

Generalised cost-effectiveness analysis: an aid to decision making in health

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Abstract: Health economics literature provides ample evidence for existing inefficiencies in health. Economic appraisal seeks to improve efficiency by guiding policy makers in how scarce resources can be used to derive the greatest possible social benefit. In the past many cost-effectiveness (CE) studies have addressed sector-wide cost-effectiveness in health. However, as described in this paper, current studies suffer from a number of shortcomings, including the inability to assess the current mix of interventions, low generalisability and inconsistent methodological approaches. Most importantly, it is argued that the current incremental approach to cost-effectiveness analysis (CEA) does not provide decision makers with sufficient guidance for sector-wide priority setting in health. Instead, a broader complementary sectoral approach is proposed via the application of a generalised CEA framework that allows examination of existing inefficiencies in health systems. The wide variations in cost-effectiveness ratios observed among interventions that are currently in use, suggest there is considerable room to improve efficiency by moving from inefficient interventions to efficient interventions that are underutilised. This information will contribute to a more informed debate on resource allocation in the long-term.

Keywords: cost-effectiveness analysis, priority setting in health care, resource allocation

Introduction

Cost-effectiveness analysis (CEA) provides one means by which decision makers may assess and potentially improve the performance of health systems. This process helps ensure that resources devoted to health systems are achieving the maximum possible benefit in terms of outcomes that people value. Over the past three decades there has been an exponential growth in the number of economic appraisals performed in health. Following standard textbooks on economic evaluations, most of these CEA studies pursue an incremental approach that compares the additional costs of an intervention over current practice with additional health benefits (Drummond et al 2001; Drummond et al 1997; Gold et al 1996). Such an incremental approach, however, is unable to provide policy makers with all the necessary information relating to questions like: do the resources currently devoted to health achieve as much as they could? or, how best to use additional resources if they become available? Firstly, incremental analysis does not allow examination of whether current practice is efficient and should have been done in the first place, and secondly, it is not generalisable across settings as it is specific to the starting point (Murray et al 2000).

This paper proposes a broader sectoral approach via the application of a generalised CEA framework, which also allows examination of existing inefficiencies in the health system. The wide variations in CE ratios observed among interventions that are currently in use suggest there is considerable room to improve efficiency by moving from inefficient interventions currently in use to efficient interventions that are underutilised (Murray et al 2000). For developing countries in particular the reallocation of scarce financial resources is most important (Hutubessy et al 2001a). The generalised CEA framework compares interventions to a common counterfactual or to a situation of 'doing nothing'. This allows

both existing and new interventions to be analysed and cost-effectiveness results to be more generalisable across settings. The proposed framework focuses on the general use of cost-effectiveness information to inform health policy debates without being completely contextualised.

Here, we review evidence of existing inefficiencies in health systems both at the macro and micro level, indicating the need for a reallocation of health resources, and discuss past attempts at sectoral cost-effectiveness in the dealing with allocative efficiency problems, including their shortcomings. In a subsequent section the WHO generalised cost-effectiveness framework will be proposed. The implementation and operationalisation of this newly introduced framework will be illustrated by presenting ongoing activities and future plans of the WHO-CHOICE initiative (CHOosing Interventions that are Cost-Effective).

Existing inefficiencies in health care systems

Both at the macro and the micro-level there is ample evidence on existing inefficiencies in health care. On the macro level health systems have multiple goals, yet their defining objective is to improve health. Despite this common aim, health systems with very similar levels of health expenditure per capita can show wide variations in population health outcomes.

The World Health Report (2000) published a first attempt to measure the attainment of goals by the proposed health systems of 191 countries, and considered how well countries were performing given the resources available (WHO 2000). Evans and colleagues (2001) showed that countries like Sri Lanka and China, which are believed to be efficient in producing health, perform less than countries at similar levels of development. Furthermore,

the authors concluded that efficiency is positively correlated with health expenditure per capita, especially at low expenditure levels, and that performance sharply increases with expenditure up to about \$80 per capita a year. These findings can in part be explained by variation in factors outside of health systems, such as the education level of the population. However, a further part can be explained by the fact that some systems devote resources to expensive interventions with small effects on population health, while at the same time low cost interventions which would result in relatively large health improvements are not fully implemented or even ignored.

