KING'S FUND COLLEGE OF HOSPITAL MANAGEMENT

GLOSSARY

for

THE APPRAISAL OF HEALTH SERVICE PROJECTS

using

COST-BENEFIT ANALYSIS

GLOSSARY

ANNUITY FACTOR

See Annuity Tables.

ANNUITY TABLES

If constant annual net benefits are assumed annuity tables may be used to determine the present value. The tables will give the present value of an annuity of 1, for the period of the constant flow of benefits, at the specified interest rate. The present value for an annuity of 1 is known as the annuity factor. The total value of the benefits multiplied by the annuity factor will give the present value.

AVERAGE EARNINGS

The mean gross earnings which are published in the Employment and Productivity Gazette.

BENEFITS

May be direct or indirect. The direct benefits of medical care in an economic sense are those for which the community is willing to pay. They are represented by the costs of medical care. Indirect benefits are included in the external effects of a project. Care must be taken to avoid the double-counting of indirect benefits.

COLLECTIVE GOODS

These goods have the characteristics (a) that consumption of them by an individual does not reduce the amount available to others and (b) that they are available to an individual whether he wants them or not. Environmental health services and national defence are collective goods.

CONSUMPTION VALUE

The price which a person is willing to pay for the benefit of a good or service.

COST-EFFECTIVENESS

A modified form of cost-benefit analysis, which is used when costs and benefits are difficult to measure or to express in units which are commensurate. The aim of a cost-effectiveness analysis may be either to determine the cheapest means of achieving a given objective or to obtain the maximum value for a specified expenditure. Externalities will normally be excluded.

COSTS

Direct costs include capital expenditure and operating costs. There may also be some intangible costs which are directly associated with an investment, such as the loss of an environment of historical interest on the replacement of an old building.

Indirect costs will include all social dis-benefits which have not been evaluated in any form.

See also under "External effects".

CUT-OFF POINT

Some external costs and benefits have a secondary effect of producing further costs and benefits. In order to avoid double-counting it is desirable to define the extent to which external effects should be pursued. The limit is known as the cut-off point.

DEATH

See "Value of human life".

DEPRECIATION

No allowance is made for depreciation in the technique of discounted cash flow as receipts and payments are entered under the year in which they occurred.

DISCOUNTED CASH FLOW

Determination of the net costs and benefits (cash flows) accruing to a capital investment during a year and the discounting of their value in order to obtain their present value. A table of present value factors gives the discounted values of £1 for different periods and at different interest rates.

DISCOUNTING

The application of a discount rate to compute the present value of a future cost or benefit. In the British nationalised industries the rate employed is known as the Test Discount Rate. Tables of present value factors give the present value of £1 received at different future times for various rates of compound interest (discount rates). If end of year tables are used, the present value factor will be slightly higher than in mid-year tables.

End-year discounting assumes that all costs/benefits occur on the last day of the year. This is for convenience and will not seriously affect the net present worth, provided both benefits and costs are calculated on the same basis.

DISTRIBUTIONAL CONSTRAINTS

The limitations imposed by a need to maintain a fair distribution of benefits and costs. When the public object to the closing of a local hospital and the centralisation of services on a district general hospital, they are in fact complaining that distributional constraints are being ignored. Any form of compensation resulting from a redistribution of benefits (e.g. the provision of additional transport) must be included in the costs.

DOUBLE-COUNTING

A project may result in benefits which in turn produce secondary benefits. An improvement in health is a benefit which may have a multiplier effect. An increase in work output may result in further increases. In particular, individuals may profit financially from projects. All such secondary benefits should not be included in the evaluation if they stem from benefits which have already been evaluated. It may, however, be useful to record them, but to note that they should not be evaluated.

EQUIVALENT ANNUAL COST

This is a means of using the discounted cash flow technique in order to appraise alternative projects with different durations of life. An example is the purchase of equipment having an expectation of life which varies according to the cost. For each project the cumulative present value, at the acceptable rate of return, is divided by the sum of the present value factors at that rate over the life of the project, i.e. by what is known as the "cumulative present value factor".

EXOGENEOUS FORECASTING

Forecasts used in a cost-benefit analysis which have been obtained from secondary sources, e.g. population projections by the General Register Office or by planning departments of local authorities.

EXTERNAL EFFECTS (EXTERNALITIES)

These are the costs and benefits which were not included in the budget and are additional to the direct operating costs and benefits. They are mainly the social consequences of projects, and must be taken into account in order to be able to appraise the social optimality of a project. Financial effects may be described as "pecuniary spill-overs", whereas non-financial effects are "technological spill-overs".

INCAPACITY

Inability to work. The period of incapacity of patients treated in hospital will be the duration of stay plus days off work for convalescence or further home care. If earlier discharge is followed by a compensating additional period of convalescence it will be necessary to consider whether there has been a resultant increase or decrease in work output. Earlier discharge may result in an increase in the work output of a housewife since she will be discharged to her working environment.

INTANGIBLES

Intangibles may be benefits such as comfort, convenience, sympathy and enjoyment, or the corresponding dis-benefits (costs). They may be either direct or indirect costs and benefits. As good health and other positive benefits are difficult to quantify, it is suggested that the removal or postponement of dis-benefits should form the basis for the evaluation of intangibles.

Intangible dis-benefits may be regarded as a form of disability to the person affected. They have accordingly been placed in two groups according to the degree to which they affect a person's capacity to work and to enjoy living. For their valuation reference has been made to the monetary values assigned by society for industrial injuries.

