The Road to Cost-Effectiveness Analysis

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AN APPROPRIATE STARTING POINT FOR EXAMINING the application of cost-benefit analysis to health care can be found in the work of Selma Mushkin (1958), work which is both in the mainstream of economics and in the vanguard of health economics. In cost-benefit analysis the mainstream has meant a preoccupation with the measurement (valuation) of economic benefits. As seen by economists, the essential tasks in measuring benefits are these: avoid duplication in counting benefits; distinguish between real and pecuniary benefits and include only the former; find a market price or obtain a shadow price (an imputed price or an adjusted market price) for each set of benefits; and obtain their present value by discounting.

A close reading of Mushkin's early writings on cost-benefit analysis suggests what appears to be a small deviation from the economics mainstream. She tended to minimize the use of a discount rate, citing for illustration health programs that yield returns rather promptly and over a short interval of a year or two. Under these circumstances the discount rate is immaterial (Mushkin and Collings, 1959). I am unable to determine from Mushkin's early writings whether she intended to go further and do away altogether with the discount rate

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in cost-benefit analysis, perhaps in accommodation to the public health environment in which she then worked, for public health experts excoriated the discount rate, seeing it as an untoward capitulation to mammon (Klarman, 1967).

Mushkin shares the predominant emphasis of the economics literature on the measurement (valuation) of economic benefits (Layard, 1976). This emphasis pervades the writings of economists criticizing the valuation of benefits in water resources projects by the Army Corps of Engineers (Eckstein, 1958; McKean, 1958); the papers and discussions at the two Brookings Institution conferences on the measurement of benefits from public expenditures (Dorfman, 1965; Chase, 1968); the two major review articles (Eckstein, 1961; Prest and Turvey, 1965); the work by Dorothy Rice and the staff at the Social Security Administration (Rice, 1966; Cooper and Rice, 1976; Rice et al., 1977); and the attempt by Haveman and Weisbrod (1977) to reformulate the economists' approach for the mid-1970s. In almost every empirical study the economist recognizes that the economic benefits to be measured (valued) represent the value of the difference in outcomes *with* and *without* the program in question. However, even as the importance of determining that difference in outcomes is noted, measuring the difference is rarely pursued. Freeman's (1977) observations on the importance of determining program outcomes are an explicit exception, but he does not perform here any empirical operations.

Economists agree that the economic costs of a program are opportunity costs, which are not the same as accounting costs. Again, with a few exceptions such as Judy (1969) and Merewitz and Sosnick (1971), they do not treat the calculation of program costs as a serious problem and tend to neglect it when they do not dismiss it.

As a sometime practitioner of cost-benefit analysis in the health field (Klarman 1965a, 1965c, 1974; Klarman et al., 1968; Klarman and Guzick, 1976), I have drawn upon and profited from the rich economics and health-economics literature, but not without increasing misgivings. These doubts have led me over the years to turn to cost-effectiveness analysis, which is a truncated form of cost-benefit analysis that stops short of putting an economic value on the health status outcomes of programs. My misgivings fall under four headings, which are discussed in turn as follows:

1. Reconsidering the conceptual basis for valuing economic benefits.
2. Determining the outcomes or effects of programs, which is the same as ascertaining the state of the world with and without the program in question.
3. Measuring the economic costs of programs yielding multiple outputs that are produced jointly.
4. Taking account of the distribution of program benefits and costs.

Problems in Economic Valuation

Cost-benefit analysis is the analogue in the public sector of supply-demand analysis in the private market. In neither sector of the economy is it the goal of economic activity to maximize the national income. Rather, the goal is to maximize consumers' well-being. Thus, it is recognized that people may prefer to accept part of the fruit of economic growth in the form of more leisure or cleaner air, rather than more goods or services (Samuelson, 1980). That is the reason for establishing intangible health benefits, such as avoidance of pain or grief due to morbidity or premature mortality, as the third category of economic benefits from improved health, in addition to the two sets of tangible benefits—savings in health care expenditures and averted losses in earnings. In the empirical literature on cost-benefit analysis in health care, however, the measurement of intangible benefits has not received equal attention. Often its existence is noted and promptly disregarded (Fein, 1967). Alternatively Weisbrod (1961) assumes away the need to measure intangible benefits by positing that they may be held to be proportional to the sum of the two sets of tangible benefits. I put a good deal of effort into an attempt to value intangible benefits in the paper on syphilis for the first Brookings conference (Klarman, 1965a). The subsequent literature frequently cites this effort but does not repeat it.

