

Costing and Perspective in Published Cost-Effectiveness Analysis

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Background: Methods for appropriate costing in Cost-effectiveness analyses (CEAs), seemingly straightforward, have always raised questions. Questions linger about what cost components to include under a “societal” perspective, as well as how to value resources.

Objectives: This article discusses issues surrounding costing and “perspective” in published CEA.

Methods: I examine data from the Tufts Medical Center Cost-Effectiveness (CEA) Registry to investigate the use of perspective and costing methodology in published cost-utility analyses. The CEA Registry contains over 3000 cost-utility ratios and utility weights for roughly 4000 health states from 1164 published cost-utility analyses through 2005. The Registry also provides an online-based searchable database (Available at: www.cearegistry.org). I analyze changes over time in several dimensions related to costing methodology: disclosure of study perspective; statement of time horizon; use of discounting for future costs and quality-adjusted life years (QALYs); statement of year of currency; reporting of sensitivity analysis; and use of incremental analysis.

Results: In practice, there has been a great deal of variation in costing methodology used in published CEAs, though methods have improved somewhat over time. Many CE researchers continue to claim that their studies take a societal perspective, but instead their articles only consider a health care payer perspective.

Conclusions: Analysts conducting CEAs should be more transparent about their costing methodology and clearer in their usage of terminology regarding perspective. The field would also benefit from more attention to the question of how much different costing methods influence the results of CEAs.

Key Words: cost-effectiveness analysis, health costs, QALYs

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This article discusses issues surrounding costing and “perspective” in published cost-effectiveness analysis (CEA). CEA provides a standard, well-accepted methodological approach for judging whether a health and medical service provides value. Its application to a wide variety of health care interventions has been well documented.¹

The denominator of the CE ratio—ie, its measure of health effects or benefits—has received a great deal of attention over the years, in terms of methodological controversies and calls for standards.² However, methods for appropriate costing in the numerator of the CE ratio, seemingly straightforward, have always raised questions as well, particularly with respect to the perspective of the analysis.^{3,4} Which components should be included? How should they be valued?

COSTING METHODOLOGY AND THE “SOCIAL” PERSPECTIVE

Economists have long sought to establish the theoretical underpinnings and practical considerations involved with costing.⁵ The volume on CEA in health care, published by the US Panel on CE in Health and Medicine (the Panel), published in 1996 and still a standard reference for the field, provides a good point of departure for discussing key principles and controversies.⁶

The Panel recommended that analysts conducting CEAs use a standard or reference case analysis to improve comparability and consistency across studies. They suggested that the reference case reflect a “societal perspective,” in which all costs and effects should be incorporated no matter who pays the costs or who receives them. Other standard texts on CE generally concur. For example, Drummond et al state that “we believe that economic evaluations in health care should, where feasible, consider the societal viewpoint, although on occasions analytical difficulties will preclude full measurement and valuation of all costs and consequences in monetary terms.”⁷

In terms of costing, the societal perspective prescribes that all resource costs associated with the use of an intervention should be identified and valued. The Panel noted that the introduction of one health care intervention or program over another has potentially far-reaching economic implications. Use of an intervention usually requires health care resources such as physician time and other health care resources, and may also involve the use of nonhealth care resources such as caregiver time. The intervention may reduce morbidity or

mortality, which in turn has consequences in terms of other health and nonhealth resources and in terms of the amount of work the patient can accomplish.⁶

In practice, when trying to identify and then value health resources from the societal perspective, one quickly encounters methodological questions. Consider just 3: indirect costs, future costs, and the valuation of costs.

