Costing interventions in primary care

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Against a background of increasing demands on limited resources, studies that relate benefits of health interventions to the resources they consume will be an important part of any decision-making process in primary care, and an accurate assessment of costs will be an important part of any economic evaluation. Although there is no such thing as a gold standard cost estimate, there are a number of basic costing concepts that underlie any costing study. How costs are derived and combined will depend on the assumptions that have been made in their derivation. It is important to be clear what assumptions have been made and why in order to maintain consistency across comparative studies and prevent inappropriate conclusions being drawn. This paper outlines some costing concepts and principles to enable primary care practitioners and researchers to have a basic understanding of costing exercises and their pitfalls.

Keywords. Costs, economic evaluation, health economics, primary care.

Introduction

Against a background of increasing demands on limited resources, an economic evaluation can assist choices between competing interventions by relating the health outputs (benefits or dis-benefits) of a medical intervention to their inputs (resources consumed), as shown in Figure 1. With an increasing emphasis on a primary care-led NHS, a basic understanding of costing principles and pitfalls will be important for all those involved in the delivery of primary care.

Costs can vary in the way in which they are valued and combined. Studies undertaken at different times or places may not be comparable unless standard costing procedures are used. For example, a recent review of 20 studies that derived the cost of a GP consultation found a range of between £3 and £11 depending on the method of costing used.

Guidelines help to maintain consistency and comparability across studies where uncertainty can arise from variability in sample data, generalizability and analytical methods employed. Some countries have regulatory standards for the conduct of pharmaco-economic evaluations, and there are a number of guidelines for undertaking economic analysis. However, consensus on how costs should be derived has still not been achieved in a number of areas, and there remain reservations about the quality of expenditure and activity data in many areas of the NHS.

Some basic costing concepts

Cost and prices

In classical economic theory, revenue implications of providing a service will usually be measured using the market price of inputs, as this reflects the value that the user places on a resource. In a truly competitive market, prices can be taken as a proxy for costs, and for the most part there will be little need to be concerned for causes of price distortion. Clearly, the NHS is not a true market, and although the NHS Executive have provided guidelines that prices should be cost-based avoiding cross-subsidization (i.e. the revenue from one procedure subsidizing another in a different area), there are wide geographical price variations. These variations rarely reflect provider costs or efficiency differences but are probably due to costing difficulties or market-induced manipulation. Figure 2 demonstrates this point with a selection of surgical out-patient prices from a sample of Trusts across the UK obtained by the author.

Although unit costs rather than price data for hospital services are available from analysis of the programme cost returns of the Department of Health, there remain reservations about the quality of these data. These analyses are likely to improve in the future with the introduction of a national schedule of reference costs and benchmarks for each treatment which will form the basis of hospital cost targets.

Opportunity costs

When resources are limited, someone’s gain is somebody else’s loss. When measuring costs in economic terms, the objective is to identify the opportunity cost, i.e. the value...
of the best alternative forgone in order to provide that service. Consider the cost of a GP increasing consultation time by an extra hour. The GP may work the same number of hours but reduce services provided in other areas, so the opportunity cost is the value of the services displaced. Alternatively, the working week may be extended, so the opportunity cost is that of the GP’s leisure time. In practice, the most appropriate estimate of the cost will depend on the context of the evaluation and the perspective of the exercise.

**Direct and indirect costs**

*Direct costs* represent the resources consumed by the intervention and associated events. For example, direct costs associated with primary care include GP time, practice nurse costs, drugs, and capital costs arising from equipment and buildings.

*Indirect costs* may be tangible, i.e. productivity losses or inputs from carers, or intangible, i.e. loss of leisure time, costs of pain, suffering, uncertainty or death. As indirect costs do not have a market value, costs allocated to them are known as ‘shadow prices’.

