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How Does Cost-Effectiveness Analysis Inform Health Care Decisions?

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Abstract

Cost-effectiveness analysis (CEA) provides a formal assessment of trade-offs involving benefits, harms, and costs inherent in alternative options. CEA has been increasingly used to inform public and private organizations' reimbursement decisions, benefit designs, and price negotiations worldwide. Despite the lack of centralized efforts to promote CEA in the United States, the demand for CEA is growing. This article briefly reviews the history of CEA in the United States, highlights advances in practice guidelines, and discusses CEA's ethical challenges. It also offers a way forward to inform health care decisions.

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Background

Decision makers in health care often face challenging questions. Should clinicians check every adult's blood pressure? Should a health plan's drug formularies cover a new and expensive drug? How should vaccines or treatments be priced in a pandemic? Answers to these questions require careful examination of potential trade-offs involving benefits, harms, and costs associated with policies or health interventions to determine the optimal choice.¹

One approach to aid such decisions is to conduct a cost-effectiveness analysis (CEA) that explicitly quantifies the relative costs and benefits of alternative interventions.^{2,3} It aims to illuminate the potential trade-offs and inform discussions of whether the additional resources demanded by an intervention (over an alternative) are worth the additional gain in health produced by it.⁴ A CEA expresses this trade-off using a metric called the incremental cost-effectiveness ratio (ICER).⁵ The ICER can be regarded as a "price" for an additional unit of health gained through an intervention. Like lower prices, a

smaller ratio is more favorable because it implies that an intervention can produce an incremental health gain at a lower cost. ICERs are often compared to a range of predetermined threshold values that reflect the willingness to pay for an additional unit of health gain from the perspective taken. For example, the willingness-to-pay threshold usually ranges from \$100 000 to \$150 000 per additional unit of health gain measured by quality-adjusted life-years (QALYs) in the United States.^{6,7,8} It implies that if the ICER for the intervention lies below the chosen threshold, it is deemed cost-effective.

Since the 1990s, the number of CEAs has grown substantially, covering a wide range of diseases and interventions.^{9,10,11} In the United States and abroad, many public and private organizations have formally adopted a health technology assessment (HTA) process that uses ICERs to inform reimbursement decisions, benefit designs, and price negotiations.^{12,13} The rest of this article offers a brief on the use of CEA in US health care, highlights advances in CEA practice guidelines, discusses ethical challenges of using CEA for health care decisions, and suggests a way forward.

Cost-Effectiveness Analysis in the United States

Unlike many other developed countries where CEA has been incorporated into the formal HTA process,^{11,13} the United States has resisted following suit. One exception is the use of cost-effectiveness evidence by the Centers for Disease Control and Prevention's Advisory Committee on Immunization Practices to inform national recommendations on immunization policy.¹⁴ However, a growing concern about inefficient health care spending has led to the incorporation of value (typically measured by ICERs using QALY as the measure of health gain) into organizations' health care decisions and practice guidelines.^{15,16} For example, the Institute for Clinical and Economic Review (ironically, with the moniker ICER), a US-based nonprofit organization, applies systematic and evidence-based approaches—including CEAs—to assess the value of various health technologies.⁷ Medical professional societies and other organizations have also developed practice guidelines incorporating value measured by ICERs, for example.¹⁷

Nevertheless, the use of cost-effectiveness evidence to inform health care decisions faces challenges and opposition from policymakers, the drug industry, and patient advocates. Our fragmented health care system with its various key players diminishes the incentive to consider the broader implication of **resource allocation decisions**.¹⁸ Some resistance to CEA pertains to Americans' aversion to rationing and unwillingness to accept limits in the delivery of health care.^{19,20} Methodological challenges—often based on incomplete evidence (eg, the need to extrapolate clinical trial data beyond follow-up periods), CEA's limited applicability in assessing effectiveness in the real-world setting, and judgment calls made by the analyst—have contributed to the mistrust of results.^{20,21,22} Although how well and how widely CEA will be accepted and implemented in the United States remains to be seen, CEA methods have been substantially improved to meet some of these challenges.