The tendency in empirical studies to put an economic value only on the two sets of tangible benefits has limited the direct applicability of the findings of cost-benefit analysis to public policy decisions. In effect, it is left to the decision maker to put a value on the intangible benefits. Moreover, if consumption is subtracted from earnings, as was sometimes done (for example, Laitin, 1956; Jones-Lee, 1976),

the measured benefits of a health care program for the aged are bound to fall short of costs. Most decision makers are not prepared to accept and act on the implications of such findings (Margolis, 1977). One solution has been to take earnings gross, without subtracting consumption, on the ground that aged persons are full-fledged members of society (Weisbrod, 1961; Klarman, 1965a; Jones-Lee, 1976). Another partial solution to overcome the bias of market earnings in favor of men has been to bring into the calculations proxy measures for the services contributed by housewives. These proxy measures have undergone considerable elaboration and refinement particularly by Rice (1966; Cooper and Rice, 1976; Rice et al., 1977; Brody, 1975). Still another approach, after noting the absence of a quantified value for the intangible benefits, has been to treat the sum of the two sets of tangible benefits as a conservative lower bound estimate of the total value of a program's economic benefits (Goode, 1964).

Because its criticism is conceptual in nature, the most serious challenge to the conventional and widely accepted three-category classification of the economic benefits of health programs came from Schelling (1968) at the second Brookings conference, although other theorists had apparently preceded him (Dreze, 1962). Schelling doubted that a necessary connection existed between the expected earnings of potential beneficiaries from life-saving programs and the willingness of such persons to pay for the probability of a small improvement in life expectancy. He called them measures of livelihood and the value of life-saving, respectively. Further, he distinguished between a community's ready willingness to spend very large sums on saving an identified human life and a population's aggregate willingness to pay for a statistical reduction in the death rate. To measure the latter, he devised and administered a questionnaire designed to elicit such information from friends and colleagues. Done informally on a small scale, and evidently not with a representative sample of the population, Schelling's questionnaire provided a schematic outline of such an approach, not a systematic research protocol.

Within a few years Acton (1973) applied Schelling's approach, along with the other approaches, in a study of life-saving techniques for victims of sudden heart attack. Also within a short time span, Mishan (1971) endorsed and reformulated the willingness-to-pay approach for measuring the economic benefits of life-saving programs as the only one consistent with the criterion of Pareto optimality for

persons exposed to risks involuntarily. Finally, at the conference sponsored by Mushkin in the late 1970s, Nancy Dorfman (1979) demonstrated that, to the extent that earnings enter into the valuation of the economic benefits of life-saving programs, they must do so net of consumption by the beneficiaries themselves, since the pecuniary benefits are of interest only to the relatives and close friends of program beneficiaries and not the beneficiaries themselves. If so, it follows that the sum of the two sets of tangible benefits—consisting of savings in health care resources plus the averted loss of gross earnings—may no longer be taken as a lower bound estimate of total economic benefits.

A dilemma is currently facing those who wish to measure the value of economic benefits of health programs. On the one hand, earnings, which can be measured and have been measured with increasing precision (Rice et al., 1977; Mushkin, 1979), may not be an appropriate component of benefits and certainly are not if taken gross, before consumption. On the other hand, willingness to pay, which is accepted as the appropriate measure of the value of benefits, is extremely difficult to ascertain, for a variety of reasons. One difficulty is the problem of respondents' dissembling their true preferences for a public good that is desired by many individuals, in the hope that others would pay for it. This general "free-rider" problem is aggravated in health care by the tradition that nobody in need of health care should be denied it for lack of ability to pay; it has been documented that this liberal attitude is espoused by a wide range of political opinion, from left to right (Klarman, 1951). Another difficulty is that respondents to questionnaires generally do not know much about the mortality risks for their own cohorts, do not grasp the implications for themselves of a small improvement in life expectancy, nor are able to respond rationally and consistently to questions of life and death (Klarman, 1974), matters that we have tended to leave to chance or God.

