Economic evaluation of health care: a survey*

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Economic appraisal of health care projects is not new. Indeed the instigator of this approach, Sir William Petty, the so-called father of political economy, was an Oxford medical don in the late 17th century.

To an economist the aim of studies evaluating expenditure on health care is to throw light on the use of resources and to provide information which will enable us to improve our decision taking. The studies can provide guidance about (a) the allocation of resources to the health sector, and (b) the allocation of resources within the health sector.

In this paper the various studies which have been made are considered and the problems and limitations of the techniques used and the usefulness of the studies to planners of services are discussed.

RESOURCES TO THE HEALTH SECTOR

The earliest efforts at economic appraisal were highly polemical and of a reforming nature, attempting to justify expenditure on health by drawing attention to the investment potential of man. They were often, but not always, concerned with the provision of public health facilities. Rashi Fein (1971), in his excellent survey article ‘On measuring economic benefits of health programmes’, quoted some delightful attempts by Petty (1899) to justify health expenditures:

In his plan, 7 October 1667, 'Of lessening ye Plagues of London' Petty estimated that 'given the value of an individual and the cost of transporting people outside of London and caring for them for three months thus increasing the probability of survival, every pound expended would yield a return of £84'.

In 1676 in a lecture on anatomy, Petty noted that the value of better medicine was that it could save some 200,000 lives, even valued at only £20, the lowest price of slaves, this was a large sum and better medicine therefore represented a sensible state expenditure, 'wherefore it is not in the interests of the state to leave physicians and patients to their own shifts'.

More than a century later we learn again from Fein (1971) that Edwin Chadwick (1842), in his sanitary report, was estimating that loss due to expensive sickness and premature death including loss of productive power, caused by inadequate sanitation, equalled £14 million per year.

William Farr (1885), using his life tables, estimates the value of a labourer at different ages based on the sum of future earnings and cost of future maintenance as:

<table>
<thead>
<tr>
<th>Years</th>
<th>£5</th>
<th>£246</th>
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<tr>
<td>5</td>
<td>£56</td>
<td>£241</td>
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<td>10</td>
<td>£117</td>
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<td>15</td>
<td>£192</td>
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<td>20</td>
<td>£234</td>
<td>80</td>
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He uses these data to justify particular concern about fever, consumption, cholera, violence in all its forms, and childbirth.

At the end of the 19th century, Gary Calkins (1891) used these estimates of Farr to consider the impact of sanitary legislation in England and concluded that in 10 years the country had more than regained the sum that was spent for sanitary improvements in the 15 years 1875-90 even though in his calculations:

Nothing figures for maladies avoided; nothing for that which cannot be expressed in figures: spared grief, better and happier lives.

This tradition is continued in the work of Dublin (Dublin and Lotka, 1946) who, in a paper which he wrote with Whitney (Dublin and Whitney, 1920) provided a rationale for using economic appraisal of medical care:

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Public health work, as now practised is often expensive. In the effort to obtain the necessary appropriations with which to carry on the work, health officers are learning to utilize figures showing the economic loss sustained by preventive sickness and premature death in communities. Factors of this kind carry much weight with hard headed municipal authorities.

Their study estimates the number of years of life lost by age, colour, sex, and social attributes. This is then related to data on wealth, income, and production in the United States. They estimated that the loss of one year of life was £100 and, using this information, went on to calculate that, excluding the losses due to morbidity, cost of treatment, etc., the loss to the country from tuberculosis was 26\(\frac{1}{2}\) billion dollars. They concluded that the amount of damage was great enough to justify large expenditures for the control of tuberculosis.

In recent decades there have been many classic American studies: Fein (1958) looked at the costs of mental illness; Weisbrod (1961) considered polio, tuberculosis, and cancer; Blumenthal (1959) analyses the consequences of peptic ulcer; Holtmann (1964) looked at alcoholism; and Klarman (1965) undertook a study of the economic impact of syphilis. Klarman's work on syphilis includes an interesting discussion of the methodological problems involved in the evaluation of consumer benefits derived from medical care, the insurance principle, and the discounting process. Klarman begins by estimating the incidence of syphilis for the current year and projects the distribution of the total by the stage and year of discovery. He then calculates the lost output (using average earnings) and medical care expenditures associated with the new cases of syphilis by stage of discovery and attempts to measure the loss of consumer benefit, which includes an attempt to evaluate the effects of stigma.

