More Care Needed: Incorporating Equity into Health Technology Assessment

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Introduction

Many healthcare systems have the objective of not only improving health outcomes but also reducing health inequities.[1] This is reflected in the decision factors considered in Health Technology Assessment (HTA). However, whereas efficiency is often precisely defined and formally measured, equity considerations are generally incorporated into HTA through committee deliberations.[2] The lack of rigor and transparency associated with such deliberative approaches may very well lead to inconsistent and inadequate considerations of equity in HTA.

Several approaches have been proposed to redress this imbalance.[3] Most prominently, it has been suggested that willingness to pay thresholds be weighted to reflect health equity considerations such as baseline burden of disease. This approach is adopted in the Netherlands,[4] and is currently the favored method used by NICE in their consultation on value-based assessment.[5]

"One particular benefit [of MCDA] is its ability to formally define, measure, weight, and incorporate health equity considerations into a comprehensive evaluation of health technologies."

Multi-criteria decision analysis (MCDA) is an alternative approach receiving an increasing amount of attention. MCDA is an umbrella term that refers to a set of analytical methods and techniques to support decision-making and the evaluation of alternatives on multiple, often conflicting, criteria and objectives. Indeed, MCDA has the potential to bring a number of benefits to healthcare decision making.[6] It offers techniques that can value health technologies in a manner compatible with traditional approaches to HTA.[7] One particular benefit is its ability to formally define, measure, weight, and incorporate health equity considerations into a comprehensive evaluation of health technologies.

The objective of this article is twofold: to review and illustrate the use of MCDA to incorporate health equity into HTA, and to identify good practices in doing so.

Current use of MCDA to capture health equity benefits

As their familiarity with MCDA grows, healthcare decision-makers and researchers are increasingly acknowledging its potential to improve decision-making.[8] Consequently, there has recently been an increase in the number of publications on the implementation of MCDA in healthcare.[9] Among these, there are several examples of MCDAs that incorporate health equity criteria, such as severity of disease or access to effective treatment. More specifically, of those MCDAs designed to support healthcare resource allocation decisions, 53% included severity of a disease and 42% included access to an effective treatment.[6]

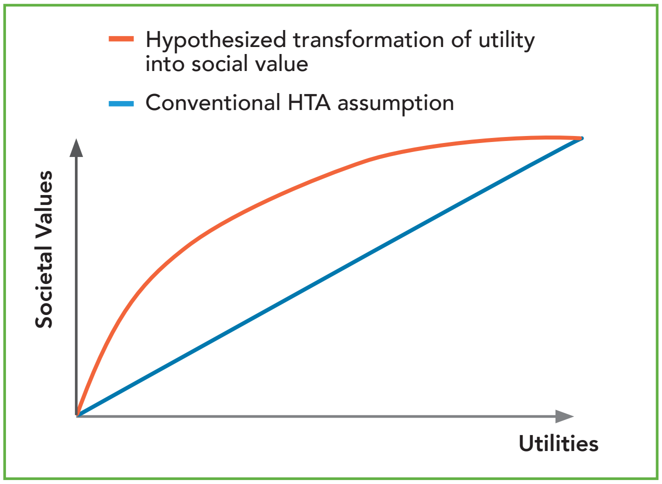
This interest is not confined to methodological curiosity. HTA agencies are piloting and implementing MCDA. In Germany, the Institute for Quality and Efficiency in Health Care (IQWiG) has piloted the use of two types of MCDAs – conjoint analysis and the analytical hierarchy process – to weigh clinical endpoints and generate efficiency frontiers based on aggregated outcomes.[10, 11] The Lombardi region of Italy has adopted an MCDA framework for HTA.[12]

Table 1 illustrates how health equity is incorporated in an MCDA assessment of hospital medical technologies in Hungary. Between its introduction in 2010 and 2013,

Table 1: Criteria and Weights from the Multi-Criteria Decision Analysis of New Hospital Medical Technologies in Hungary[13]

Criteria	Points (weight)
1. Health care priority	20
I.1. Public health programs	6
I.2. Health policy priority	7
I.3. Aggregated health benefit	7
II. Severity of disease	15
II.1. Life-threatening disease — acute	13-15
II.2. Life-threatening disease — chronic	10-12
II.3. Not a life-threatening disease — acute	8-9
II.4. Not a life-threatening disease — chronic	6-7
III. Equity	15
III.1. Number of patients	8
III.2. Availability Access	7
IV. Cost-effectiveness, quality of life	30
IV.1. ICER (incremental cost-effectiveness ratio)	15
IV.2. Health benefit per patient	15
V. Aggregated budget impact	10
VI. National and international reputation	10
VI.1. Opinion of medical college	3
VI.2. International application	3
VI.3. Grading of evidences related to the procedure under consideration	4
Total	100

Figure 1: Valuing Health Outcomes[3]



14 applications were assessed using this MCDA. Criteria and their weights were established by a committee comprising the healthcare financing agency, the Ministry of Health, clinical experts, and health economists. Weights were determined by allocating 100 points across the criteria to reflect their relative importance. The criteria and weights were submitted to other stakeholders for validation. Several equity concepts are incorporated into the Hungarian MCDA, including numbers of patients, access to treatment, and severity of disease. In combination these factors account for 30% of the weights attached to criteria.