Costs associated with loss of economic activity are likely to form the major component of indirect costs, but there remains a lack of consensus over how they should be derived. For example, from a societal viewpoint, work loss may have a direct effect on gross national product although the contribution towards economic
health economists advocate the use of the “human capital approach”\(^{15}\) which derives monetary time. In which case the cost of his attendance is his leisure employment by staying extra time on return to work, a session in the afternoon may make up his lost opportunity of domestic activities.\(^{14}\) In many cases, non-wage and work time may overlap, and difficulties may arise in separating these elements when illness and medical interventions have implications for both. For example, a patient attending a hospital out-patient and medical interventions have implications for both. Most decisions in health are not concerned with whether a service should be provided or not but whether to expand or contract an existing service. For this reason, health economists advocate the use of marginal costs rather than average costs. For example, the average cost of N consultations will be the total cost of GP services divided by N, and the marginal cost will be the cost of the \((N + 1)^{th}\) consultation. As most costs will have fixed and variable elements, in the short run marginal costs will differ from average costs.

Table 1 shows how marginal and average costs can vary taking an example of a day-case surgical procedure with fixed cost overheads of £2000.

<table>
<thead>
<tr>
<th>No. of patients</th>
<th>Total cost (£)</th>
<th>Average cost (£)</th>
<th>Marginal cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2000</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>1</td>
<td>2500</td>
<td>2500</td>
<td>500</td>
</tr>
<tr>
<td>2</td>
<td>3000</td>
<td>1500</td>
<td>500</td>
</tr>
<tr>
<td>3</td>
<td>3250</td>
<td>1083</td>
<td>250</td>
</tr>
<tr>
<td>4</td>
<td>3300</td>
<td>825</td>
<td>50</td>
</tr>
</tbody>
</table>

The total cost of £2000 represents the fixed overheads of the unit.

### Some basic costing principles

**Costs and time**

**The time horizon of a study.** Economic time horizons refer to periods over which different types of resources can vary rather than specific measures of elapsed time. Ideally, the period over which all types of resources including capital facilities can vary should be considered. If fixed and overhead costs are relevant to a study, in practice long-run marginal cost can be taken to be approximately the same as short-run average costs. However, from a practical standpoint, differences between average and long-run marginal costs only become relevant in the estimation of the value of capital (buildings and equipment) if services are expanding or contracting. For example, if a service is expanding to the extent that another building or piece of equipment will be required, the marginal cost should include the purchase of that item. If a service is contracting, the marginal cost is the resale value. The difference between these values can be marked, especially with health service facilities which are costly to build but have limited resale value.

**Discounting future costs.** In many cases, an intervention will incur costs in the future, and competing interventions may have different patterns of expenditure. In general, we prefer to incur costs later rather than sooner, and in economic terms this is known as time preference. To quantify this difference and enable costs to be expressed in present value terms, costs should be evaluated at the end of each year and discounted at the prevailing rate using the formula

\[
\text{Present value} = \sum C_n/(1 + r)^n
\]

where \(n = \text{year under consideration}\), \(C_n = \text{costs in year } n\) and \(r = \text{discount rate}\).
The Treasury sets the discount rate for the public sector which is currently 6% p.a.\textsuperscript{16} Table 2 shows the actual cost and discounted cost of two competing interventions that are delivered over a period of 3 years.

\textit{Costs changing with time.} Unit costs may not always be available within the same time frame. For example, cost data may only be available for a year prior to a study. Where necessary, unit costs must be adjusted by a service-specific inflator.

\textit{Which costs should be counted—defining the perspective of an exercise}

The perspective of a study will dictate which costs to count. The perspective of the individual patient, the GP practice, the purchasing authority, the NHS or society in general can all be considered, and different answers may be obtained for each approach. Health economists generally advocate a comprehensive societal perspective measuring all costs regardless of who incurs them.

Presenting comprehensive data in a disaggregated form allows an analysis to be undertaken from different viewpoints, allowing the needs of key decision holders to be met. For example, it is not possible to identify the savings generated for the state by reducing length of stay in hospitals without a comprehensive estimate of the additional costs falling on community health and social services.