In the United Kingdom, with effect from 5.11.69, the basic rate for 100% disablement is £8.8.0. per week. In addition the pensioner is likely to receive an unemployability supplement of £5.0.0. per week if incapable of work. The pensioner may be entitled to other allowances for his family and for constant attendance.

MUTUAL EXCLUSIVENESS

This situation occurs when the selection of one alternative excludes another alternative, e.g. the use of a ward for obstetrics will exclude its use for psychiatry. The choice between hiring or buying a particular piece of equipment is another simple example of mutually exclusive alternatives.

In order to ensure a balanced programme of health care, it has been suggested that the selection of priorities should be based in the first place on the need for care. Any problem of mutual exclusiveness involving ethical or political considerations should be considered at that stage, before the application of cost-benefit analysis to assist in the choice between alternative means of providing services.

NET PRESENT VALUE

See under 'Net present worth'.

NET PRESENT WORTH

The aggregate value of all future benefits, expressed at their net present value by discounting, less the present value of capital expenditure, operating costs and all other costs. Externalities should be included in the computation.

OPERATING COSTS AND BENEFITS

These are the financial income and expenditure on a project (e.g. in the United Kingdom, the revenue consequences of capital schemes) and the benefits which are the primary purpose of the project. External costs and benefits are excluded.

OPPORTUNITY COST

The interest or benefit which could be obtained from the best alternative investment, i.e. the cost of investment forgone. Opportunity cost should be allowed for in shadow prices. Social opportunity cost is the value to the community of the next best alternative to the proposed investment.

PLANNING, PROGRAMMING AND BUDGETING SYSTEM (P.P.B.S.)

A detailed analysis of objectives, output, total costs, alternatives and methodology of government programmes. The system includes cost-benefit and cost-effectiveness studies.

PRESENT VALUE

The value of a future benefit or cash flow after discounting at an appropriate rate of interest to allow for the time factor. It is the reverse of the future value of a present sum of money at compound interest. Present value factors for £1 are given in discount tables.

Assuming that 100% disablement, valued at £13.8.0. per week may be equated with the major dis-benefits listed below, the minor intangible dis-benefits may be rated at the 50% disablement rate with exclusion of the unemployability and comforts allowances, i.e. at a basic rate of £4.4.0. per week. These rates would then be applied only for so long as the dis-benefits are expected to last, or to be relieved, in respect of all persons affected, whether patients, friends and relatives, the staff of the hospital or the public. This reduction to 50% for minor dis-benefits is arbitrary and subjective. However, the rate could be determined by a sample of informed opinion.

Major dis-benefits: pain, disablement, anxiety, depression, sleeplessness.

Minor dis-benefits: discomfort, lack of privacy, restriction on movement, poor food, boredom, uncongenial environment, inconvenience for visiting, over-crowding, embarrassment, unkindness, annoyance.

INTERNAL RATE OF RETURN

The yield on an investment, i.e. the discount rate which equates the cumulative present value of benefits with that of costs, is known as the internal rate of return. It may be found by plotting on a graph the ratio of cumulative present values of costs to benefits at four widely different discount rates and then drawing freehand a smooth curve through the four points. The discount rates should be shown on the vertical scale since the rate of return is read from the vertical scale by drawing a horizontal line from a ratio of 1 : 1 so that it intersects the curve. A ratio of 1 : 1 indicates that costs and benefits are equal. The point of intersection will give the internal rate of return or yield of the project.

If in any year following the years in which the initial capital expenditure was incurred, costs exceed benefits, the value of the costs may be deducted from the previous year's benefits. Benefits will then be shown as nil. If, however, the previous year's benefits are insufficient to absorb the costs of the following year, the present value method should be used instead of the internal rate of return.

LIFE

See 'Value of Human Life'.

LIFE OF A PROJECT

The period over which the costs will be spread and most of the benefits (say, 90%) may be anticipated. The higher the discount rate the less important is likely to be the life of the project, for the present value of costs and benefits at a time horizon of over 20 years will be negligible at the present test discount rate of 10%. However there will be considerations in each project which may affect not only the optimum life but also the scale of the project.

PRESENT VALUE FACTOR

The present value of £1 received at a future specified date at a specified rate of compound interest. The present value factor is the reciprocal of the value of £1 at compound interest for the same period and rate of interest.

RATE OF RETURN

See under 'Internal rate of return'.

RISK

The calculated probability of changes in the estimated costs and benefits should be included in the shadow prices for each item. Inclusion of a risk premium in the discount rate distorts the element for social time preference and fails to take into account variations in the degree of risk for different items.

SCRAP VALUE

The value of land, buildings and equipment replaced by new developments. The value should be entered as a cash flow in the year when it is expected to be received.

Each project should be appraised over a defined period of time. At the end of that period of time, there will probably be a terminal scrap value. No allowance is made for depreciation in the technique of discounted cash flow.

SENSITIVITY ANALYSIS

Computation of net costs/benefits of alternative projects, one of which should represent the probable valuation. The alternative assumptions are made by varying the shadow prices and other variables. Mathematical models may be constructed and simulation studies carried out by computer for the several possibilities.

SHADOW PRICES

The values placed on externalities. Care must be taken to be objective for there is a risk of personal bias when pricing intangibles. An administrator will be influenced by his own social and economic background and may have difficulty in interpreting the views of other sections of the community. The shadow price of a service or good should represent its social value. There may be a market price which is applicable, but market prices should not be accepted uncritically. To illustrate this point, although the work of a housewife is similar to that of a domestic worker, an additional allowance may be appropriate in order to take into account her social value as a key member of a family. It is accordingly suggested that housewives' time be valued at the appropriate gross earnings of women, i.e. at the opportunity cost, rather than at the rate paid to domestic workers.