At the micro level Tengs (1997) and Murray and colleagues (1991) argued that health both in the United States and sub-Saharan Africa could be greatly improved by reallocating available resources from interventions that are not cost effective to those that are more cost-effective but not fully implemented. For the case of the United States it was estimated that a set of 185 currently publicly-funded interventions costs about US\$214.4 billion, for an estimated saving of 592 000 years of life. Reallocating those funds to the most cost-effective interventions could save an additional 638 000 life years if all potential beneficiaries were reached (Tengs 1997).

Sectoral CEA

One approach that has been developed to facilitate policy makers in decisions to reallocate resources is the construction of a 'league table' that rank-orders interventions by their cost-effectiveness ratios (cost per Quality Adjusted Life Years (QALY)). Many published league tables have been criticised for including only a few interventions (Birch and Gafni 1994;

Drummond et al 1993; Mason et al 1993), or only including interventions within one disease area. For example, recently Pinkerton and colleagues (2001) constructed league tables to compare interventions to prevent sexual transmission of HIV. Only rarely has the 'league table' approach been applied in an explicit broader sectoral perspective, in which CE-studies are compared on a wide range of health interventions in a single research effort. Exceptions are the work of Oregon Health Services (Blumstein 1997), the Harvard Life Saving Project (Tengs et al 1995) and World Bank Health Sector Priorities Review (HSPR) (Jamison et al 1993). What these studies have in common is their aim to allocate health care resources across many interventions and population groups to generate the highest possible overall level of population health in a single exercise. Each study will be described in more detail hereafter.

World Bank Health Sector Priorities Review project

The most comprehensive sectoral CEA example on a global level is the World Bank HSPR. In 1987, as recognition surrounding the importance of the HIV epidemic mounted, many groups called upon the health sector of the World Bank to make HIV control their number one priority in health. This provoked a debate on substantive priorities for action in the health sector. The World Bank initiated the HSPR to address this problem. A list of more than twenty important conditions or clusters of conditions was drawn up. The main results of the HSPR are estimates of the long-term average cost-effectiveness of a set of interventions.

Overall, the study showed that categorical assessments such as 'primary health care is cost-effective and hospital care is cost-ineffective' are too simplistic: each intervention needs to be evaluated, and one cannot guess cost-effectiveness on the basis of an intervention being curative or preventive or delivered at a given level of the health system. But one of the

key findings was that many of the interventions currently undertaken are very expensive ways of improving health, while many of the low cost ways of improving health are not fully funded. This implies there is considerable room to improve allocative efficiency, even if technical efficiency is also low. The World Development Report 1993 (World Bank 1993) introduced a global league table of priority health interventions, cardinally ranked by health gain per dollar spent in order to improve efficiency of public health expenditure. Based on this global league table the World Bank proposed a minimum package of basic public and curative health interventions.

Oregon Health Plan

The Oregon Health Plan (OHP) has been widely heralded as an important innovation in American medical care policy. Oregon's pioneering model of prioritising funding for health care through systematically ranking services has drawn an extraordinary amount of national and international attention. The rationing of services rested on an elaborate technical analysis, one that merged cost-effectiveness analysis and medical outcomes research with public participation in policy making decisions.

A Health Services Commission was organised to compile clinical information from physicians, treatment costs and benefit data, and community values from the public. This Commission reduced over 10 000 services to a prioritised list that initially rank 709 condition and treatment pairs.

The net effect has been to exclude a limited number of services such as medical management of back pain, but to expand coverage of Medicaid to more people without

increasing the budget. The Oregon Health Plan has sparked significant controversy in the US concerning the role of the state in controlling the set of available services in the health sector.

