Cost-Value Analysis of Health Interventions: Introduction and Update on Methods and Preference Data

Erik Nord

Published online: 9 December 2014
© Springer International Publishing Switzerland 2014

Abstract According to the consensus statement from the International Society for Pharmacoeconomics and Outcomes Research Quality-Adjusted Life-Year (QALY) workshop in Philadelphia in 2007 “concerns for fairness may cause social resource allocation preferences to deviate considerably from the ranking that consideration of costs per QALY would suggest.” Salient concerns for fairness include the view that priority should be given to the severely ill over the less severely ill, that people have a right to realize their potential for health even if their capacity to benefit from treatment is moderate, and that everybody has the same right to treatment that averts premature death, even if their health and functional level is less than perfect. Cost-value analysis incorporates these concerns in formal economic evaluation of health interventions and programs and thus has a potential for ranking interventions and programs in a way that is more consistent with societal values. Data on the strength of public concerns for fairness are now sufficient to be useful in formal economic evaluation. The data may, within a context of fair and open deliberations, help societal decision makers to roughly indicate the societal value of a QALY in different circumstances and thus determine a tentative grading of willingness to pay for a QALY.

Key Points for Decision Makers

Prioritising between health programs mainly according to their costs per quality-adjusted life-year (QALY) is in many jurisdictions inconsistent with societal concerns for fairness

Concerns for fairness, such as concerns for severity of illness and realization of people’s potential for health, may in principle be quantified at a cardinal level of measurement

In cost-value analysis, such concerns are incorporated in formal economic evaluation

Data on the strength of the general public’s concerns for fairness are now available to such an extent that cost-value analysis may be helpful in informing societal decision making about resource allocation and priority setting

1 Introduction

Cost-value analysis is what societal decision makers do whenever they judge whether the value of a healthcare activity is great enough to justify public coverage of the costs. Societal decision makers typically conduct such value judgements ‘all things considered.’ This means that they take into account considerations of both effect sizes (efficiency) and distributive fairness (equity). Value assessments in this broad sense are commonly referred to as ‘societal’ or ‘social’ [1, 2].

Health economists see it as their role to inform policy makers engaged in cost-value judgements by providing

E. Nord (✉)
Norwegian Institute of Public Health,
Torshov, PO Box 4404, 0403 Oslo, Norway
e-mail: erik.nord@folkehelsa.no

systematic and formal presentations of costs and benefits of the health interventions in question. Ideally—that is, in order to be as useful as possible—they should in these presentations include the same value considerations as the policy makers have decided are relevant. This implies using a broad societal concept of value that includes concerns for both efficiency and equity. But this is not what health economists mainly have been doing for the last 40 years. Their focus has been on cost-effectiveness analysis, in which the benefits of healthcare are quantified as the unweighted sum of individual benefits measured in terms of quality-adjusted life-years (QALYs). The ratio between the costs of the activity and the QALY gains it provides is a measure of how efficient the activity is in producing health. This is in itself interesting information. But it does not answer the question of whether the societal value of the activity (the value all things considered) justifies its costs.

Arguably, this conceptual point is of little interest if, in practice, estimates of QALY gains are fairly consistent with estimates of societal value. This seems to have been the assumption until quite recently in the UK, where the National Institute for Health and Care Excellence (NICE) has judged considerations other than the amount of health produced to be of relatively little importance. The key question for decision making has simply been whether the cost per QALY of an activity is within what NICE has decided is an acceptable upper limit to costs per QALY.

But the relative societal value of different healthcare activities may deviate significantly from their relative value in terms of QALYs. An example is as follows: Assume QALYs are calculated by means of utilities from the much used quality-of-life instrument the EQ-5D [3]. Consider an illness A, which entails some problems in moving about and in performing daily activities, but has no effects on self-care, pain, or mental health (code 21211). Assume another illness B, which entails some problems in moving about and in performing daily activities, but also moderate pain and moderate depression (code 21222). The two states score 0.81 and 0.62, respectively, according to the time trade-off-based York tariff of the EQ-5D [3]. The scores imply that an intervention that cures people with illness A and increases utility by 0.19 yields as many QALYs as an intervention that increases utility by 0.19 by relieving people with illness B of their pain and depression (assuming the same number of life-years affected per person). However, in many countries, there is much emphasis on severity of illness in priority setting (a concern for ‘the worse off’), such that symptom relief in people with illness B would be thought of as more important than curing people with illness A [4], see also support in theories of justice, Daniels [5].

Another example is this: Assume two groups of patients with different diseases, both in a state scoring 0.62 above.

Assume one group is more treatable than the other, so that one group can be cured, while the other group can only be relieved of its pain and depression. Treatment of the former group will score twice as much in terms of QALYs as the latter group. But societal decision makers may not think it fair to give the latter group lower priority than the former, on the grounds that the two groups are in equal need, both can be helped significantly, and it would be unfair to discriminate against a group who happens to have a lower potential for improvement [6, 7].

The primacy given to QALYs in estimations of societal value has increasingly been questioned. According to a consensus statement from a large international workshop on the QALY organized by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) in Philadelphia in 2007 ‘concerns for fairness have been raised internationally in all settings where cost-effectiveness analysis (CEA) has been studied and/or applied’ and ‘such concerns may cause social resource allocation preferences to deviate considerably from the ranking that consideration of costs per QALY would suggest’ [8]. In some countries, this has led to interest in ways to ‘equity weight’ QALYs. I return to this in the discussion section. In Germany, concerns for fairness have led policy makers to steer completely away from cost-per QALY comparisons across therapeutic areas. The country’s national health technology assessment institute, IQWiG, instead limits itself to determining what may be an acceptable price for a new technology—typically a drug—given the going rate of cost effectiveness hitherto in the therapeutic area in question [9].