SOCIAL OPPORTUNITY COST

See 'Opportunity cost'.

SOCIAL TIME PREFERENCE

The preference for immediate rather than future benefits. The social time preference rate is the interest rate which represents reluctance to sacrifice current for future consumption.

SPILL-OVER EFFECTS

See 'External effects'.

STAY

The mean duration of stay in days for all hospitals, excepting long-stay hospitals, may be calculated by dividing the number of occupied bed-days by the number of discharges and deaths.

TEST DISCOUNT RATE

This is the minimum rate of return which investments of the nationalised industries are expected to earn on purely financial grounds. The rate is higher than the interest paid by the Government on the relevant loan capital in order to prevent too great a proportion of the limited resources which are available for investment, being used for the public sector: private firms cannot borrow on gilt-edged terms. The rate is similar to the minimum return before tax which would be regarded as acceptable on new investment by a large private firm of good standing engaged in low-risk business.

THROUGHPUT

Throughput of patients per bed during a specified period is calculated by dividing the number of discharges plus deaths in the period by the number of beds.

TRAVEL COST

The cost of vehicle operation, road maintenance, accidents and intangibles such as noise and dirt.

See also 'Travel time'.

TRAVEL TIME

Loss of time on travel which would normally be spent on work will usually be more costly to the individual and to society than loss of leisure time.

Age, sex, and personal income may be factors in particular situations. As a guide to recent thinking, the following values have been used in cost-benefit studies:

13/6d. an hour for working time) Road Research Laboratory Report
3/0d. an hour for leisure time) No. LR.165, 1968.

12/0d. an hour for working time) Appendix J. of the Transport in
3/0d. an hour for leisure time) London White Paper, July, 1968.

It should be noted, however, that there is a danger in applying such values arbitrarily without consideration of the prevailing local circumstances.

The value of an individual's travel time by private car will slightly undervalue the loss of output, since each extra journey will slightly lengthen the travel times of other people. The cost of journeys to hospital will consist of (a) the monetary cost, and (b) the time lost.

TURNOVER INTERVAL

The turnover interval may be calculated by dividing the number of empty bed-days by the number of discharges plus deaths in the same period. It is the mean number of empty bed-days per patient or, in other words, the average number of days a bed remains empty between the discharge of one patient and the admission of the next patient.

UNCERTAINTY

Uncertainty will occur where risk or probability cannot be estimated. Allowances may be made for uncertainty when fixing shadow prices and when determining the period which the appraisal is to cover (the life of the project). The discount rate will also allow for uncertainty. Since it is a function of time, it will affect the life of the project: the higher the rate of discount the less important will be costs and benefits in the more distant future.

See also 'Sensitivity analysis'.

VALUE OF HUMAN LIFE

The stream of future earnings less consumption, discounted to the total present value, is usually taken as the basis for the valuation of human life in cost-benefit studies. In reality, the value of life on the basis of what society will pay in order to save it, or to prevent death, varies enormously. In the United States, in 1966, the cost per life saved by the cervical-uterine cancer screening programme was estimated at $3,470, whereas the cost per life saved by head and neck cancer detection research was $29,100 (Hovey p.123). Against these figures the cost value assigned to a general aviation fatality in the same year of $422,000 (Dorfman p.196) is high indeed. In the Road Research Laboratory Study on Crash Helmets for Motor Cyclists (R.R.L. Report No. LR.72, 1967) the economic cost of fatal casualties ranged from £1,910 to £8,130 each. In 1960 for the M.I. Study (published by H.M.S.O.) the cost of a fatal casualty was estimated at £2,500. These low values for young men and women are due to the deduction of the value of the consumption of resources by an individual. Without such a deduction the value of human life has been estimated by J.E. Hayzelden at about £30,000. A method of evaluation, for the purpose of hospital project appraisal, has been suggested in the introductory outline. This is a subject, however, which requires much further study.

WORK OUTPUT

The value of work output gained or lost is an important external effect of health service projects. A tentative suggestion of a method for estimating the value of work output has been included in the notes on the proforma. However there are clearly many problems and much further study of the subject is necessary. The value of the work of a housewife, of an active retired man and of all those who spend their leisure on voluntary work or on "do it yourself" activities, should be considered. There is also the problem of how to value short periods of time gained or lost. In the U.S.S.R. the loss of work output due to poliomyelitis deaths and disablement was estimated on the basis of one worker's share of the national income (W.H.O. Health Economics, p.35). For the evaluation of major projects sensitivity analysis is desirable, so that the projects are examined according to a range of assumptions.

YIELD

See 'Internal rate of return'.

KING'S FUND COLLEGE OF HOSPITAL MANAGEMENT

PROFORMA

for

THE APPRAISAL OF HEALTH SERVICE PROJECTS

using

COST-BENEFIT ANALYSIS

EWCS/KWL
10.4.70.

COST-BENEFIT ANALYSIS FORM - HOSPITALS

(All Values in £'s.)

SUMMARY

Year at 31.12	COSTS		Present Value Factor (10%)	BENEFITS	
	Current at 31.12.	Present Value		Current at 31.12.	Present Value
1			0.9091		
2			0.8264		
3			0.7513		
4			0.6830		
5			0.6209		
6			0.5645		
7			0.5132		
8			0.4665		
9			0.4241		
10			0.3855		
11			0.3505		
12			0.3186		
13			0.2897		
14			0.2633		
15			0.2394		
16			0.2176		
17			0.1978		
18			0.1799		
19			0.1635		
20			0.1486		
Cumulative Present Values	—		—	—	
NET PRESENT WORTH					

Detail for year ..... at prices current at 31.12.