“INDIRECT” COSTS

CE analysts have often employed the term indirect costs to refer to productivity costs, which are costs associated with lost or impaired ability to work or lost productivity due to death. The Panel recommended avoiding the term indirect, because it has many interpretations (eg, it is used to describe overhead or fixed costs of production in accounting).⁶ Instead, they distinguish “direct health care costs” (eg, the costs of tests, drugs, supplies, health care personnel, and medical facilities) from “direct nonhealth care costs” (eg, child care costs for a parent undergoing treatment or the costs of transportation to and from a physician’s office, or the time a family member spends caring for a disabled relative).⁶ Nonetheless, use of the term, indirect, endures.^{7–9}

In one of its most controversial recommendations, the Panel suggested that to avoid double counting analysts should incorporate morbidity costs (“the costs associated with lost or impaired ability to work or engage in leisure activities due to morbidity”) as part of the quality-adjusted life years (QALY) estimation and place it in the denominator of the CE ratio. The Panel reasoned that it is difficult to separate health-related quality of life impacts of being ill from effects on working and other experiences associated with time, and that the spirit of CEA was to include “effects” in the denominator.⁶

Since publication of the Panel report, other researchers have questioned this recommendation.^{7,10} Meltzer and Johannesson, for example, have argued that even if individuals consider income changes in responding to quality of life questions, the Panel’s recommended practice would underestimate production losses due to morbidity, because individuals do not bear a major part of lost production.¹¹ Moreover, some empirical evidence has suggested that the economic costs of illness are unlikely to be reflected in answers to health related quality of life questions, so they should be counted separately.¹² Drummond et al, (p 86) recommend that analysts ask individuals to ignore income effects when they are asked to estimate the value of improved health, and then to estimate productivity changes separately for inclusion in the numerator of the CE ratio.⁷

Whether to include costs related to productivity consequences in the numerator of a CE ratio could have considerable influence on the estimated CE ratio. As 1 example, Cheng et al reported that the direct medical cost per QALY of cochlear implantation in deaf children was roughly \$9000 per QALY; when indirect costs, such as changes in future earnings were included, the technology was estimated to save net resources.

A related question pertains to the matter of how to value changes in productivity. Traditionally, these have been estimated using a human capital approach whereby healthy

time produced is quantified in terms of an individual’s productive potential as measured by market wage rates (with some analysts imputing an equivalent value for those not in paid employment).⁷ Koopmanschap et al, have argued for a “friction cost” method, which considers the time span of unemployment before production levels are restored.¹³ Studies have shown that, at least in some instances, whether one uses the human capital or friction cost method can substantially influence results.¹⁴

FUTURE COSTS

Over the years, analysts have debated whether CE analyses should include future resource use associated with diseases unrelated to the intervention in question, as well as nonhealth care costs which occurs during added years of life? On these questions the Panel hedged, stating that “analysts use their discretion in including or excluding these costs.”⁶ The Panel noted that, “Like other costs and consequences, the rule of reason applies to these costs: if they are small compared with the magnitude of the C/E ratio, they can be omitted without affecting results in any case, and if they are large, we recommend that the analyst conduct a sensitivity analysis to assess their effects.”⁶ Since the Panel report, others have persuasively argued that omitting future costs could distort comparisons of programs at different ages and favor programs that extend life over those that improve quality of life.¹¹ Johannesson et al, for example, reported that the cost per QALY for hypertension treatment was lowest among middle-aged men and women when future costs were included, but lowest among older men and women when they were excluded.¹⁵ Including future costs in the analysis increased the cost per QALY ratio from \$3000 to \$30,000 in older men and women.¹⁵

HOW TO VALUE DRUG COSTS?

Another set of questions related to costing and perspective pertains to the valuation, rather than the identification, of resources. Following standard economic theory, the Panel noted that the real cost to society of any resource is its opportunity cost – ie, the value of the resource in its next best alternative use. The Panel further pointed out that market prices often provide a reasonable estimate of opportunity cost, though they also noted that health care is notorious for its market imperfections (eg, taxes, insurance subsidies, asymmetric information). As an example, using actual market prices – say, hospital charges – to value health care resources could lead to large distortions between the estimated and real economic costs involved in the production of health services.