\textit{Allowing for uncertainty—the role of sensitivity analysis}

Given the problems associated with cost estimation, it is important to identify sources and assumptions when reporting cost studies, and wherever possible test the sensitivity of any conclusions drawn to any assumptions made across the range of cost estimates that are found. Sensitivity analysis allows the outcome of an analysis to be tested over a range of situations likely to be found in practice in order to determine the robustness of analysis to potential changes in key variables.\textsuperscript{17}

\textit{Statistical manipulation of cost data}

Although the principles of statistical inference are well advanced in the analysis of clinical data, some issues relating to the statistical analysis of economic data remain unresolved\textsuperscript{18} and improvements in the statistical analysis and reporting of data are urgently required.\textsuperscript{19} One of the major problems is the conflict in sample size required for adequate power between clinical outcomes and economic evaluations. In most cases, larger trials are needed to detect statistically important differences between economic indices and clinical measures but, usually, clinical requirements prevail.

A misleading conclusion can be drawn in the absence of supporting statistical cost data. For example, a relatively small number of high cost events can disproportionately affect overall costs and the ability to detect significant cost differences between interventions. The need to revise economic guidelines and incorporate more detailed statistical cost data is recognized, although this approach does require the collection of cost data alongside clinical trials.

\textit{Some basic costing ‘rules’}

Knapp\textsuperscript{20} has identified a number of ‘rules’ to be used when estimating and using cost information.

\textit{Costs should be measured accurately and comprehensively} in order to prevent inappropriate conclusions being drawn from a costing exercise. There will inevitably be resource implications in obtaining accurate data but, if the conclusions of a study are sensitive to variations in a particular unit cost, it should be assessed accurately. Care must be taken to include all relevant costs. For example, a meningitis immunization programme must include not only nurse costs and equipment but implications for practice administrative and managerial staff in addition to cost implications of attending patients.

Data should be presented on both the unit cost of resources and the quantities of those units used.

\textit{Like should be always compared with like.} Care must be taken to avoid drawing inferences from misjudged comparisons. Inappropriate comparison with respect to case mix is unlikely to be an issue when cost data are generated alongside comparative trials. Problems are more likely to arise from omission of important elements of costs relevant in one context but not another. For example, studies of early hospital discharge should include living costs at home over the study period as hospital costs will include living expenses of an inpatient.

\begin{table}[h]
\centering
\caption{Total actual and discounted costs of two competing interventions which incur costs over 3 years}
\begin{tabular}{|l|c|c|c|c|c|}
\hline
 & Year 1 & Year 2 & Year 3 & Actual total cost & Discounted total cost \\
\hline
Intervention A & 50 & 100 & 200 & 350 & 321 \\
Intervention B & 200 & 100 & 50 & 350 & 338 \\
\hline
\end{tabular}
\end{table}
Costs should never stand alone but always be related to outcomes. Ideally, costs should be measured alongside controlled trials, but this may not always be practical or feasible and not all clinical trials will be candidates for economic analysis. Drummond21 has defined four criteria that should be applied: a trial should be capable of delivering unbiased and unambiguous answers to the questions addressed; the economic importance of the question should be relevant; trials should be undertaken in settings which can be generalizable; and the logistical implications of adding an economic analysis must be carefully considered.

Conclusion

How costs are defined and combined should be clearly identified in any economic evaluation as different approaches may effect the conclusions of a study. There is no such thing as a gold standard cost estimate. How cost is estimated will depend on the purpose of the exercise. For every study, sources and assumptions should be clarified as far as possible with the aim of enabling end users to adapt the information and substitute better information where or when it is available, and whenever possible ranges of estimates should be provided.

Ideally, all unit cost data should be collected alongside the intervention being evaluated. However, research resources are often limited and data collection itself may influence a study. In many cases, unit costs will be obtained either from data in a parallel study or from national statistics. The context of the evaluation will dictate the correct approach, but in many cases national statistics will be unavailable and care must be exercised when using local prices which may be atypical of those across the NHS.

Deriving costs is not the straightforward exercise it may seem, and concern still remains over the accuracy of cost data within the NHS. However, at least we know where the gaps in our knowledge are, and frameworks are being developed that will allow a more rigorous approach to this important area.

Resources

The Unit Costs of Health and Social Care Report (Netten A, Dennet J, PSSRU, University of Kent Canterbury 1998) compiles a comprehensive list of unit costs and pay and prices inflation indices which is updated annually.

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References