	COSTS	BENEFITS
Providing Authority		
Net operating costs or benefits (1)		
Staff travelling and other time gained or lost (2)		
Major intangibles (3) " " "		
Minor intangibles (3) " " "		
Other externalities " " "		
Patients		
Time gained or lost (2)		
Deaths		
Major intangibles gained or lost		
Minor intangibles " " "		
Other externalities " " "		
Relatives and friends		
Time gained or lost		
Major intangibles gained or lost		
Minor intangibles " " "		
Other externalities " " "		
Public		
Time gained or lost		
Major intangibles gained or lost		
Minor intangibles " " "		
Other externalities " " "		
Note: Forecast particulars on the above lines will be required for each of the years included in the analysis		

EWCS/OMM
19.1.70.

NOTES ON PRO-FORMA

1. Net Operating Costs or Benefits

These are the financial costs and benefits to the health service authority providing the service. The costs comprise capital expenditure plus anticipated revenue consequences (operating costs). If an anticipated change in the value of money will affect both costs and benefits equally, the costs should be estimated in real terms without any allowance being made for the resultant rise or fall in the level of prices. On the other hand, if a rise in real terms is probable, it should be included in the operating costs. Such a rise may, for example, be likely in salaries and wages.

Operating benefits will include any income from the project including proceeds from the sale of scrap. They will include the cost of treatment if it is regarded as the price paid for treatment, i.e. for treatment per se (e.g. relief of pain, reduction of disability), excluding external effects. If the throughput of patients is expected to increase, as a result of a reduction in stay and/or turnover interval, an allowance should be made for a saving in capital costs, since beds will be made available to treat more cases, whereas without the increased throughput further beds would have to be provided.

2. Time gained or lost may be differently valued according to whether it is work time or leisure time. A change in the value to society of work output, resulting from an increase or reduction in the total days of incapacity of patients can be approximately valued by dividing the total number of days of incapacity saved or incurred in respect of patients of working age by seven and multiplying the result by the average weekly gross earnings for the region irrespective of age and sex.

To estimate the economic effect of an increase or decrease in the number of deaths, it will be necessary to calculate the aggregate saving or loss of working life by multiplying the increase or decrease in the number of deaths of patients aged 16 to 65 years by the expectation of working life in years at the average age of death of all patients aged 16 to 65 years dying in hospital. It is suggested that the result should then be multiplied by the average annual earnings expected for the remainder of life at that age. An increase or decrease in the number of deaths of children should be multiplied by the average earnings per annum for a full working life times the expectation of working life in years at the average age of the children.

3. The treatment of morbidity may result in intangible benefits and dis-benefits. A project which provides quicker treatment may give the patient relief from pain and sleeplessness and lessen the anxiety of his family. These are major intangible benefits, for pain, sleeplessness and anxiety may be so intense that productive work and the enjoyment of living are made impossible. They must clearly be priced higher than, say, boredom and irritation at unpleasant sights, sounds and smells, which are of relatively minor importance as disabilities. It must be appreciated, however, that there is a danger of double-counting. The cost of treatment may already have been taken into account and have included the cost of analgesics. A value may also already have been placed on inability to work.

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KING'S FUND COLLEGE OF HOSPITAL MANAGEMENT

THE APPRAISAL OF HEALTH SERVICE PROJECTS USING COST-BENEFIT ANALYSIS

1. INTRODUCTION

The many competing demands made on health service resources point to the need for a rational method of appraisal of alternative investment projects. Cost-benefit analysis aims at providing such a method. It supplements the normal budgeting of capital expenditure and recurring operating charges by attempting to express in financial terms the social costs and benefits of a project, extending over many years. By giving such costs and benefits monetary values and taking into account the time value of money, as expressed by interest rates, it is possible to make valid comparisons between alternative schemes. This searching form of investigation is desirable because the investment decision which is most favourable according to accepted medical and financial criteria may not be the most beneficial to society if its social consequences are taken into account.

This memorandum briefly describes a method of cost-benefit analysis and is intended to form a basis for discussion by multi-disciplinary management courses in the health service. A pro-forma, with instructions, is suggested for the use of persons undertaking an analysis. A glossary and a select bibliography are appended in order to provide additional detail and to assist further reading. Terms included in the glossary are underlined in the following text.

2. SELECTING PRIORITIES FOR MEDICAL CARE

Before attempting to use cost-benefit analysis in the selection of health service projects, it is suggested that needs should be identified and decisions taken on medical priorities and on the standards of care which should be met. The provision of care for the elderly and the chronic sick may thus be safeguarded before the application of economic criteria.

Base-line data for the selection of priorities for medical care will be required:

a) to measure levels of health in the community for the various groups which comprise the population: age-sex and ethnic groups, occupations and industries, administrative and geographically defined populations, urban, semi-urban and rural communities;

b) to ascertain the resources available in terms of time, finance, equipment, materials. persons and skills;

c) to determine the political, social, economic, physical and distributional constraints on the project;

d) to set standards for the provision of services.

A tentative selection of priorities can then be made from these base-line data and any further investigations carried out in order to determine requirements. When requirements have been stated cost-benefit analysis can be applied to choose between alternative means of achieving given ends.