In many of the earlier studies a simple aggregate model of the economy is used to derive the value of man, and this figure is then applied to the epidemiological data. A similar approach is to be found in the recent studies of birth control in developing countries. Early workers in Britain and America assumed that man contributed to the future wealth of society. In the developing countries, however, models stress the parasitic aspect of man. In these studies the objective is taken to be the maximization of output per head; population is not thought to have much impact upon output per head but the ratio of output to population can be increased if population is limited. It is from this sort of assumption that Enke (1973) and others have derived their arguments in favour of birth control. Enke compares the effects of birth control with more conventional investment projects in the raising of per capita income. He concludes:

If economic resources of a given value were devoted to retarding population growth the former resources could be 100 or so times more effective in raising per capita incomes in many L.D.C.s.

This approach has been criticized by other economists (i.e., Leibenstein, 1969; Simon, 1969) who, while being broadly sympathetic towards birth control campaigns, find the methods used to evaluate the campaigns to be too simplistic. More sophisticated models are necessary to predict usefully the effects of birth control programmes or in fact of any project which has significant impact upon the many aspects of the economy. Such models have been used by Coale and Hoover (1958) to measure the effects of birth control in India and by Barlow (1967) in his estimates of the effects of the malaria eradication campaign in Ceylon. Barlow was concerned with estimating the effects of the campaign on Ceylonese per capita income during a 30-year period following the successful campaign of 1947. He simulated the course of income with and without an eradication campaign and found that initially the programme did raise per capita income but that this effect was diminished when the increased population which resulted from the reduction in mortality began to make demands upon the economy. Although one may disagree with Barlow about the assumptions of his model it is only from the use of models and simulation studies such as these that we can hope to measure the impact of large-scale programmes. Peter Newman (1967), in his appraisal of the Barlow study, concludes with a plea for:

...public health workers interested in the problem of evaluation to recognize that it is deceptively difficult and to understand and sympathize with the complexities contained in such work as Barlow's. These are not introduced as mere economic pyrotechnics but are inherent in any adequate handling of the problem. Simple-minded models will not work.

In the British literature the classic study is, of course, the work of Reynolds (1956), whose work was developed by Dawson (1967) and Allsop (1972), on the costs of road accidents. This does not, however, provide an argument for allocating funds to the health service, but is attempting to justify expenditure on prevention of road accidents by indicating the benefits in terms of hospital costs and productivity which would be recouped if accidents could be reduced.

Beveridge and the other architects of the British National Health Service all pointed to the potential of the health service as an investment which should...
increase the productive capacity of society. But recently we seem to have lost all zest in our attempts to achieve more money for the health sector by using economic arguments. Has the investment aspect of health provision been exhausted and must we accept Salter's (1972) pessimistic view of the results to be expected from such studies?

We think that dangers for us are firstly, that with the new techniques of economic appraisal greater shares of public expenditure may go to those sectors which can show clearly an economic return on investment and that our unconscious bias may develop towards favouring the economic rather than the social programmes. Secondly we fear that even with the social programmes health and welfare will suffer by comparison, for example, with education and roads because we cannot express our needs in mathematical terms nor show that better returns will come from an increase in health and welfare expenditures.

Maybe expenditure on health care now contributes less than previously to increasing productivity. But health care involves more direct 'consumer' benefits, which we need to measure. These measurements will be difficult but they should be attempted. There is another reason for the lack of faith in the method. This is related to a defect in budgetary arrangements rather than returns to health. This defect is highlighted in another quotation from Salter:

We do not get credit, so to speak, for off-setting economic benefits and have to contain expenditure within a predetermined total. Even though the benefits of spending £x may be obvious, we may still not be able to spend it simply because we haven't got it.