In the case of drugs, CE analysts have often used the published Average Wholesale Price (AWP) as the source for valuing drug costs in the United States.¹⁶ However, the AWP does not measure actual prices paid for pharmaceuticals, because it ignores the discounts and rebates that health plans typically receive. Moreover, the AWP does not reflect the marginal cost of producing and distributing the drug, which typically are quite low once the drug has been approved for the market place.⁶ As Garrison et al highlight, because the marginal societal costs of drugs are much less than the total

acquisition costs (whether they reflect AWP, average sales price, or deeply discounted negotiated prices) during the period of patent protection, most of CEAs of drugs to date have most likely overestimated the drug's CE ratios (ie, the published ratios are higher or less favorable than they actually are).¹⁶ On the other hand, Garrison et al also observe that the AWP rather than the marginal social cost of drugs may be more relevant to actual payers. The issue of which drug price to use is not simply a theoretical matter, because the estimated CE ratios for pharmaceuticals are typically heavily influenced by the drug price assumed in the analysis.¹⁷ As just 1 example, Lieu et al estimated that the CE of pneumococcal conjugate vaccination of healthy infants would result in net savings for society if the vaccine cost less than \$46 per dose; at the manufacturer's list price of \$58 per dose, infant vaccination would cost society \$80,000 per life-year saved.¹⁸

The question of whose "perspective" the CEA should take has always loomed as one of the thorniest areas of CEA, for the measurement of both costs and benefits. In terms of costing, the theoretical ideal of the societal perspective conflicts with the perspective of the decision maker who pays the bills.

Another aspect of the perspective question pertains to whether one should consider a short- or a long-term time horizon. In terms of drug costs, the Panel noted that from a long-term societal perspective, if a drug is not already in existence, the appropriate valuation would include the research and development (R and D) costs, as well as costs of production, distribution, and provision of the drug. If the intervention is already in existence, however, they recommended excluding R and D costs. In the end, the Panel side-stepped the issue with a nod to the pragmatic appeal of prevailing transaction prices (AWP) as a "serviceable way to value consumption of drugs," and by encouraging analysts to conduct sensitivity analyses to determine the impact of R and D costs on the price.⁶

DATA AND METHODS

An analysis of the Tufts Medical Center CEA Registry sheds light on the state and evolution of cost estimation in published CEAs. The Registry, developed and maintained by researchers at the Center for the Evaluation of Value and Risk in Health at Tufts Medical Center, contains information on the methods and results from original cost-utility analyses (CUAs) published in the medical literature.¹⁹ The Registry also provides an online-based searchable database (Available at: www.cearegistry.org). The goal of the project is to shed light on society's best opportunities for saving lives and improving human health, and to move the field toward a standardization of CE methodology. Our methods for data collection has been described elsewhere.¹ Essentially, 2 trained readers systematically review each article with the aid of a 40-item audit form to collect information on a wide range of variables, including methods used in cost estimation. After independently reading articles, the readers engage in a consensus discussion to address any discrepancies. Currently, the CEA Registry contains over 3000 cost-utility ratios and utility weights for roughly 4000 health states from 1164 published CUAs through 2005.

Previous analyses of the Registry have shown that there is a great deal of variation in the costing methodology used in published CEAs (Table 1). In a review of 228 CUAs published through 1997, Stone et al found that although most studies (99%) included direct health care costs, relatively few included direct nonhealth care costs (17%).³ The studies that included direct nonhealth costs estimated patient time (9.6%), transportation (4.8%), family or caregiver time (5.7%), or social services (2.6%). Only 8% of the studies included what they termed productivity costs, whereas 6% considered future costs in added life-years.

For purposes of this article, I examine updated data from the CEA Registry to investigate the use of perspective in published CUAs. I also analyze changes over time in several dimensions related to costing methodology: disclosure of study perspective; statement of time horizon; use of discounting for future costs and QALYs; statement of year of currency; reporting of sensitivity analysis; and use of incremental analysis.