The MCDA technique adopted in Hungary is an additive value approach, as is the case for most MCDAs for HTA developed to date. Such additive models are commonly used as they are relatively easy to understand and apply. They do, however, raise several methodological concerns. This is illustrated in the next section.

Good practice when using MCDA to incorporate health equity into HTA

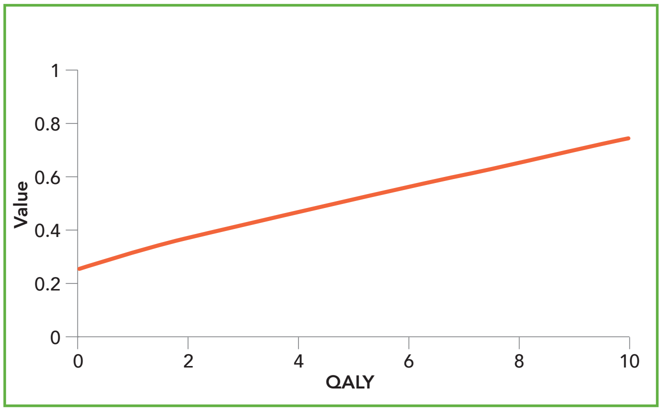
Additive value models of the type applied to support HTA require a number of analytical assumptions. Among these assumptions is the requirement that criteria are preferentially independent – the strength of preference for the performance of an option on a given criterion should not depend on its performance on another criterion.[14] However, incorporating certain health equity considerations, such as severity of disease, into additive value models often ignores this requirement, as the health outcome criterion is not preferentially independent of the severity of disease criterion.

This observation is the basis for a criticism of the way that the quality adjusted life year (QALY) is currently used in HTA. Cost-utility analysis invariably assumes that QALYs have the same value; an approach often summarized in the saying 'a QALY is a QALY is a QALY'. However, this is contrary to the argument that the value of a health outcome is a function of baseline health, among other things.[3] Figure 1 shows Nord's proposed health value function, which illustrates how we might expect the value of a health outcome to depend on baseline health.

In the remainder of this section, we illustrate the challenges of using the additive models in the presence of non-independent criteria, assuming that our objective is to capture the value judgments reflected in Figure 1. Table 2 illustrates the calculations involved in applying the type of additive model commonly used when applying MCDA to HTA. A simple two-criteria MCDA is used in the illustration. The first criterion is health outcome, measured as life expectancy in QALYs. The second criterion is baseline health, which we use as a proxy for equity considerations. This is measured in discrete categories, also defined in QALYs, with decreasing severity. The analysis contains 11 hypothetical treatments that have 0-10 QALY health outcomes with different baseline health profiles (categories 0-9 QALYs).

The first step in the MCDA is to convert performance on each criterion into preference scores on a common 0-1 scale, representing the perceived value of these performances, which enables the comparison and subsequent aggregation of the measures. We assume a linear transformation for both the health outcome and the baseline health criterion, for simplicity of illustration, although we appreciate different disease contexts may call for different shapes.

Figure 2: Additive Value Function



The second step is to determine value trade-offs, or to quantify how each criterion is prioritized using weights. We assume one unit increase in health outcome to be 2.7 times more important than one unit decrease in baseline health, meaning that the weight of health outcome must be 3 = $^{10}/_{9}$ × 2.7 times the weight of baseline health. The normalized weights are then 0.75 and 0.25, and an overall value for each treatment can then be obtained by aggregating these scores and weights. For instance, the value of the fourth treatment in Table 2 using the additive function is 0.42 = 0.75 x 0.30 + 0.25 x 0.78.

The challenge with using additive value functions in the presence of non-preferentially independent criteria can be illustrated by comparing the health value function generated with the additive value model (Figure 2) with that hypothesized in Figure 1. In contrast to the

Table 2: Illustration of Additive and Multiplicative Value Functions (VF)

Treatment	Health Outcome		Baseline Health			Additive VF	Multiplicative VF
	QALYs	Normalized Score	QALY Category	Normalized Score	Multiplicative Factor		
1	0	0.00	0	1.00	2.00	0.25	0.00
2	1	0.10	0	1.00	2.00	0.33	0.20
3	2	0.20	1	0.89	1.89	0.37	0.38
4	3	0.30	2	0.78	1.78	0.42	0.53
5	4	0.40	3	0.67	1.67	0.47	0.67
6	5	0.50	4	0.56	1.56	0.51	0.78
7	6	0.60	5	0.44	1.44	0.56	0.87
8	7	0.70	6	0.33	1.33	0.61	0.93
9	8	0.80	7	0.22	1.22	0.66	0.98
10	9	0.90	8	0.11	1.11	0.70	1.00
11	10	1.00	9	0.00	1.00	0.75	1.00

non-linear function in Figure 1, the additive value function in Figure 2 is broadly linear.

