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Country-Level Cost-Effectiveness Thresholds: Initial Estimates and the Need for Further Research

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ABSTRACT

Background: Cost-effectiveness analysis can guide policymakers in resource allocation decisions. It assesses whether the health gains offered by an intervention are large enough relative to any additional costs to warrant adoption. When there are constraints on the health care system's budget or ability to increase expenditures, additional costs imposed by interventions have an "opportunity cost" in terms of the health foregone because other interventions cannot be provided. Cost-effectiveness thresholds (CETs) are typically used to assess whether an intervention is worthwhile and should reflect health opportunity cost. Nevertheless, CETs used by some decision makers —such as the World Health Organization that suggested CETs of 1 to 3 times the gross domestic product (GDP) per capita—do not. **Objectives:** To estimate CETs based on opportunity cost for a wide range of countries. **Methods:** We estimated CETs based on recent empirical estimates of opportunity cost (from the English National Health Service), estimates of the relationship between country GDP per capita and the value of a statistical life, and a series of explicit assumptions. **Results:** CETs for Malawi (the country with the lowest income in the world), Cambodia (with borderline low/low-middle income), El Salvador (with borderline low-middle/upper-middle income), and Kazakhstan (with borderline high-middle/high income) were estimated to be $3 to $116 (1%–51% GDP per capita), $44 to $518 (4%–51%), $422 to $1967 (11%–51%), and $4485 to $8018 (32%–59%), respectively. **Conclusions:** To date, opportunity-cost-based CETs for low-/middle-income countries have not been available. Although uncertainty exists in the underlying assumptions, these estimates can provide a useful input to inform resource allocation decisions and suggest that routinely used CETs have been too high.

Keywords: benefits package, cost-effectiveness, quality-adjusted life-years, threshold, universal health care, willingness to pay.

Introduction

Policymakers in all health care systems face difficult choices about which interventions, programs, or activities (hereinafter referred to solely as "interventions") should be funded from limited available resources. The tools of economic evaluation offer various means to assist policymakers in the process of prioritization. A common approach is the incremental cost-effectiveness analysis (CEA), which is based on the comparative assessment of costs and benefits, with the latter generally focused on health gains. CEA seeks to identify which interventions offer health gains large enough, relative to their costs, to warrant adoption [1].

CEA typically includes detailed information about the incremental costs (Δcosts) and the incremental health effects (Δhealth) of an intervention relative to alternative interventions. The results of CEA are often expressed as an incremental cost-effectiveness ratio (ICER), the ratio of incremental costs to incremental health effects (Δcosts/Δhealth) [1]. Health effects are often represented as quality-adjusted life-years (QALYs) gained or disability-adjusted life-years (DALYs) averted, and so the ICER gives the "cost per QALY gained/DALY averted" associated with an intervention. Although these are useful summaries, the question remains as to whether a particular cost per QALY gained/DALY averted ought to lead to the evaluated intervention being considered cost-effective.

If an intervention offers incremental health gains but at some additional costs, then a decision regarding whether it should be funded should be informed by the value of what will be given up as a consequence of those costs (i.e., the opportunity cost of funding the intervention [2]). All systems face some restrictions on the resources available for health care. If resources are committed to the funding of one intervention, then they are not available to fund and deliver others. The opportunity cost of a commitment of resources is, therefore, the health foregone because these "other" interventions that are available to the health system cannot be delivered. Even if additional resources are placed into the health care system to be made available for a

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particular new intervention, there is an opportunity cost to these resources—the health that could have been gained by investing these additional resources elsewhere in the system.

In the context of CEA, the opportunity cost can be expressed using a cost-effectiveness threshold (CET). CETs based on opportunity costs describe the amount of money that, if removed from the health care system, would result in one less unit of health being generated, or equivalently, the cost of generating health in the present system. In the case of the introduction of a new intervention that imposes additional costs on the system, this is equivalent to a marginal reduction in the resources available for other activities. If the ICER (cost per QALY gained/DALY averted) is less than the CET, it means that diverting funds to the intervention will increase population health. For example, if the CET is $1000/QALY and the ICER for an intervention is $100/QALY, then for every $1000 spent on the intervention 1 QALY is lost in the wider health care system but 10 are gained from the new intervention. The net health effect is positive. Therefore, if an ICER is less than the CET, an intervention can be considered cost-effective, but if an ICER is more than the CET, the benefits are insufficient in comparison with costs and the intervention cannot be considered to be cost-effective. Hence, CEA simplifies to an assessment of whether a new intervention will result in gains in population health and the inverse of the CET should reflect the marginal product of health care spending (Δhealth/Δcosts).