In the economic literature a good deal of the discussion of how to measure the economic benefits of health care programs appears under the heading of shadow prices, previously defined (McKean, 1968; Margolis, 1977). Shadow prices are to be used when market prices are lacking or require adjustment for market failure. By and large, substitution of a shadow price for an existing market price is discouraged. An important problem in shadow pricing that cannot be

escaped, however, is that of the discount rate, also previously mentioned. The discount rate is a rate of interest that is meant to equate the present and future values of a dollar, so that a program's expected streams of costs and benefits over time may be rendered commensurate, thereby permitting calculation of the present value of a program's total net economic benefits. Unfortunately, economists disagree over how to measure the discount rate (Feldstein, 1964; Henderson, 1965). In consequence, they frequently employ two or more discount rates as a form of sensitivity analysis (Rothenberg, 1975; Weisbrod, 1961, 1971). I prefer a single rate on the ground that it affords more definite guidance to decision makers, recognizing at the same time my inability to justify a particular rate, except on the rather tenuous basis of wide usage (Klarman et al., 1968). In any case, it is fair to say that unlike the problem of valuing economic benefits, the economists' controversy over the level of the discount rate has not been a major factor in the lagging application of cost-benefit analysis to health care programs.

The several difficulties in valuing the economic benefits of health care programs, especially those with life-extending effects, are far from resolution. In time it may become practicable to obtain measures of willingness to pay operationally; that prospect is in the realm of research. The outlook in health care is certainly brighter than in the area of such a pure public good as national defense, where one person's consumption of a good does not reduce another's. Meanwhile, the health scene has witnessed the widespread adoption of cost-effectiveness analysis.

Determining Program Outcomes

Mushkin brought the concepts of cost-benefit analysis to the health field as an application of developments in economic theory and empirical measurement by economists (Mushkin, 1962; Mushkin and Collings, 1959). Drawing on the new welfare economics, the theory of investment in human capital, and the economic studies of water resources projects, she developed their implications for the health field independently, and before or simultaneously with the integration of the several lines of scholarly activity in the major review articles (Eckstein, 1961; Prest and Turvey, 1965).

Simultaneously, Fein (1958) and Weisbrod (1961) were performing their studies in the measurement of the economic benefits of averting specific diseases. The first Brookings conference in 1964 commissioned a paper on some health problem or program (Klarman, 1965a). The DeBakey Commission on Heart Disease, Cancer and Stroke requested some work on the economic costs of these diseases (Rice, 1965); while this work was in progress, it was reviewed by a panel of leading economists (Klarman, 1965b). The major impetus to applying these methods of decision-making came with President Johnson's promulgation of the planning, programming, and budgeting system in the civilian branches of the federal government in 1965.

Leadership for this task in the Department of Health, Education, and Welfare came mostly from persons transferred from the Department of Defense, to which, in turn, they had brought in 1961 the methods of systems analysis developed at the Rand Corporation after World War II (Enthoven and Smith, 1970). As practiced in the Defense Department, systems analysis differed from the economists' standard cost-benefit analysis in at least two respects: 1) the emphasis was on ascertaining the effects or determining the outcomes (*not* outputs) of alternative programs; and 2) given the presence of budget constraints on the one hand, and similarities among the outcomes of competing programs on the other hand, the focus of analysis became the measurement of program cost in money terms and of program benefits in terms of physical outcome. In national defense no attempt was made to take the next step of putting an economic value on the effects of alternative programs.

It is worth noting again that discussions by economists of how to measure economic benefits dealt with which effects to count and which to exclude, in order to avoid double counting, and then with measuring what had been properly counted. In the health field the attempts by economists to measure economic benefits usually dealt with entire disease entities or diagnostic categories, and not with health care programs. It was as if an entire disease would be eradicated. If so, it would not be necessary to measure or put a value on the economic benefits of programs that served only to lower the incidence or prevalence of a disease.

Perhaps our historical success in the virtual eradication of such communicable diseases as yellow fever in Panama and tuberculosis

domestically served as precedents for an all-or-nothing approach. But other factors may have contributed to the economists' neglect of the practical problem of determining the outcomes of specific health care programs. One was that many economists treat the statistical method of multiple regression analysis as a close substitute for a controlled experiment in the real world. This view seems to obviate the need for concern with problems of research design and program evaluation, the difficulties posed by self-selection on the part of program users, and possible biases in statistical analysis resulting from the use of aggregated, geographic data. Another factor was the economists' belief, probably ill-founded, that health experts know the magnitude of the effects produced by the health programs that they administer or espouse.