Budgetary policy at present does not take into account adequately benefits which accrue to other sectors in the economy or to society as a whole when allocating funds to public services departments. Maybe it is for this reason that the great majority of studies in Britain in recent years have been concerned with the second aspect of the problem of resource allocation, i.e., with the allocation of resources within the health sector.

**Resources within the Health Sector**

There are many studies in this area, and the following broad classification may be a useful way of considering them:

- Alternative types of care
- Alternative place of care
- Alternative time of care

**Alternative Types of Care**

Those studies which are concerned with simple clearly defined problems are the ones which possibly have most impact. For instance, the study of Piachaud and Weddell (1972) compared cases of varicose veins treated by two well-defined methods— injection compression therapy (an out-patient therapy) and surgery. About three-quarters of a group of patients had their condition surveyed and were allocated at random to the two therapy procedures. The procedures were costed and these costs were related to the findings of a follow-up study three years later. Although there was no significant difference shown in the medical outcome of the procedures after that lapse of time the comparative treatment costs were £9.77 per case for injection-compression treatment and £44.22 for surgical treatment.

Another interesting study in this category is the study of Klarman, Francis, and Rosenthal (1968) of renal dialysis and renal transplantation for kidney failure. The question in this study is:

Under existing conditions of knowledge regarding cost and end result of treating patients with chronic renal disease, what is the best mix of center dialysis, home dialysis and kidney transplantation?

It is concluded on the basis of epidemiological data, which include speculative projections, and the costing information that transplantation is economically the most effective way to increase the life expectancy of persons with chronic kidney failure. The authors admit, however, that the lack of suitable transplant organs is a severe constraint and they suggest changes in the law and research to deal with the supply problem. The relative cost of a year of life saved by the different techniques was $2.60 for transplantation and $11.60 for dialysis at a treatment centre and $4.20 for dialysis at home. It would be interesting, though difficult, to include as a benefit the possible technological 'spin-off' to other fields of the differing techniques.

McCaffree (1966) studied the changing methods of the care of the mentally ill. He makes a comparison of the relative economic efficiency in an institutional setting (the State Mental Hospital in Washington State) and the new intensive therapies. In order to compare the systems he uses the average costs per patient as a measure of economic efficiency. After a detailed breakdown of costs, including loss of income, he concludes that:

The grand total state and private costs per patient are 30% less under intensive care than under a custodial programme.

In his study of the general benefits of birth control programmes, mentioned above, Enke (1973) also includes a section on the cost effectiveness of the various methods of birth control and considers the choice of method according to whether its acceptability or the budget is the constraint.
ALTERNATIVE PLACE OF CARE

The studies which concern themselves with the place of treatment are of particular interest, especially at a time when the high cost of residential care has led to the demand from many quarters for a reduction in the days of hospital in-patient stay.

Care of the elderly is a growing problem in our society and so the contribution by Wager (1972) is most interesting. He attempts to consider the cost of caring for elderly persons living with various degrees of disability—measured by a health indicator—in their own home or in residential accommodation. He considers various qualities of home care and the supplementary care which would be desirable and also the size and efficiency of the residential homes. He finds the large ones slightly cheaper but sets this information against the evidence of institutionalization of elderly persons provided in the work of Townsend (1962).

McCaffree (1968) also considered this aspect of the care of the mentally ill. He compares the treatment in psychiatric wards of general hospitals, in the treatment centres, and in acute treatment services of a state mental hospital. The paper includes a wide ranging discussion of the methodological problems involved in such studies and enumerates the difficulties which were found in estimating per patient costs. He points to the need for an index of severity before unequivocal estimates of economic efficiency are possible. He estimated that the average per patient direct costs were less in day treatment centres and in general hospitals than in the state mental hospital.

Both Babson (1973) and Ferster and Pethybridge (1973, 1974) have considered the costs of different regimes for maternity care. They found that domiciliary care and general practitioner units tended to be more expensive than consultant units when no intervention was needed. Babson (1973) also studied the cost of day care and traditional in-patient treatment for hernia and varicose veins and found that for these conditions day care is considerably cheaper.

Brooks (1969) in Edinburgh has looked at the use of a rheumatology clinic. He finds it is a 'good investment' for males but for females it was much less justified. As Glass (1973) points out in his review, this analysis by Brooks indicates the limitations of using earnings as a measure of benefits of medical care.