RESULTS

The number of published CEAs has grown rapidly in recent years, averaging roughly 50 per year from 1995 to 1999 and over 150 per year from 2001 to 2005. In over 40% of published CUAs, analysts have claimed that they followed a societal perspective, though our own reviewers judge the perspective to be a societal perspective in only 29% of the studies (Table 2). Analysts claim a health care payer perspective in just below 33% of cases, while our readers judge 69% to have a payer perspective.

An analysis of CEA Registry data also indicates that costing methods have improved over time in some respects. As Table 3 illustrates, the percentage of studies clearly reporting their methods for estimating costs has improved in certain categories, including statement of study perspective, and statement about the year and currency of costed items. In all of the

TABLE 1. Cost Components Included in Published CUAs, 1976 to 1997

Cost Components Included	n = 228
Direct health care costs	226 (99.1%)
Intervention	222 (97.4%)
Hospitalization	199 (87.3%)
Outpatient visits	167 (73.2%)
Long-term care	28 (12.3%)
Other health care	165 (72.4%)
Direct nonhealth care and time costs	38 (16.7%)
Patient time	22 (9.6%)
Transportation	11 (4.8%)
Family/caregiver time	13 (5.7%)
Social services	6 (2.6%)
Productivity costs	19 (8.3%)
Other	5 (2.2%)

Source: Stone PW, Liljas B, Chapman RC, et al. Variations in methods to estimate costs in cost-effectiveness analyses. *Int J Technol Assess Health Care*. 2000;16:111-124.³

TABLE 2. Perspective Used in Published CUAs, 1976 to 2005

	As Stated By Author	As Stated By Reviewer
Societal	473 (40.6%)	341 (29.3%)
Health care payer	382 (32.8%)	799 (68.6%)
Not stated/could not be determined	298 (25.6%)	16 (1.4%)
Other	11 (0.9%)	8 (0.7%)
Total	1164	1164

Source: Center for the Evaluation of Value and Risk in Health. Tufts Medical Center. "CEA Registry." Available at: www.cearegistry.org. Accessed May 15, 2008.¹⁹

TABLE 3. Change Over Time in Costing Methods in Published CUAs

Item	1976–1997 (n = 227)	1998–2001 (n = 300)	2002–2005 (n = 637)	P
Presented the study perspective clearly	52%	74%	83%	<0.0001
Presented the study time horizon	90%	75%	87%	0.3378
Conducted and reported sensitivity analysis	88%	93%	84%	0.0147
Discounted costs and QALYs	74%	85%	84%	0.0028
Stated the year of currency for resource costs	68%	83%	85%	<0.0001

Source: Center for the Evaluation of Value and Risk in Health. Tufts Medical Center. "CEA Registry." Available at: www.cearegistry.org. Accessed May 15, 2008.¹⁹

categories, well over 80% of the studies adhered to recommended protocols in the 2002 to 2005 time period (Table 3).

DISCUSSION

Methods for costing in CEA show some progress and room for improvement. On the whole, the field has improved in terms of the transparency with which study authors report costing methodology. However, problems persist, particularly in the sense that many analysts continue to claim a societal perspective, while collecting and analyzing data only from a payer perspective.

The discrepancy between the perspective researchers declare in their published CEAs, and the perspective for the article as judged by our Registry readers suggests lingering confusion about what set of cost components constitutes a societal perspective. For example, should all CEAs include nonmedical costs? Should they include productivity costs in the numerator or denominator of the CE ratio? Where should one "draw the line" in terms of judging when a CEA has met a societal perspective standard?

In compiling the Tufts Medical Center CEA Registry, our researchers are instructed to be generous in their assessments of perspective, labeling a CEA as adhering to a societal perspective if study authors estimate QALYs as the measure of benefit, and include any reasonable costs that do not accrue solely to health care payers. For example, if authors include direct health costs in their analyses and in addition estimate

travel costs or/and out of pocket expenses, or/and productivity/sick day costs, we label the analysis as having a societal perspective. Admittedly, there is a potential inconsistency in that a CEA that includes direct health costs plus productivity costs may be labeled a societal perspective, whereas a CEA that includes direct health care costs and assumes but do not state that productivity costs are embedded in QALY calculation can be labeled a payer perspective.

