementation of cost recovery mechanisms. In general, the relevance of alternative financing methods will vary with the type of health intervention. In each case the choice between financing alternatives can be assessed using the same framework already developed for their public sector projects in which efficiency, equity and fiscal objectives are traded off for the various services provided (Ray, 1975).

The benchmark for analysis of financing alternatives is given by long-run marginal cost of each intervention, though departures from marginal cost pricing can be justified in certain circumstances. In the presence of externalities or poorly informed consumers, both being characteristic of preventive interventions aimed at individuals, marginal cost prices will fail to induce socially optimal levels of consumption, and subsidized prices are appropriate. Public health measures, such as mollusciciding for schistosomiasis control and aerial larviciding for onchocerciasis control, have some of the characteristics of "public goods", where the benefits of intervention are not consumed by any one individual and the exclusion principle therefore fails to apply, in that access to the benefits of intervention cannot be made conditional on payment of a user charge. Direct charges for such services, levied separately on each beneficiary, may either be too expensive to administer, or simply not feasible.

The achievement of equity objectives will also be affected by the choice of financing mechanism. Interventions directed at low income beneficiaries, for example, a program of primary health care, may be ineffective under a system of direct user charges if the price elasticity of demand is high, meaning that potential consumers are deterred from seeking care by the level of prices charged. Evidence on price elasticities for health services in

LDCs is scarce, but data from Malaysia indicate that the total demand is highly inelastic with respect to cash prices, although there are significant cross-price elasticities for the services of different providers (Heller, 1982), implying that consumers do switch between providers according to variations in prices. Similar findings have been reported for the Philippines (Akin et al, 1982). If demand is inelastic, the impact of raising charges on the use of health services will by definition be minor and its fiscal impact positive, but the income transfer from the beneficiary to the public sector may not accord with distributional objectives. However, even where these difficulties apply, there may be no alternative but to generate revenues from beneficiaries or elsewhere in the private sector in order to finance the provision of health services.

It is clear, nonetheless, that for some interventions reliance on direct user charges will not be appropriate and other financing mechanisms will need to be explored. But whether the very limited resort to user charges in LDCs is appropriate - less than 10% of public sector costs are recovered by this means in countries such as Ghana (Brooks, 1981), Malaysia, Malawi, and Lesotho - require detailed examination. In general, the arguments against pricing are stronger for preventive interventions and for lower income beneficiaries. Thus a system of selective charges for curative services, especially for higher income users, may be justified to cross-subsidize preventive activities and utilization by the poor. Private sector experience, notably of mission facilities and traditional practitioners and birth attendants, demonstrates the feasibility of recovering a high proportion of recurrent costs from user charges without reducing utilization. In Lesotho, some 70% of recurrent expenditure by private hospitals is recovered from user charges (Kolobe and Pekacha, 1980).

Alternatives to charges in use in many countries include earmarked taxes, social security and insurance schemes, or indirect cost recovery by self-help (Evans et al, 1981, Stinson, 1982). Experience shows that a wide range of financing mechanisms can be employed in the health sector in LDCs. Nevertheless, the approaches generally used are dominated by the tradition of central government subsidy and the introduction of innovative methods encounters very difficult political obstacles. The prevalent view that because health is good it should be free or subsidized may have to be increasingly challenged, however, if the goals set by WHO and UNICEF, referred to in the introduction, are to be achieved.

Conclusion

In general, conventional approaches to investment appraisal in the health sector are much less rigorous than in most other sectors. A major reason for this may be that there are greater difficulties of theory and measurement at all stages of project analysis, for example in the prediction of effectiveness of health interventions, the valuation of benefits, and the design of appropriate cost recovery policies. However, these problems differ in degree rather than substance from those found in other sectors such as water supply, energy and education, where considerable analytical progress has been achieved. They certainly do not justify the prevalent tendency to avoid rigorous analysis of investment decisions altogether simply because it is difficult. It may even be argued that many of the problems which are encountered are the result of past neglect of economic analysis in the health sector. The potential role of economic appraisal is therefore very large, and indeed, essential to attainment of the dramatic improvements in health status which are now sought by LDCs.

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