Advances in Cost-Effectiveness Analysis

In 1996, the US Public Health Service's Panel on Cost-Effectiveness in Health and Medicine established a reference case analysis, a set of standard methodologies to improve the quality and comparability of CEAs that emphasized using QALY as a health outcome measure and applying a **societal perspective**.² A QALY measures the value of health gains as a function of both being alive and the quality of health captured by health-related quality-of-life weight.²³ QALYs enable comparison of well-being related to health across patients, diseases, and treatments—a necessary step to inform resource allocation decisions. The panel also endorsed a broader societal perspective because considering everyone affected and counting all benefits and costs, regardless of who gains or loses, can provide the basis for fair decisions in the public interest.^{2,24} The societal perspective accounts for disease and intervention-related nonhealth impact, including patient time, patient transportation, unpaid caregiver time, productivity loss, and spillover impact on other sectors, such as education.¹⁰

Twenty years later, the Second Panel on Cost-Effectiveness in Health and Medicine was convened to provide an updated guideline reflecting methodological advances in evidence synthesis, modeling, uncertainty analysis, and consideration of ethical and distributional issues.³ The table summarizes reference case analyses of the field's major guidelines. One of the second panel's significant updates was the recommendation of 2 reference case analyses: one from a health care sector perspective and another from a societal perspective.²⁵ The second panel recognized that the use of a societal perspective had declined since 2000 while a narrower health care sector or payer perspective persists in most published CEAs.¹⁰ The failure to apply a societal perspective might reflect (1) difficulties in defining nonhealth impact (eg, lost productivity or reductions in resource consumption) associated with a particular disease or an intervention, (2) absence of available data to quantify nonhealth impact, and (3) international guidelines that endorse a narrower health care sector or payer perspective, which may better represent the interests of particular budget holders who are not generally concerned about nonhealth impact that falls outside of their budget.

Table. Comparisons of Reference Case Analyses in Cost-Effectiveness Analysis Guidelines

Elements of analyses	Reference case analyses				
	1st US Panel (1996) ²	UK NICE reference case (2013) ²⁶	Gates/iDSI reference case (2014) ²⁷	2nd US Panel (2016) ³	ICER value assessment framework (2020) ⁷
Perspective	Societal	National Health Service	Health care sector	Societal & health care sector	Societal ^a & health care sector ^b
Comparators	Available & feasible options (including existing practice and a do-nothing option, as appropriate)				
Measurement of health effects	QALYs gained	QALYs gained	DALYs averted	QALYs gained	QALYs gained & equal value life-years gained

Time horizon	Long enough to capture all relevant future consequences (eg, lifetime)				
Discounting ^c	3.0%	3.5%	3.0%	3.0%	3.0%
Evidence	Use of all relevant evidence (eg, systematic and transparent approach)				
Nonhealth impact ^d	Should be included	If relevant, should be identified and reported separately	If relevant, should be identified & reported separately	Should be included	Should be included in scenario analysis for its modified societal perspective

Abbreviations: DALYs, disability-adjusted life years; ICER, Institute for Cost-Effectiveness Research; iDSI, International Decision Support Initiative; NICE, National Institute for Health and Care Excellence; QALYs, quality-adjusted life years.

^aThe Institute for Comparative Economic Research recommends a modified societal perspective analysis as a scenario analysis. However, when the societal costs of care for any disease are large relative to the direct health care costs and the impact of treatment on these costs is substantial (ie, there are substantial differences in the cost-effectiveness findings between the 2 perspectives), the societal perspective is included as a co-base case, presented directly alongside the health care sector perspective analysis.

^bPrimary base case.

^cCosts and benefits.

^dNonhealth impact refers to nonhealth effects of disease and its treatment, including patient time, transportation costs, caregiver time, productivity, and other nonhealth care sector impacts on education, criminal justice, housing, and environment.

Nevertheless, the second panel recognized the importance of capturing nonhealth impact that matters to the broader society, recommending that analysts attempt to quantify nonhealth impact and include it in estimates of value (eg, ICER) unless the effect is likely negligible.²⁵ The second panel advised the use of an “impact inventory,” a structured table listing an intervention’s health and nonhealth impact, to improve analyses conducted from a societal perspective.²⁵ The structured table can signal to audiences which health and nonhealth effects have been included in or excluded from analyses and whether analyses are likely to under- or overestimate the value of an intervention. For example, when analyzing policy and health interventions related to the COVID-19 pandemic, accounting for nonhealth impact is essential for generating reliable and comprehensive estimates of an intervention’s full value.²⁸