To complicate matters, practices vary considerably across published studies, and frequently study authors are not explicit about their methodology. Often, authors assert a societal perspective, but only include direct health costs that accrue to payers. In claiming a societal perspective, many CEA researchers seem to mean that they included all of society's health care costs, omitting other costs such as travel time or caregiver costs or impacts on earnings and productivity. Even so, analysts tend to exclude patients' out-of-pocket costs for health care. Sometimes authors allege a societal perspective and then explicitly state that nonmedical costs were not included.²⁰

The data from Stone et al, which examined the state of cost estimation in published CEAs through 1997, indicated that fewer than 17% of published analyses included any direct nonhealth costs.³ Unfortunately, in our CEA Registry we no longer collect detailed data on the type of cost components included in published CEAs. However, earlier 1997 data on the discrepancy between authors and our readers judgments about whether an analysis used a societal perspective suggest that the trend (ie, of analysts excluding nonhealth costs and claiming a societal perspective) has continued.

Going forward, the Panel's appeal to a "rule of reason" regarding which costs to include under a societal perspective still provides useful if somewhat vague guidance. The rule states that "decision about costs and health effects to include in a CEA, such as the precision with which costs and effects are measured . . . should strike a reasonable balance between expense and difficulty and potential importance in the analysis."⁶ More clarity from leading practitioners about the placement of productivity costs would also be welcome given the conceptual ambiguity.⁸

Apart from issues pertaining to which cost components to include in the societal perspective, questions persist about how components are valued. Variations in practices underscore the need for caution in comparing results across analyses. They also highlight the need to continue to monitor the field and to work towards the standardization of costing methods across analyses.

Notably, the results presented here pertain to published CUAs, which comprise only a subset of all economic evaluations. Studies have shown that most published economic evaluations are in the form of cost-consequences analyses or other forms of CE analyses.²¹ Cost-utility analysis has been recommended by consensus groups and thus may reflect the "cream of the crop" of economic evaluations. Variations and problems in costing methodology may have appeared even worse if the analysis had been expanded to other types of economic evaluation.

The field would also benefit from more attention to the question of how much different costing methods influence the results of CE analyses. Clearly, the type of costing methodology used can be important. Productivity costs can comprise a large proportion of total costs in certain illnesses and conditions (eg, migraine, depression), which afflict working aged populations. Meltzer and Johannesson have shown future costs can matter for certain types of treatments and illnesses (and they point out that in any event, including an implicit estimate of zero by omitting such costs is not preferable to even imprecise estimates).¹¹ Moreover, as Garrison et al note, very few studies have attempted to estimate true opportunity costs of resources using instead market prices and that “when it comes to measuring the opportunity costs of patented drugs, the difference between price and true opportunity cost may be the greatest among all of the factors typically included in a CEA.”¹⁶

On the other hand, researchers have shown that in the majority of CUAs, “quality-adjusting” the life years gained from use of an intervention does not substantially alter its estimated CE, suggesting that sensitivity analyses using ad hoc adjustments or ‘off-the-shelf’ utility weights may be sufficient for many analyses.²² Conceivably, the use of off-the-shelf cost estimates (ie, standard unit costs to value particular items or services) could be employed as a reasonable approximation for the valuation of resources considered in CEAs. Ultimately, as is the case with health utility data and any inputs into CEAs, the collection of cost data should only be undertaken if the value of this information is likely to be greater than the cost of obtaining it.

At the very least analysts conducting CEAs should be more transparent about costing methodology and clearer in statements about perspective. Drummond et al have suggested reasonably that analysts should present both health care and non health care costs and benefits separately in the analysis, so that the opportunity cost on the health care budget is clearly identified.⁷ All of us in the field can raise awareness that few costing exercises produce true societal CEA.¹⁶ Finally, more attention is warranted on the question of what costing data the decision makers themselves find most useful.

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