The Harvard Life Saving Project

A project at the Harvard Center for Risk Analysis was undertaken to review the published literature on the cost-effectiveness of interventions that reduce mortality (Tengs et al 1995; Tengs 1996). It was based on published papers, with minor amendments for differences in methods, and does not include non-fatal health outcomes. As with the HSPR, the study shows a substantial range of cost-effectiveness ratios across interventions that are currently undertaken in the USA. The Harvard Life-Saving Project estimated that this type of reallocation for primary prevention interventions in the USA would save an additional 600 000 years of life annually for the same level of investment. Tengs (1996) has subsequently shown that reallocating resources from those that are cost-ineffective to those that are cost-effective in the US could save a very considerable number of life years.

Requirements for sectoral CEA

The sectoral CEA studies presented in the previous section have demonstrated major inefficiencies in the current allocation of resources, implying that countries could make significant gains in population health by shifting resources from high-costs, low-effect interventions currently in use, to low cost, high-effect interventions that are not used, or underutilised. However, it is not always clear how to interpret the results from current CE studies with the aim of sectoral analysis. Some of the difficulties in using current CE studies for sectoral analysis are presented below. These problems (or requirements) should be

evaluated for any CE study to be useful to the allocation of resources across a broad range of interventions:

1. Current CE studies are typically based on the incremental or 'intervention-mix-constrained' CEA approach, which is appropriate in settings where policy makers are constrained not only by the availability of resources, but also by the current level of care for the condition under discussion. However, in the long-term where policy is *not* constrained by the current mix of interventions, incremental analysis does not provide best guidance to policy makers. It ignores the question of whether current interventions themselves are cost-effective. Yet, there is considerable evidence that some interventions currently undertaken are not cost-effective.

2. This form of incremental analysis has limited use for decision makers in settings other than the one in which a study is undertaken. The starting points for an incremental analysis varies across settings (according to the current state of infrastructure and the current mix of interventions), while the additional health effects achieved from a given increase in resource use is dependent on what is currently done. This makes it very difficult to generalise CEA results.

3. As has been pointed out in CE literature the comparison of CE results becomes problematic when studies are based on varying costing methods and if economic evaluations are undertaken at different points in time (eg Drummond et al 2001; Gold et al 1996; Jefferson and Demicheli 2002). For the sake of sectoral analysis, standardised methods must be used consistently across individual CEA studies to ensure external validity (Walker 2001; Walker and Fox-Rushby 2000).

4. The World Bank (1993) estimated that a minimum package of basic public and curative health interventions, each of which was considered to be cost-effective in its own right, would cost US\$12. Yet this package was unaffordable in many of the poorest countries where health expenditure per capita was as low as US\$2 (Marseille et al 1999; World Bank 1994). The usefulness of such a general statement might be questioned, and a regional or national league table might be more appropriate. As a minimum, CE studies should identify the full resource implications of implementing interventions identified to be cost-effective; a practice that is slowly beginning to occur in the literature (Broomberg et al 1996; Farmer et al 2001; Forsythe 1998; Goodman et al 1999; Marseille et al 1999; Newell et al 1998; Soucat et al 1997). Take the case of malaria: at low levels of health expenditure in a country with a high burden of the disease, case management and prophylaxis for pregnant women would be very cost-effective and affordable. Only with more resources available might impregnated mosquito nets also be implemented (WHO 1999).

5. Current CE studies typically do not consider synergistic effects between interventions. In reality, costs and/or effects of intervention A may influence the costs and/or effects of intervention B because of the relationship between them. Intervention A could be a preventive intervention for tuberculosis (TB) (eg BCG vaccination) while intervention B is a treatment for TB (eg directly observed short course therapy (DOTS)). BCG vaccination reduces the remaining TB cases which results in fewer patients requiring DOTS and therefore costs for this treatment. Likewise, the health benefits of BCG in the presence of a treatment programme are less because many of the deaths from tuberculosis expected in the absence of treatment will be avoided (Murray et al 2000).