In the first round of policy analyses mounted in the U.S. Department of Health, Education, and Welfare (1966) to apply the planning, programming, and budgeting system to health care programs, it became evident that the health care experts did not always have the requisite knowledge about program effects or outcomes. Since program analyses were linked to the annual budget cycle and had to be completed on time, it became the practice to arrive at program effects by consensus among those sitting around the table. No doubt it would have been better for the development of cost-benefit analysis and for its application in government if the lack of knowledge of program effects had been acknowledged and treated as a reason for recommending that the requisite health services research be undertaken. However, linking analysis to the budget cycle was deemed an important objective.

In addition, the intellectual influence of the earnings approach in estimating the economic benefits of health programs was strong within the department. Indeed, some staff economists believed that no program could be justified on economic grounds if its costs were not exceeded by the sum of savings engendered in future health care benefits and the additional earnings of beneficiaries. By contrast, the report of the ad hoc committee, appointed by the then Bureau of the Budget to study the federal government's responsibilities in caring for patients with chronic kidney disease, explicitly took issue with this view of economics. Recognizing that the purpose of economics is to improve consumers' well-being, the economist members of this committee proceeded to apply the tools and methods of economics as far as

possible (Gottschalk, 1967). It turned out that it was necessary to stop short of an economic valuation of the outcomes of alternative modes of treatment. However, it was possible to compare the cost per added year of life expectancy among the three then available or emerging modalities—kidney transplantation, hemodialysis at a hospital, and dialysis at the patient's home (Klarman et al., 1968). The recommendation to proceed with a combined program reflected the value judgment that it promoted the general welfare; many persons outside the committee disagreed with this judgment on the ground that the same resources could be better applied to improving the health of economically active persons.

In performing this analysis the economists enjoyed the unique advantage of a close and prolonged association with a group of preeminent experts in kidney disease research and clinical diagnosis and treatment. The clinicians were concrete in describing the patients, available treatments, staffing, and the way the characteristics of the patients and technologies were changing. The economists were in a position to—and did—impose heavy demands for extrapolation from limited experience on the biostatistician-epidemiologist member of the Gottschalk committee, Bernard Greenberg. Such ready access to superb expertise in diverse disciplines is not normally available. Usually, economists have to rely on the willingness of colleagues in the other disciplines to help them. The experts in other disciplines are not likely to see themselves as handmaidens to economists.

Despite the difficulties posed by interdisciplinary research, numerous cost-effectiveness analyses of health care programs have appeared over the past decade that incorporate and integrate the contributions of the requisite disciplines (Bunker et al., 1977; Weinstein and Stason, 1976; also numerous references in Fuchs, 1980, and Office of Technological Assessment, 1980). Who exerts leadership in a particular study is a matter of circumstance; the design chosen for determining outcomes with and without the particular program is a matter of opportunity.

It would be slighting the potential capabilities and actual accomplishments of modern economists to suggest that economists cannot perform proper evaluations. Although by training economists do not enjoy a comparative advantage over others, some economists have measured the effects of natural experiments and others have participated in designed experiments in health care. Scitovsky's work over

two decades at the Palo Alto Clinic is an example of the former (Scitovsky and Snyder, 1972; Scitovsky and McCall, 1977), and Weisbrod's recent study of alternative treatments for patients with mental illness is an example of the latter (Weisbrod and Test, 1980). Incidentally, Scitovsky was on Selma Mushkin's staff at the Social Security Administration during World War II, and Weisbrod has been a collaborator of Mushkin's (Mushkin and Weisbrod, 1964).

The usefulness of cost-effectiveness analysis for decision-making was recognized early by William Gorham, Assistant Secretary for Planning and Program Evaluation in the Department of Health, Education and Welfare (Gorham, 1966). He observed that economic analysis was more helpful as a systematic approach to allocating resources among programs within the health field than among programs in health care and in other avenues of expenditure. The intellectual status of cost-effectiveness analysis was enhanced when Acton (1973) published the results of a cost-effectiveness analysis as a by-product of his attempt to perform a cost-benefit analysis. He recognized that all the measurements required for a sound cost-benefit analysis, except one (the valuation of program outcomes), were already incorporated in the cost-effectiveness analysis of that program. When the additional step, that of valuation, can be added, well and good; if not, the findings of the cost-effectiveness analysis are by themselves useful for decision-making. Today I am inclined to go further. Economic valuation of program outcomes without a valid determination of such outcomes in the real world—I wish to emphasize here the distinction between a program's effectiveness and efficacy in a laboratory setting—is but an idle exercise. Cost-effectiveness analysis is a desirable, if not necessary, precursor of cost-benefit analysis.