3. VALUATION OF COSTS AND BENEFITS - There are two problems: firstly to identify and quantify all the costs and benefits accruing from a project during each year of its life, and secondly to place values on them so that the net cost or benefit for each year may be estimated. There is one pitfall to avoid in the identification process: the double-counting of the external effects of a project.

For the identification of costs and benefits it is suggested that a project should be examined under headings, according to the persons or bodies affected: e.g. the health service authority providing the care; the patient; relatives and friends of the patient; society i.e. all other organisations and persons affected by the project.

A difficulty may well arise in placing a value on the direct benefits to patients of treatment. Two ways may be suggested:

1) In the first method which is at present proposed only as a subject for the study, the intangible benefits of the removal or prevention of pain and discomfort would be valued according to the percentage of equivalent disablement, as described under the heading "Intangibles" in the glossary. To these benefits would then be added an allowance for any aggregate loss of function or loss of life which would be suffered if treatment were not given. The basis of the allowance might be the mean value of the individual patient to the community, as indicated by gross earnings or by pension, thus merging direct with external benefits.

This method would provide a means of comparing the estimated value of treatment to the actual cost, but presents formidable difficulties in the estimation of dis-benefits prevented and life saved. The result might not be realistic as a consumption value.

2) In the second method, medical care would be regarded as a consumption good which is bought for its own sake. Payment made for treatment would be regarded as the consumption value. In a nationalised service, where the cost of treatment is met by taxation, the cost would be regarded as the value.

This method has the advantage of simplicity. However, it is not strictly logical and must be regarded as an expedient which serves to clear the way for evaluating indirect costs and benefits, and the investment value of a health project. It has the advantage of ensuring that a value is placed on the care provided for people who would appear to have no economic value to the community. The value is, moreover, the sum which is actually spent by society. Whether the cost itself is justifiable must depend upon other criteria.

4. EXTERNAL EFFECTS OF HEALTH SERVICE PROJECTS.

A project for the improvement of personal or public health will have external or spill-over effects in addition to the direct results intended. Thus, the centralisation of hospital treatment facilities in a district general hospital may improve personal health and national productivity on the one hand, but increase road traffic congestion and accidents, with consequent loss of productivity, on the other hand.

Some external effects of health service projects may be readily quantified whereas others appear to be incommensurable. In the valuing of intangibles there are particular difficulties which are discussed in the following paragraph. There is also a risk of bias in both their selection and evaluation, as the health service organisation initiating a project will see the social problems differently from private individuals.

5. INTANGIBLES

Pain as a cost and kindness as a benefit are intangibles. To express them in monetary terms by means of shadow prices seems unrealistic. They must, however, be included in the appraisal in some form if they are factors in the project and quantification in a unit of measurement which permits comparison with other costs and benefits appears to be the best solution. Failure to measure an externality is to risk its omission from an appraisal.

It is suggested that the cost and the benefit of intangibles will depend upon their duration and their intensity. They have therefore been classified in the pro-forma into major and minor intangibles according to the degree or extent to which they are likely to affect capacity to work and to enjoy living. Thus pain, depression and sleeplessness have been listed in the glossary as major intangible costs, whereas boredom and annoyance (for example , at an uncongenial environment) have been regarded as minor intangibles, and costed at lower values for equivalent durations of time. The classification is subjective and arbitrary but could be based on a sample of public opinion.

6. THE VALUE OF HUMAN LIFE

The value of human life is a problem which inevitably frequently arises in the appraisal of social investment. Average earnings in the course of an average length of working life provide the basis for the values calculated for road transport studies and are net values after deduction of an amount representing the resources of society which the average person would consume. They consequently place a very low value on life which is likely to provide a serious obstacle to the acceptance of cost-benefit analysis for the appraisal of hospital projects. It is therefore suggested that individual consumption should be regarded as an end in itself and that the tax paid by an individual in the course of his life should also be regarded as a consumption good for the services which it buys. Gross earnings are accordingly suggested as the basis for the valuation placed on the work output of human life.

Even without the deduction of consumption by individuals the method suggested may at first seem unacceptable in that it would appear to place a nil value on the lives of those who are unable to work on account of age or disability. However, as was mentioned in the paragraph on the evaluation of costs and benefits, medical care has itself a consumption value and the community is prepared to spend money in order to save life and postpone death of those who are unlikely to be economically productive. Furthermore, it has also been provided that standards of care, and requirements based on those standards, should first be defined. Definition of health care primarily as a consumption good and the selection of priorities for care before the application of cost-benefit analysis are safeguards against decisions taken on purely economic grounds, ignoring ethical considerations. They are, on the other hand, only compromise solutions to a difficult problem which demands thorough study and which must ultimately be the subject of a value judgement.

7. DOUBLE-COUNTING

Double-counting has been mentioned as a pitfall. It would arise if secondary benefits stemming from direct or indirect benefits which have already been evaluated, were included in the analysis. Thus, if better health care in a community has resulted in higher productivity, it would be correct to include a value for the increase in work output, but not for any additional payments made to workers in consequence of the increased productivity.

8. THE TIME FACTOR IN INVESTMENT

Mention was made in the introduction of the need to take into account the time factor when evaluating health service projects. The lapse of time will affect the value of money paid and received. It will also provide an element of uncertainty which enters into any forward look. In the appraisal of alternative plans for, say, treatment facilities, it will be necessary to estimate the values of the flows of costs and benefits of each project over the life of the project, and to express them in comparable units. For this purpose a rate of interest (or discount rate) is used. The values at different periods are adjusted by means of the rate so that they may be summed and compared at a specific point of time, which is usually the present. The technique for the calculation is known as discounted cash flow (D.C.F.).