6. Changing strategies from cost-ineffective to cost-effective interventions will incur transaction costs that are typically not taken into account in current CE studies. That is, it is

assumed that what the health system is currently doing or trying to do with its existing infrastructure can be easily redirected. For example, in their Health Resource Allocation Model (HRAM) the authors point out that the presence of existing capital investments such as staff, buildings and other infrastructure play a major role in budget allocation processes (Murray et al 1994). Another example is that the cost and effectiveness of delivering anti-malarials closer to households will depend critically on whether a network of village workers currently exists (Goodman et al 1999) or on the current and past environmental management of malaria control (Utzinger et al 2001). The evidence on transaction costs in the health care sector is scarce. Examples can be found in health care reform initiatives in the United States (Sekhri 2000), United Kingdom (Ferguson and Keen 1996) and New Zealand (Ashton 1998).

7. Finally, current CE studies typically only handle uncertainty around cost-effectiveness ratios (CER) at the individual study level or do not take uncertainty into account at all. When uncertainty ranges around CERs of different interventions overlap, the question is how decision makers should interpret this information when allocating resources across a large number of interventions. For example, the World Development Report (WDR) 1993 only reported point estimates of the CERs. The league tables proposed in these sectoral studies do not provide information about uncertainty to a decision maker who is risk averse. In particular, this may be troublesome when a fixed budget applies as there may also be considerable uncertainty about the actual costs of a programme.

Generalised CEA framework and WHO-CHOICE

As discussed above the shortcomings of current CE-studies for sectoral priority setting in health care are closely related to the use of league tables in general. Many commentators

have cautioned against the unthinking use of league tables because of non-comparability of methods, inappropriate comparators and non-generalisability of results (Birch and Gafni 1994; Drummond et al 1993; Mason et al 1993). Most of the issues and shortcomings raised are addressed within the newly developed WHO generalised CEA approach (Murray et al 2000). The proposed framework provides policy makers with a simple set of results that are generalisable across settings. It does this by evaluating costs and effectiveness of new and existing interventions compared to the starting point of doing none of the current interventions. Importantly, the use of such a common reference removes the constraint that the current intervention mix must be continued, and eliminates differences in starting points which makes the results of incremental analysis difficult to transfer across settings. Only one constraint remains; the budget, which allows simple decision rules to be developed based on the calculated cost-effectiveness ratios. It should be recognised that there is still a need within this approach to elicit incremental CERs between interventions, ie generalised CEA builds on and incorporates incremental analysis.

Current CE-studies and therefore previous sectoral analyses have been restricted to assessing the efficiency of adding a single new intervention to the existing set, or replacing one existing intervention with an alternative. The generalised approach is of considerable policy importance. Because the analysis is not constrained by what is already being done, policy makers now have a tool to revisit and possibly revise past choices made, and they will have a rational basis if they decide to reallocate resources from less to more cost-effective interventions. However, as with current (sectoral) CE attempts it will remain a challenge within the generalised CE approach as to how to deal with additional costs of changing strategies (ie transition costs). Furthermore, the use of a common methodology enhances comparability between disease areas and transferability of findings across countries. Bearing in mind that obtaining context specific cost-effectiveness information is intensive, time

consuming and costly, the issue of generalisability of information is important, in particular for low and middle income countries.

The interactions between interventions, in terms of both costs and effectiveness, are a major focus within the generalised CEA approach. As explained earlier in the tuberculosis example, interventions that are likely to be delivered together in a way that reduces the unit costs are analysed singly or together, and likewise on the effectiveness side: interventions in which the effectiveness is likely to be altered if delivered with another intervention are also analysed singly and together. This approach approximates more closely the practical situation faced by policy makers.