Calculating Program Costs

The cost of a program, as it appears in the equation of cost-benefit analysis, usually pertains to the cost of resources employed in that program. Under conditions of full employment in the economy at large, program costs represent the cost of not employing the same resources in their next nearest opportunity, or the opportunity foregone. However, as noted above, costs sometimes appear on the benefits side of the equation as the total costs or economic burden of a disease.

Sometimes cost appears on the benefit side of the equation as the first component of total economic benefits, namely the potential savings in health care expenditures attributable to the program. The potential source of confusion here, it seems to me, is the focus on economic measurement of the benefits of public expenditures apart from a particular program. When the focus is on measuring the costs and benefits of a given specified program, the two streams of costs and benefits are necessarily juxtaposed, and in this context costs can only mean program costs.

With few exceptions (Judy, 1969; Merewitz and Sosnick, 1971) the economics literature on cost-benefit analysis pays little attention and devotes small space to the measurement of costs. It is as if the task were either self-evident or too simple for comment, once the notion of opportunity cost is accepted as the proper measure of cost. The widespread injunction to measure costs, as well as benefits, in dollars of constant purchasing power is clear enough. When inflation occurs in the economy at large, current dollars are to be deflated by an appropriate price index. It is further accepted that expected shifts in relative prices are to be taken into account (Klarman, 1965a). This adjustment can be made as a separate step or incorporated as a decrement or increment to the discount rate.

A central difficulty in measuring program costs is that many health care programs produce several services jointly—inpatient and outpatient care, services and education of health manpower, services and research, and so forth. When multiple services are produced jointly it is possible to calculate the marginal cost of the service without ambiguity, but average unit cost can be calculated in a uniform manner only by adhering to standard rules of accounting for allocating overhead costs. Although average cost figures calculated under such standard rules are not capricious, they are arbitrary and subject to change when other, perhaps equally plausible, rules are adopted (Klarman, 1950).

There is no general solution to this problem. In practice it is possible to narrow the range of ambiguity by reducing the variety of outputs and making a program's unit of output sufficiently large. This is illustrated by the study of the treatment of patients with chronic kidney disease, in which the units of outcome were taken to be hemodialysis for a patient for one year and all the preoperative and postoperative costs associated with a kidney transplantation (Klar-

man et al., 1968). The aim was to avoid costing and pricing separately vast numbers and types of laboratory and X-ray examinations and treatments by ancillary personnel. The wholesale procedure offers the obvious advantage of reducing the volume of calculations, but it also avoids the appearance of a spurious accuracy that can be misleading.

Another problem in calculating program costs arises when they are projected into the future. In this process it is desirable to take account of the size of the proposed program in relation to the size of exisitng programs. Pointing to possible reduction in unit cost in the future is the effect achieved through learning by doing. Also pointing in the same direction are economies of scale in the individual firm, if these are attainable. By contrast, pointing to a possible rise in unit cost is the effect of diverting to the proposed program, if it is massive, resources employed elsewhere that may not be well suited for it. Also pointing to a possible rise in unit cost is entry into the program, as it expands, of persons who are increasingly more difficult to diagnose and treat. In projecting program unit costs into the future, it is a matter of judgment where to strike the balance between the opposing tendencies.

Finally, it is accepted procedure to allow for unemployment. In the presence of unemployed resources in an occupation, industry, or region, it is appropriate to resort to shadow pricing and to adjust money costs downward, in order to obtain an accurate measure of real resource costs. The fact that an agency's budgetary costs are higher than the adjusted amount has a bearing on who should finance the program but not on the calculations for determining whether or not the particular program is worthwhile for society to undertake (Haveman, 1977). The adjustment for unemployment applies only for the period in which such unemployment must be accepted as an externally imposed constraint.