Discounting is the reverse of estimating future value by compounding interest. The present values of future costs and benefits are found by multiplying their monetary value by the present value factor for the selected interest rate and the appropriate period of time, as shown in a table of present value factors. The present value factor is the value of one pound received at the specified future date after discounting. The technique of discounted cash flow may be usefully employed in small as well as large projects. If a constant net benefit is anticipated, the calculation of the present value can be simplified by the use of annuity tables. If the net costs/benefits fluctuate and it is desired to calculate the effective average, the cumulative present value should be divided by the annuity factor (present value of an annuity of 1) for the specified rate of interest and period.

In regard to risk and uncertainty, it is suggested that each cost or benefit should be separately valued, but that if necessary, maximum and minimum values should be estimated. In addition, to facilitate the selection of projects it may be useful to recalculate at several different discount rates in order to determine the best project in varied circumstances.

9. FINAL SELECTIONS

If a "test discount rate", is applied, the net present worth may be found by subtracting the cumulative (total) present value of costs from the cumulative present value of benefits. Alternative projects may then be ranked by net present worth, subject to the constraints of capital rationing.

Another method of comparing two projects is to plot on a graph the ratio of costs to benefits (shown on the horizontal axis) at four widely different discount rates and then to draw freehand a smooth curve through the four points. A ratio of 1 : 1, indicating that discounted costs and benefits are equal, will give a measure known as the internal rate of return. (See Appendix A). The higher the rate the better the project, other factors being equal. However, if a more costly project has a lower rate of return, but the extra expenditure gives a return which is above the test discount rate, the more costly project is to be preferred on economic grounds.

Finally, where different time factors apply to the alternatives under consideration, the equivalent annual cost may be calculated. The method is explained in the glossary. It is useful in quite small projects where, for example, the relative costs of buying a new piece of equipment is to be compared with overhauling the equipment which is at present in use.

10. CONCLUSION

Project appraisal, as at present practised, is less complicated. Uncertainties and intangibles are not quantified. It is natural, therefore, that administrators should be sceptical of cost-benefit analysis. It is necessary that they should be and that they should examine carefully the findings of a cost-benefit study. They would be mistaken, however, if they dismissed the attempt to evaluate social costs and benefits as a waste of time. Recent protests at the spill-over effects of major investment projects in the public sector clearly point to the need for the identification and costing of all social benefits and dis-benefits. The mind of the administrator might boggle at first at the apparent complexity of the task of cost-benefit analysis, but in retrospect he will have no doubt that it stimulated clear thinking and may well have avoided a less than optimal expenditure of scarce resources.

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Calculation for Graphical Interpolation of Internal Rate of Return using Hypothetical Data (all values in £'s)

Net Costs (including externalities expressed in monetary terms)

Year	0%	5%		15%		25%		35%	
	Actual Value	Factor	Present Value	Factor	Present Value	Factor	Present Value	Factor	Present Value
0 1	50,000	0.9524	47,620	0.8696	43,480	0.8000	40,000	0.7407	37,035
1 2	100,000	0.9070	90,700	0.7561	75,610	0.6400	64,000	0.5487	54,870
2 3	100,000	0.8638	86,380	0.6575	65,750	0.5120	51,200	0.4064	40,640
3 4									
OTAL COSTS	250,000		224,700		184,840		155,200		132,545

Net Benefits (including externalities expressed in monetary terms)

1	-	0.9524	-	0.8696	-	0.8000	-	0.7407	-
2	-	0.9070	-	0.7561	-	0.6400	-	0.5487	-
3	20,000	0.8638	17,276	0.6575	13,150	0.5120	10,240	0.4064	8,128
4	70,000	0.8227	57,589	0.5718	40,026	0.4096	28,672	0.3011	21,077
5	90,000	0.7835	70,515	0.4972	44,748	0.3277	29,493	0.2230	20,070
6	90,000	0.7462	67,158	0.4323	38,907	0.2621	23,589	0.1652	14,868
7	70,000	0.7107	49,749	0.3759	26,313	0.2097	14,679	0.1224	8,568
8	50,000	0.6768	33,840	0.3269	16,345	0.1678	8,390	0.0906	4,530
9	20,000	0.6446	12,892	0.2843	5,686	0.1342	2,684	0.0671	1,342
10	60,000	0.6139	36,834	0.2472	14,832	0.1074	6,444	0.0497	2,982
TOTAL ENEFITS	470,000		345,853		200,007		124,191		85,565
ATIO OF OSTS TO BENEFITS	= 0.532		= 0.650		= 0.924		= 1.250		= 1.625