Estimating the opportunity cost of health care spending (i.e., estimating the CET) is, therefore, a crucial aspect of any resource allocation decision in health care.

Understanding CETs

Recent methods research has emphasized the centrality of opportunity costs in informing resource allocation decisions and how CETs can be appropriately estimated for CEA to inform decisions aimed at improving population health [3,4] (see (Chapter 4 of Drummond et al. [1] for a full overview). A clear distinction needs to be made between two related, but separate, concepts that have informed the debate regarding the most appropriate value for the CET: 1) opportunity costs in terms of health foregone when costs fall on health care budgets and 2) opportunity costs in terms of foregone consumption (the "consumption value of health") when additional costs fall on consumption opportunities outside health care. The first is an issue of "fact," resulting from limits in the overall collective budget available for health care or constraints on the health system's abilities to increase expenditure. It reflects the health generated at present from the health care system (or that could be gained if expenditure were increased) and, therefore, reflects the "supply side" of the system. The second is an issue of "value" and depends on how individuals and society value health as compared with other forms of consumption or publicly funded non-health goods. This indicates what individuals and society want from the health care system, or the "demand side."

For economic evaluation it is important to consider what type of opportunity costs would result from investment in new activities. If opportunity costs result in the form of health forgone (e.g., through displacement of other health-generating interventions), then the CET should reflect this (let's denote this as "k," the amount of money that would displace one QALY's worth of health care investment). If opportunity costs are in terms of other forms of consumption, then the CET should reflect the consumption value of health (let's denote this as "v").

If we observe that the consumption value of health is higher than the amount of health care resource required to improve health (i.e., if $v > k$), then this suggests that the health care system is not meeting individual preferences. Individuals would be willing to give up more of the resources available to them to improve their own health than the health care system would require. There are a number of reasons why this may be the case, not least the welfare losses associated with socially acceptable ways to finance health care systems and the fact that individuals may be willing to expend more resources in improving their own health than in improving the health of others via a collectively funded system.

For incremental CEA to inform the allocation of health care expenditures, for which the primary purpose is generally regarded as being the generation of health from limited collective health care resources, CETs reflecting the opportunity costs of health care spending (k) will always be required if there are any restrictions on the growth in health care expenditure (see Chapter 4 of Drummond et al. [1]).

Estimating Cost-Effectiveness Thresholds

CETs have not generally been set to reflect k. For instance, values of £20,000 to £30,000 and $50,000 have commonly been applied in the United Kingdom and the United States, respectively [5,6]. Similarly, for low- and middle-income countries, the World Health Organization (WHO) has recommended thresholds of 1 to 3 times the gross domestic product (GDP) per capita [7]. These values are not based on assessment of health opportunity costs resulting from resource constraints. The basis for these thresholds is unclear; they, however, appear to have been conceptually and to some degree empirically informed by the consumption value of health (or more accurately, estimates of individuals' willingness to pay [WTP] to improve their own health). For instance, the WHO threshold is described as being based on estimates reported in the Commission on Macroeconomics and Health report from 2001 [8]. These estimates were intended to inform decisions regarding overall investments in health care spending and used estimates of the WTP for mortality risk reductions. Indeed, similar approaches continue to be used to advocate for increased health care spending [9]. Nevertheless, the use of these thresholds when assessing the value of individual interventions in the context of existing spending limits is not consistent with population health improvement, because they do not reflect the opportunity costs that are imposed on health care systems. Although demand-side thresholds might inform social choices about the magnitude of financial resources committed to health care, they are inappropriate measures of health opportunity cost and so risk reducing, rather than increasing, population health when used in the context of CEA.

Alternatively, the relationship between changes in health care expenditure and health outcomes—the marginal productivity of the health care system in generating health—can be estimated. This provides a direct measure of the health consequence of changes in available resources, for example, when a cost-escalating intervention is adopted or what could be gained if additional resources are made available in general to fund health care. Using such estimates of k to inform CETs provides a basis for informing resource allocation decisions with a view to increasing population health. There is, however, a paucity of estimates of CETs using these approaches. One notable exception is in the study by Claxton et al. [4] which used local-level program expenditure data, in a range of disease areas, to estimate the relationship between changes in health care expenditure and health outcomes in the English National Health Service (NHS) (see Chapter 4 of Drummond et al. [1] for a full description of this work).

By exploiting the variation in expenditure and in mortality outcomes, Claxton et al. estimated the relationship between changes in spending and mortality in those clinical program areas in which a mortality effect could be identified while accounting for endogeneity. With additional information about age and sex of the patient population, these mortality effects