There is also the large volume of work done by Crombie and Cross (1959, 1963) and Crombie (1972) on the evaluation of home and hospital care. In 1954, for example, in a study attempting to estimate the cost and effectiveness of home care and of serious illness, they found that it cost the family £6-8 to care for the patient at home, whereas it would have cost £30 in a hospital.

ALTERNATIVE TIME OF CARE

This is the realm of preventive medicine. It is an enormous field covering the broad aspects of public health measures, environmental issues, immunization programmes, and early detection screening programmes. These studies are concerned with health care programmes which (a) prevent or lower the risk of a disease occurring at all (i.e., primary prevention); or (b) detect and treat the disease early in its history (i.e., secondary prevention).

PRIMARY PREVENTION In the first category are the various vaccination campaigns. In his survey on cost-benefit studies, Teeling-Smith (1972) refers to the polio study carried out by the Office of Health Economics (1973) as:

one of the first major blows to our earlier tacit assumption that progress in medical care and preventive medicine in particular could normally be assumed to bring economic benefits.

In this study it was found that the cost of treatment and support for individuals taken together with their loss of earnings would exceed the cost of the polio vaccination campaign only if it was assumed that the epidemic of the late 1940s and early 1950s had continued. This Teeling-Smith sees as an indication that:

Economic savings in these cases are a bonus in addition to the personal benefits of medical care; they cannot be expected to justify expenditure on health services as a whole.

Thus, in economist's jargon, the 'investment potential' was small and we were to rely on the 'consumption aspects' of health care to justify our expenditure. The results are superficially reasonable, but Weisbrod (1971) concluded:

Except under the most extreme assumption this research is raising output and reducing treatment expenditures in amounts producing a rate of return on the research and application costs of at least 5% and probably 11-12%.

Weisbrod (1971) considers that the economic benefits of the prevention of polio consist of the avoided loss of production caused by the death and incapacity of persons having polio and the costs of resources devoted to treatment and rehabilitation. These benefits are to be set against the costs of discovering the vaccine and organizing and implementing the
vaccination campaign. Thus, even when the research costs are included, the American study shows a higher rate of return than the British study. Why is this? One of the most important explanations of the difference in their studies is the time span considered in the studies. Had both treatment costs and preventive costs been projected into the future and discounting procedures used the Office of Health Economics results would have been rather different.

Another study of a vaccination campaign is that undertaken by Mosley, Bart, and Sonmer (1972) of the cholera control programme in East Pakistan. They found that for the population as a whole the effectiveness of the vaccine programme over a three-year period was only 44% and there was little residual protection after two years. They considered medical treatment of patients in both temporary and permanent hospitals to be an alternative to the vaccination campaign. The vaccination campaign was found to be more costly and less effective than the setting up of a temporary hospital.

Laing's (1972) polemical study of birth control could also be viewed as demonstrating alternative times of providing care or service. Laing estimates the possible financial implications to public authorities of the lack of birth control facilities.

**Secondary Prevention** The predominant aspect in secondary prevention is, of course, the evaluation of screening procedures. In his paper on the economics of mass radiography, Pole (1972) refers us to two objectives of screening—the identification of communicable diseases, and the need for early diagnosis to improve prognosis. He found that the cost of discovering an acute case by mobile and static units was £414 and £323 respectively. The costs of treating a case of tuberculosis found by screening do not appear to differ materially from those of treating symptomatic cases. The general conclusion appears to be that the policy should be to follow up contacts, survey high-risk groups, and rely on self-referrals for the remainder. In a review of the literature, Pole (1972) considers a number of screening processes, including a search for bacteruria where he finds a rough balance between the costs of treating and screening, and breast cancer where costs of treatment seem likely to be small in comparison with the cost of finding the cases. Kodlin (1972) provides an elegant framework in which to consider screening for breast cancer, in which he divides the cases into the number of true/false positives and true/false negatives and adds up costs in each cell after weighting them with the probable frequencies. He thus derives the costs of the screening process which can be set against the cost of the conventional treatment. This framework will no doubt be used in many subsequent studies.