In the presence of a lack of independence between criteria, good practice is to either adopt a multiplicative model[15] or to combine the interacting criteria into a single criterion.[16] Multiplicative models give different values to health gains for different levels of baseline health. Table 2 illustrates this in the form of a 'multiplicative factor', which values each QALY outcome differently depending on the baseline health level. For instance, the value of the fourth treatment in Table 2 using the multiplicative function would be 0.53 = 1.78 × 0.30, where 1.78 represents the multiplicative factor applied to the health outcome due to the severity of the disease. Figure 3 reports the result of this multiplicative model which displays similar non-linear characteristics to Nord's hypothesized function (Figure 1).

The multiplicative function in Figure 3, while having similar characteristics, does not have the exact same form as the hypothesized function in Figure 1. This is because of the exact multiplicative factors applied in the multiplicative function, which were assumed for the sake of illustration. These should be elicited from stakeholders, rather than being assumed by the researcher. The recommended approach for eliciting these value judgments is illustrated in Figure 4, which requires stakeholders to provide a value for the same QALY gain dependent on the baseline disease severity. In this instance, we are determining the value (on a 0-100 scale) of three levels of QALY gain for three levels of disease severity, where a high QALY gain from a point of high disease severity is valued at 100. The result is effectively a new criterion, which can be scored on nine levels, where each level is a function of two attributes: severity of disease and health outcome.

Figure 3: Multiplicative Value Function

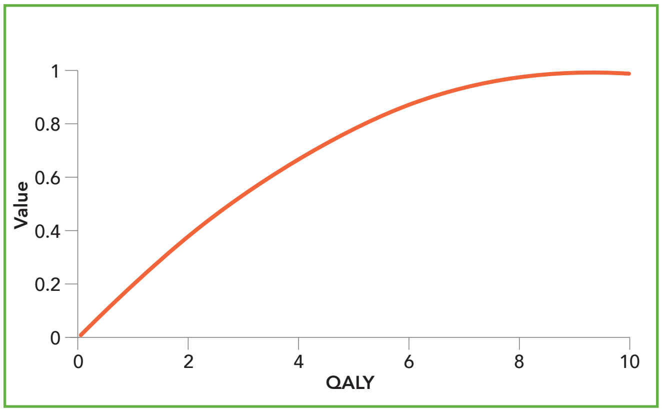
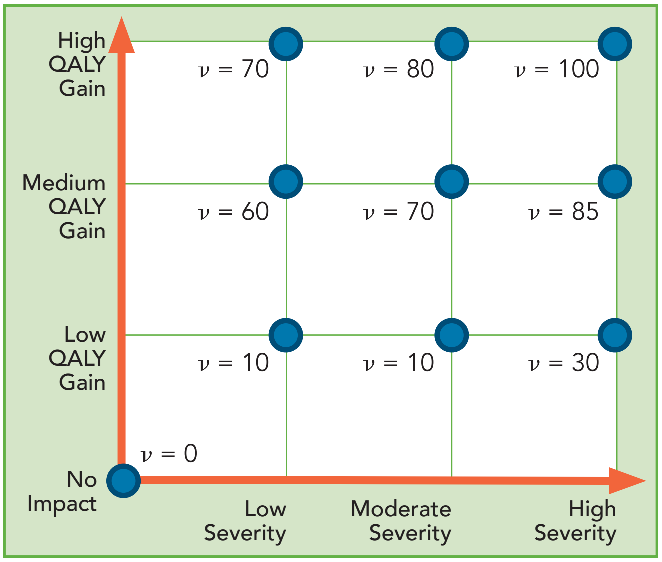


Figure 4: Illustration of Eliciting Values for Interacting Criteria



The implications of these observations will depend on the decision problem the MCDA is designed to support. If the purpose is to rank interventions, such as when supporting clinician-patient shared decision-making, the additive model may be acceptable. If, however, the objective is to value interventions, such as when undertaking HTA or informing pricing decisions, a more sophisticated approach would be needed, such as either the multiplicative method or the additive method with combined criteria as described earlier.

Conclusion

MCDA has the potential to bring increased transparency, consistency and accountability to healthcare decision making. However, current applications of MCDA fail to adequately capture social value judgments, risking providing spurious recommendations to decision makers. We have illustrated this with the example of health equities. This illustration is based on an assumption that the true health value function corresponds with that hypothesized by Nord. This assumption requires further validation. However, in the meantime this serves to raise important questions about the appropriateness of the current use of additive value function in healthcare. We welcome the increased interest in MCDA, though caution that more care is needed, and that the use of MCDA is accompanied by a more sophisticated methodological discussion than is currently the case.

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