Concern for Distributional Effects

From the outset, cost-benefit analysts have recognized that public programs are likely to produce changes in the distribution of income, consequent to their effects on the distribution of costs and benefits. The new welfare economics, though rooted in the criterion of the Pareto optimum, recognized that the rule of unanimity implied by

it was not operational in the real world and opted for the modification offered by the Hicks-Kaldor rule of potential compensation. Under this rule, a proposed program is regarded as efficient for purposes of resource allocation if it yields a surplus of benefits over costs in the aggregate, so that winners could compensate losers (Haveman and Weisbrod, 1977). That such compensation may not take place does not affect the determination of economic efficiency.

But the absence of actual compensation, despite the presence of potential compensation, affords no solace to losers. Indeed, Weisbrod (1977) has cogently argued that virtually every public program, whatever its objectives, has distributional consequences in the form of pecuniary benefits. In the standard cost-benefit analysis such pecuniary benefits, as well as transfer payments, must not be counted (Weisbrod, 1968). An obvious example of distributional consequences, by no means rare, arises from an agency's budgetary constraint; in urban renewal programs politically influential losers, e.g., landlords, are likely to receive compensation when the government's power of eminent domain is exercised while small businessmen removed from the cleared area are not. Nor will those who question the fairness of the existing distribution of income and wish to change it through cash payments or benefits in kind be impressed by the qualification that is conventionally attached to the Pareto optimum, namely, that it pertains only to a particular distribution of income and that other optima for the efficient economic allocation of resources will correspond to other distributions of income.

Clearly the tradeoff between a program's aggregate balance of net benefits and the same program's effects on the distribution of costs and benefits is a value judgment or a political judgment, which the economist may be able to explicate but cannot decide. This problem can arise even in the absence of economic valuation of benefits. The reason is that a given average gain in physical measures of health status may be appraised differently when it reflects small gains for everybody rather than large gains for a few. It seems to me that such a distributional effect may constitute the real, even if not the intended, justification for the application of a discount rate by Weinstein and Stason (1976) to the expected average gains in life expectancy by persons treated for asymptomatic hypertension. The point is that a given gain in average life expectancy accruing to a small proportion of program participants reflects gains over a longer period than does

the same average gain accruing to a large proportion of total participants.

Conclusions and Prospects

The shift toward cost-effectiveness analysis in health care, away from cost-benefit analysis, can be justified on grounds of usefulness in decision-making, today and for the foreseeable future.

Margolis (1977) has pointed out that the human capital approach to the valuation of benefits is particularly limited in education and health. In education there are the political and social benefits of having an enlightened citizenry. As for health services, Margolis believes that health is much more of a consumer good than is education. While individuals are concerned about the loss of working time due to illness, "pain, discomfort and the fear of incapacity may be even more of a basis of willingness to pay to avoid illness" (Margolis, 1977, p. 216).

It is easier to carry out a cost-effectiveness analysis when the outcomes of programs being compared are identical or at least similar along major dimensions. It is worthwhile to invest in further research to ascertain people's preferences for and rankings of diverse changes in health status (Berg, 1973), an activity that Mushkin encouraged and sponsored in the 1970s (Chen and Bush, 1979). It may turn out that preferences vary by age, sex, economic status, cultural background, and other characteristics.

One must recognize that cost-effectiveness analysis cannot provide rankings or priorities across diverse avenues of public expenditure. To compare the worthwhileness of programs between housing and health or between education and health it is necessary to complete full-fledged cost-benefit analyses. In turn, this requires the development of measures of willingness to pay for all the programs being compared, not only for health programs (Clarke, 1979). That is a tall order, and useful results are not imminent.

Meanwhile cost-effectiveness analysis, which has survived the demise of the planning, programming, and budgeting system in the federal government, does afford direct help to decision makers in the public sector. Moreover, a well executed cost-effectiveness analysis points up the importance of obtaining realistic estimates of program costs and of valid determinations of program outcomes in the real world.

Finally, a well executed cost-effectiveness analysis can lay a firm foundation for a cost-benefit analysis. If the several elements that comprise a sound cost-effectiveness analysis are lacking, performing the additional step of valuing benefits to complete a cost-benefit analysis is a fruitless exercise. Conversely, the discipline imposed by the process of the cost-effectiveness analysis, in which program costs and outcomes are juxtaposed, assures that findings will provide help to decision makers today, even as greater help may be anticipated when the economic valuation of benefits is improved.

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