**Problems, Limitations, and Usefulness**

The aim of these studies evaluating expenditure on health care is to provide information which will enable us to use our resources more efficiently. If they are to have any special significance for the optimization of society’s resources, we would like them to be presented in the form of a rigorous cost-benefit study. However, such studies would involve the estimation in money terms of all the costs and benefits to society of the various procedures or programmes under consideration, a difficult and costly exercise. Many of the papers considered in this survey make no pretension to be cost-benefit studies, and it would be otiose to criticize them from that standpoint. They all attempt to consider the advantages and disadvantages of undertaking certain regimes of health care and, as such, provide useful information for decision taking. The usefulness of a study to planners and organizers of services depends upon:

(a) the thoroughness of the study and the information it provides; and

(b) the acuteness of the planners in their interpretation of the results, and their examination of the assumptions upon which the studies are based.

In the interpretation of the economic aspects, some points should be borne in mind. There are many problems involved in deriving accurate costs from the accounting returns, which have been discussed by Mason, Perry, and Skegg (1973), but what do the costs which we obtain tell us? Usually they give us information about the present operating efficiency of the units concerned, and so our choices may be made between or among inefficiently organized regimes. Too few of the units considered are in any sense standard or representative of their type; many others are in fact studies carried out in America, which cannot easily be translated to the British framework. More information is required about the physical resources used, the size or scale of the unit, and the efficiency with which it is operated if these studies are to be useful planning material. Costs tend to be subject to high variation. To deal with this problem it would be useful and interesting if it became standard practice to include some sort of sensitivity test in such studies so that planners could assess the variables which are likely to have most impact on costs if changes occur.
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Another related aspect is the problem of externalities. Different caring regimes change the distribution of health care costs among individuals and other service sectors. It is important that all costs are included in the study, because the economic rationale of public expenditure is that it provides a way of taking into account the costs and benefits for society as a whole. To departmentalize the evaluation of projects to save money for the individual sectors of the economy would be defeating this objective.

The outcomes of health care projects, even if not evaluated in money terms, as would be required for a cost-benefit study, must be specified as fully as possible, and the differing distributional impacts of the regimes should not be forgotten. For example, the introduction of different types of cardiac management might well affect the distribution of mortality between rural and urban populations, or between coronary heart disease patients who do and those who do not suffer ventricular fibrillation. These matters should be kept in mind.

The end results of such studies are seen by some to be the development of a matrix, showing the relative merits, usually in terms of lives saved, of the various health care procedures from which we could read off our ‘best-buy’ within the health sector. Some problems have to be faced before we can usefully employ such a method. Klarman (1965) mentioned an important problem which will complicate such evaluations, i.e., that there will be interconnections between the programmes, which may cause some benefits to be double-counted and some costs to be over-estimated. There is no doubt that we value the prevention of death differently in different circumstances, and before we consider this irrational we must attempt to consider the factors which appear to influence our evaluations, such as how we take into account the quality of life saved, the age of the person, and whether the risks were self-imposed or autonomous. We can begin to do this by considering the values of life implied in the current allocation of our resources. These matters are discussed and developed by Mooney (1973).

Another limitation which seems to appear in the use of this approach is that there is a tendency to consider ‘all-or-nothing’ programmes. Health care is not a homogeneous commodity, and different results would often be achieved by caring for more or less severe cases; in fact the cut-off point is often arbitrary. It would be interesting to consider the spectrum of the disease before we make decisions about which diseases to treat. We should be asking ourselves how much of each disease to treat, that is, move towards a ‘marginalist’ approach.

The economic evaluation of health care regimes has a long history but the techniques used are not as yet very refined. At best, economic evaluations, be they cost-benefit analyses or cost-effectiveness studies, can erode some of the area of the unknown, at worst they can mislead. They will not provide clear-cut information for decision making. They will need to be interpreted with care by the policy makers, who should be reminded that there are many techniques in economics which could aid planners in using resources more efficiently. Information is expensive. We should choose among the techniques available for providing information and choose the one which yields us most benefit for funds expended.

REFERENCES