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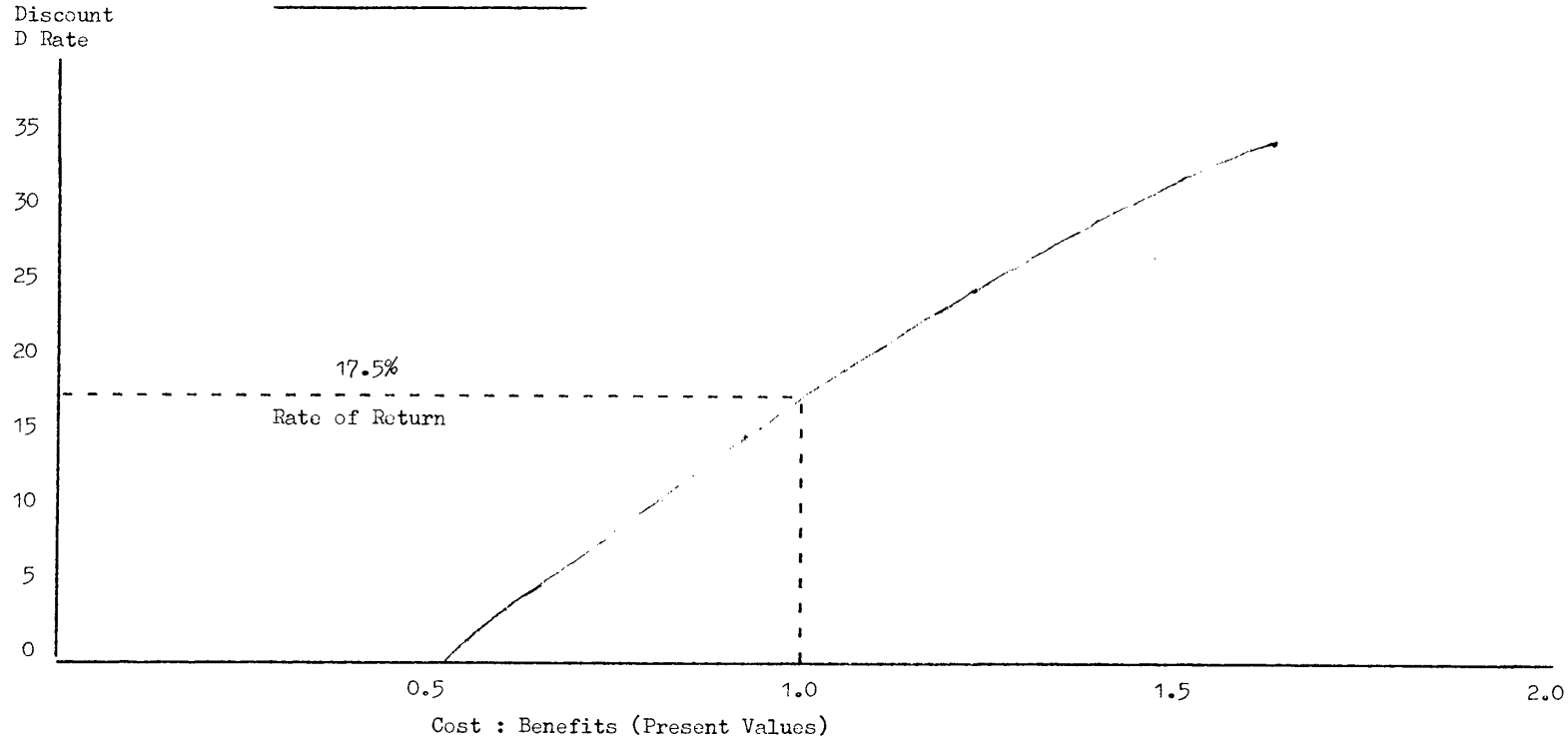
Appendix A (2)

Internal Rate of Return :
Interpolation Graph



KING'S FUND COLLEGE OF HOSPITAL MANAGEMENT

Programme on Cost-benefit Analysis

SENIOR MANAGEMENT COURSE

Monday, 6th June 1970

Display of books and other reference material at entrance to Library.

Wednesday 10th June 1970

9.30.am. Cost-benefit Analysis and its use for the appraisal of Health Service projects.
(E.W.C.Seccombe)

10.00 a.m. Discounted Cash Flow: the technique will be introduced in an extract from an industrial film and will be discussed by an economist.
(K.W. Harry) *

10.45 a.m. Coffee

11.05 a.m. Briefing followed by syndicate discussion.

Thursday 11th June 1970

11.15 a.m. Conference and presentation of syndicate reports.
(Verbal)

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* Mr. K.W. Harry, B.Sc.(Econ.) is Senior Lecturer on Financial Management and Control at the Kingston Polytechnic, Kingston-upon-Thames, Surrey, and was previously a finacial analyst with the Ford Motor Company.

MCS/CMP
29th May 1970

SYNDICATE 'A'

Place of meeting: Ante-room to lecture room on ground floor

Members:
Mr. J.M. Andrews
Mr. A.J. Bannister
Mr. A.G.H. Corney
Mr. C. Dwyer
Mr. W.E. Forgham
Mr. T. Mason
Dr. J.M. O'Callaghan
Mr. R.E. Titley (Chairman)
Mr. K. Vaughan

Tutor: Mr. K.W. Harry

Subjects for Discussion

1. Do the immediate objectives of health service boards and committees, and the limitation of their authority to the field of heath care, provide an obstacle to the application of cost-benefit analysis, since the evaluation of the social costs and benefits of a project may be regarded as falling within the responsibility of other authorities? If so, how can this obstacle be overcome?

2. Suggest a basis for pricing the cost of death, or placing a value on the saving of life of persons in the following age-groups: 0-4, 5-14, 15-24, 25-44,45-64, 65-74, 75+.