WHO-CHOICE introduces stochastic league tables to inform decision makers about the probability that a specific intervention would be included in the optimal mix of interventions for various levels of resource availability, taking into account the uncertainty around cost and effectiveness of different interventions simultaneously (Hutubessy et al 2001b). This would overcome the shortcomings outlined earlier on uncertainty of the existing sectoral league tables. This information helps decision makers decide on the relative attractiveness of different mixes of interventions given the resources available. Moreover, stochastic league tables inform policy makers about the total budget impact of an intervention. More recently similar attempts to incorporate affordability thresholds and uncertainty around CE results have been proposed by other authors (Sendi et al 2002; Fenwick et al 2001; Laska et al 2002).

The WHO-CHOICE project will provide league tables of the cost-effectiveness of interventions (expressed in terms of cost per healthy life year or disability adjusted life year (DALY)) for a group of 17 world sub-regions that have been chosen to ensure maximum

amount of comparability between countries in terms of health systems and epidemiological profiles. The league table will cover a range of preventive, curative and rehabilitative interventions clustered with various target populations and disease areas such as ‘children under five’ (eg diarrhoeal diseases, food fortification and vaccination programmes); women aged 15–44 (eg antenatal care and perinatal care); adolescents and adults (eg cancers, stroke, diabetes, mental disorders, HIV, TB) and diseases affecting all ages (eg malaria, blindness).

Discussion and conclusions

For sector-wide priority setting, cost-effectiveness information should be collected in a way that will allow policy makers to address the policy questions raised earlier in the introduction of this paper: do the resources currently devoted to health achieve as much as they could? and, how best to use additional resources if they become available? It has been shown that current CE studies and therefore sectoral analysis have their limitations, eg they do not allow assessment of the current mix of interventions, they are setting specific, and based on incremental CE information with inconsistent methodologies and typically inappropriate comparators. Generalised CEA used by WHO-CHOICE permits both questions raised on technical and allocative efficiency at sectoral level to be answered and deals with them simultaneously.

In reality, many factors may alter the actual cost-effectiveness of a given intervention programme during implementation. These include the availability of the intervention, mix and quality of inputs, local prices, implementation capacity, underlying organisational structures and incentives, and the supporting institutional framework (Hammer 1996; Peabody JW et al 1999). All these obstacles imply that even on the sole criterion of cost-effectiveness, analysis of a health system’s potential for getting more health from what it

spends needs to begin with the current capacities, activities and outcomes, and consider what steps can be taken from that starting point to add, modify or eliminate services. This is likely to have profound implications for investment if little can be changed simply by redirecting the existing staff, facilities and equipment (Murray et al 1994). Since the generalised CEA approach focuses on the general assessment of the costs and health benefits of different interventions in the absence of various highly variable local decision constraints the only remaining constraint using a general league table for priority setting is the availability of resources. It will give policy makers indications of how to plan and organise their health system from a long-term perspective.

But nevertheless, information other than cost-effectiveness league tables is also important, such as, evidence about major causes of ill-health and death; responsiveness of the system to people's non-health needs; and inequalities in health outcomes, responsiveness, and the way in which households contribute financially to the system (Murray and Frenk 2000). The debates on the use of CE information from the Oregon experience clearly showed that political, ethical, or social issues can easily take precedence over economic criteria (Callahan 1991; Daniels 1991). To choose the appropriate mix of interventions, cost-effectiveness information is only one of a set of criteria that a health system may be asked to respect. It ought to protect people from financial risk to be consistent with the goal of fair financial contribution; strive for both horizontal and vertical equity; and, it should spend public funds in favour of the poor (Musgrove 1999). In addition, what makes setting priorities among interventions particularly difficult is that these different criteria are not always compatible. In particular, efficiency and equity can easily conflict as the costs of treating a given health problem differ among individuals, or because the severity of a disease bears little relation to the effectiveness of interventions against it or to their costs. The

application of generalised CEA is one way to ensure that sound evidence on cost and effects is used in the sector-wide policy making process.

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