Ethical Considerations

There have been a few criticisms on ethical grounds of CEA’s use for decision making. These include (1) controversies associated with the use of QALYs, (2) distributive justice, and (3) incomplete valuation. We discuss each of them in detail here. However, it is worth pointing out that cost-effectiveness evidence is only one of many factors considered in resource allocation decisions. We have found that none of the international HTA bodies bases its decisions solely on cost-effectiveness evidence. Therefore, much of CEA’s criticisms, fair or not, can be addressed through deliberative processes.²⁹

QALYs. The lower health utility, or health-related quality of life, assigned to patients with worse health (because of more severe disease, disability, age, and so on) raises distributive issues in using QALYs for resource allocation decisions. For example, because patients with disabilities have a lower overall health utility weight, any extension of their lives by reducing the health burden from one disease “would not generate as many QALYs as a similar extension of life for otherwise healthy people.”³⁰ This distributive limitation arises because of the multiplicative nature of QALYs, which are a product of life-years and health

utility weight. Consequently, the National Council on Disability has strongly denounced the use of QALYs.³¹

Alternatives to QALYs have been proposed. The Institute for Clinical and Economic Review has started using the equal value of life-years gained metric,³² a modified version of the equal value of life (EVL) metric,³³ to supplement QALYs. In EVL calculations, any life-year gained is valued at a weight of 1 QALY, irrespective of individuals' health status during the extra year.³⁴ EVL, however, "has had limited traction among academics and decision-making bodies" because it undervalues interventions that extend life-years by the same amount as other interventions but that substantially improve quality of life.³⁰ More recently, a health-years-in-total metric was proposed to overcome the limitations of both QALYs and EVL, but more work is needed to fully understand its theoretical foundations.³⁰

Distributive justice. The second criticism pertains to the fundamental notion that "a QALY is a QALY is a QALY no matter who gets it."³⁵ Because of this egalitarian notion, the question of whose values shall count for how much raises some ethical issues. For example, should large benefits to a small number of people receive priority over smaller but greater aggregate benefits to a large number of people? Or when should society give priority to treating the sickest or worst off?^{36,37,38,39,40} However, CEA was not meant to address such **distributional considerations** directly. The Second Panel on Cost-Effectiveness in Health and Medicine emphasized that such distributive considerations also matter to decision makers and are often part of deliberative processes.^{3,4} Areas of ongoing research include the development of equity weights, which assign numerical values based on considerations other than QALYs (eg, the severity or rarity of the disease), and incorporating social distributions of health (eg, by income or ethnicity) into CEA.^{41,42,43}

Incomplete valuation. The third criticism relates to CEA's consideration (or lack thereof) of certain value elements. Many HTA bodies around the world use CEA from a health care sector perspective and do not incorporate value elements such as productivity, time costs, caregivers' costs, and spillover to other sectors of the society.¹⁰ Even in the United States, ICER has not considered these elements formally, although more recently it has allowed for a modified societal perspective as a secondary analysis.⁷ The Second Panel on Cost-Effectiveness in Health and Medicine, which recommends analyses using both the health care sector perspective and the societal perspective, has laid out the methods for incorporating such value elements.³ Often, lack of data (eg, the effect of a treatment on productive time) precludes analysts from including some of these value elements in the analysis, even though they are generally believed to be important to patients and their caregivers. Although recent advances in measuring these value elements have provided a set of useful resources,^{44,45} more work is needed to readily incorporate these elements into standard CEA.

Informing Decision Making

Resources to improve health are always limited. It is impossible to provide all the interventions that offer health benefits without sacrificing resources that could be used for other desirable and important goals, such as education.

Consequently, whether explicitly or implicitly, some form of prioritization or **rationing is unavoidable**. Without considering opportunity cost, we would not know whether better use of those resources was possible; choosing an intervention in ignorance of opportunity costs cannot be deemed ethical, either. Although it does not capture all relevant concerns, CEA is a systematic and explicit way of assessing a given decision's opportunity cost.

In the United States, a step forward would be the establishment of a national HTA agency that formally incorporates cost-effectiveness evidence along with other contextual elements, such as distributional concerns and budget impact. With a transparent, scientifically rigorous, and deliberative process of assessing trade-offs among alternative health policies or interventions, such an agency could provide valuable information to better inform resource allocation decisions in health care, including value-based prices for price negotiations.

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