3. How suitable are the following subjects for cost-benefit analysis? (Please tick).

	Subjects for evaluation	Suitable	Probably Suitable	Probably Unsuitable	Unsuitable
a)	Screening programmes for the early identification of treatable disease (excluding investigations following patients' requests for advice)				
b)	Rehabilitation and follow-up projects for the prevention of chronic disability				
c)	Health education projects				
d)	Programmes for the control or eradication of specific diseases				
e)	Programmes for the promotion of health (prevention of air pollution, reduction of noise, provision of recreational facilities)				
f)	Programmes for inoculation against specific diseases				
g)	Alternative projects for the provision of curative services				
h)	Alternative compositions of health and medical care teams (affecting the ratio of doctors: nurses: other health workers trained and employed)				
i)	Alternative methods of providing supplies				

SYNDICATE 'B'

Place of Meeting: Lecture Room on ground floor

Members:
Mr. H. Parsonage (Chairman)
Mr. B.F. Chudley
Miss B. Conway
Miss G. N. Crompton
Mr. M.W.J. Haward
Mrs K. Knight
Miss E.Y. Mullen
Mr. C.W. Sheldrake
Miss E.P. Watt

Tutor: Mr. K. W. Harry

Subjects for Discussion

1. Is there a danger that cost-benefit analysis will favour expenditure on medical care in the short term and that long term projects for the improvement of health will tend to be neglected because value of benefits will be negligible after more than, say, twenty years at high discount rates? If this danger exists, could it be avoided by selecting priorities for medical care before the application of cost-benefit analysis?

2. Suggest a basis for pricing the cost of time spent in travelling to and from hospital by persons in the following age groups: 0-4, 5-14, 15-24, 25-44, 45-64, 65-74, 75+ .

3. How suitable are the following subjects for cost-benefit analysis? (Please tick).

	Subjects for evaluation	Suitable	Probably Suitable	Probably Unsuitable	Unsuitable
a)	Screening programmes for the early identification of treatable disease (excluding investigations following patients' requests for advice)				
b)	Rehabilitation and follow-up projects for the prevention of chronic disability				
c)	Health education projects				
d)	Programmes for the control or eradication of specific diseases				
e)	Programmes for the promotion of health (prevention of air pollution, reduction of noise, provision of recreational facilities)				
f)	Programmes for inoculation against specific diseases				
g)	Alternative projects for the provision of curative services				
h)	Alternative compositions of health and medical care teams (affecting the ratio of doctors: nurses: other health workers trained and employed)				
i)	Alternative methods of providing supplies				

SYNDICATE 'C'

Place of Meeting: Basement front room.

Members:

Mr. R.J. Reed (Chairman)
Mr. K.E. Coles
Miss J.B. Davis
Mr. D. Forbes
Mr. W.E. Forgham
Mr. E.M.A. Lindsey
Mr. A. Smith
Miss B.D. Thomas
Mr. A.J. Wall
Mr. K. Wright.

Tutor: Mr. E.W.C. Seccombe

Subjects for Discussion

1. A "crash" programme would result in a reduction of the waiting time for admission by, say, one month, and the reduced waiting period could then be maintained. What benefits to patients should be taken into account in a cost-benefit analysis and for how long should the benefits of a shorter waiting period be regarded as valid?

2. Suggest a basis for pricing savings in empty bed-days through a reduction in the turnover interval.

3. How suitable are the following subjects for cost-benefit analysis? (Please tick).

	Subjects for evaluation	Suitable	Probably Suitable	Probably Unsuitable	Unsuitabl
a)	Screening programmes for the early identification of treatable disease (excluding investigations following patients' requests for advice)				
b)	Rehabilitation and follow-up projects for the prevention of chronic disability				
c)	Health education projects				
d)	Programmes for the control or eradication of specific diseases				
e)	Programmes for the promotion of health (prevention of air pollution, reduction of noise, provision of recreational facilities)				
f)	Programmes for inoculation against specific diseases				
g)	Alternative projects for the provision of curative services				
h)	Alternative compositions of health and medical care teams (affecting the ratio of doctors: nurses: other health workers trained and employed)				
i)	Alternative methods of providing supplies				

SYNDICATE 'D'

Place of Meeting: Basement middle room

Members:
Mr. G. Whittaker (Chairman)
Mr. L.A. Bradshaw
Dr. T.E. Hall
Mr. C.A. Hulbert
Miss M. Livesey
Mr. S.C. Stapley
Miss M. Thompson
Mr. N. Yardley
Miss E.W. Young

Tutor: Mr. E.W.C. Seccombe

Subjects for Discussion

1. Indicate the possible costs and benefits to be considered in a project for the closing of a cottage hospital and the admission of patients to a distrct general hospital which is 10 miles from the small town where the cottage hospital is situated.

2. Suggest a basis for pricing savings in occupied bed-days resulting from a reduction in the duration of stay.

3. How suitable are the following subjects for cost-benefit analysis? (Please tick).

	Subjects for evaluation	Suitable	Probably Suitable	Probably Unsuitable	Unsuitable
a)	Screening programmes for the early identification of treatable disease (excluding investigations following patients' requests for advice)				
b)	Rehabilitation and follow-up projects for the prevention of chronic disability				
c)	Health education projects				
d)	Programmes for the control or eradication of specific diseases				
e)	Programmes for the promotion of health (prevention of air pollution, reduction of noise, provision of recreational facilities)				
f)	Programmes for inoculation against specific diseases				
g)	Alternative projects for the provision of curative services				
h)	Alternative compositions of health and medical care teams (affecting the ratio of doctors: nurses: other health workers trained and employed)				
i)	Alternative methods of providing supplies				

KING'S FUND COLLEGE OF HOSPITAL MANAGEMENT

SELECT BIBLIOGRAPHY

for

THE APPRAISAL OF HEALTH SERVICE PROJECTS

using

COST-BENEFIT ANALYSIS

EWCS/KWL
10.4.70.

SELECT BIBLIOGRAPHY

(Note: (1) = Introductory reading
(2) = Further reading
(3) = Background reading.)

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