Nord, in 1993 [10], introduced the term ‘cost-value analysis’ (CVA) to designate economic evaluation in which the valuation of outcomes takes concerns for fairness—or equity—into account in a formal, quantitative manner. The essence of CVA is to replace estimates of aggregate personal value in terms of unweighted QALYs with estimates of overall societal value. CVA is meant to be supplementary to conventional CEA and provide decision makers with a broader picture than does CEA alone.

A first version of CVA included the two concerns for fairness that were illustrated in the examples above, as these seemed to be particularly widespread and salient [4, 11]. One is the concern for severity, often referred to as a concern for ‘vertical equity’. The other is the wish not to discriminate too strongly between groups that are in equal need but have different potentials for health and thus different capacities to benefit from interventions. This is often referred to as a concern for ‘horizontal equity’.

While many researchers in the field of health economics are by now familiar with the term ‘cost-value analysis’, the details of the method are unknown to many, and so far it has only rarely been used in practice. The purpose of this paper is to summarize for potentially interested readers

how concerns for fairness are handled formally in CVA and to show the considerable body of evidence from preference studies that is now available to support CVA.

2 Measuring the Strength of Concerns for Fairness

The strength of societal concerns for severity and realisation of potentials has been studied in samples of the general public in several ways. The most widely used technique is the person trade-off, which was introduced by Patrick et al. [12] in 1973 under the name ‘equivalence of numbers’ and given its present name by Nord [13] in 1992. Typically, samples of the general public are presented with pairs of programs targeting two groups of patients that differ on one characteristic. The subjects are presented with numbers of beneficiaries in the two programs and asked to judge at what ratio between the numbers of beneficiaries they find the two programs equally worthy of funding. For instance, a program A provides an improvement in utility from 0.4 to 0.6 for 100 people, while program B provides an improvement from 0.8 to 1.0 for a larger number of people. How large must the latter number be for the two programs to be deemed equally worthy of funding? The stronger the concern for the worse off (those in program A), the higher the stated ‘equivalence number’ in program B will be. Another possible approach to measuring public preferences for equity is to ask questions about how much money a national health service should be willing to spend on different programs. A third approach was used by Dolan [14]. To measure the importance people assign to severity, he presented subjects with an intervention A that would increase utility for one person from 0.2 to 0.4 and an intervention B that would increase utility for another person from 0.4 to some higher level U . The question was: What would U have to be for the two interventions to be considered equally worthy of funding? In a small trial sample, the mean chosen value for U was 0.8, suggesting that the greater the severity, the lower cost effectiveness was demanded by the subjects.

3 Modeling

Concerns for fairness may be represented in a formal evaluation model in various ways. In the following, two approaches that have been suggested hitherto are briefly described.

3.1 Transformation of Utilities

To capture concerns for fairness when prioritising between programs that improve quality of life, Nord and colleagues [15, 16] proposed to replace utilities used in conventional

QALY calculations by societal values characterized by mild and moderate health states being compressed towards the upper end of the 0–1 value scale and such that there is decreasing marginal societal value of increases in individual utility over the whole 0–1 continuum. Consider, for example, Fig. 1. Two patient groups are in states A and B, respectively, and score 0.4 and 0.7, respectively, in terms of utility. An improvement from state A to state B scores the same as an improvement from state B to healthy (0.3). The figure exemplifies how the utilities may be transformed into societal values for priority setting by means of a curve that is convex towards the y-axis. Assume this yields societal values of 0.80 for A and 0.95 for B. In terms of societal value, the improvement from A to B then scores three times as much (rather than equally much) as the one from B to healthy (0.15 vs. 0.05). The transformation thus accommodates concerns for severity. Furthermore, consider two patient groups who are both in state A. One can be raised to state B, the other to full health. With the transformation, the difference in score between the improvements for the two groups is significantly reduced (the former improvement scores 50 % of the latter before the transformation, but 75 % after the transformation). The concern for non-discrimination between groups with different potentials is thus to some extent accommodated.

Note that the transformed values in Fig. 1 are meant as tools to estimate the societal value of changes (improvements) in health. They are not to be understood as the ‘the value of life’ in different health states. This important distinction is overlooked in conventional QALY calculations. I return to this in the discussion section.

Based on rough, informal judgement of Norwegian person trade-off studies, in 1996, Nord and colleagues [15, 16] published a tentative table of societal values for health states with a structure as illustrated in Fig. 1. The table was included in pharmacoeconomic guidelines from the Norwegian Medicine Agency in 2002 as a tool for the pharmaceutical industry to use in order to supplement

Fig. 1 Transformation of utilities into societal values for priority setting

conventional cost-utility analyses with CVA. A major update was conducted recently, based on a review of 17 preferences studies in nine different countries in the time period 1978–2010 [17]. The number of subjects in each study sample was typically 30–70 people. The samples included subjects from the general public, health workers, and politicians—either separately or in various combinations. The review included 116 pairwise comparisons of health improvements where one improvement had a lower start point in terms of utility than the other (i.e. it related to a more severe state) and where subjects had been asked to value the former improvement relative to the latter in terms of a person trade-off or an equivalent method. For each of the 17 studies, regression analysis was used to estimate a functional relationship between the societal value of a health state and its utility measured by the EQ-5D. The following function was used:

$$SV = (n + 1)u / (nu + 1) \quad (1)$$

where SV is the estimated societal value of a health state and u is its EQ-5D utility. For each study, the parameter ‘ n ’ was estimated such that valuations of health benefits by means of the societal values would fit as well as possible to the observed person trade-off data. The size of n varied widely across studies but was, in most cases, in the order of 2–6. Table 1 shows utilities and corresponding societal values for two plausible values of n . Columns 3 and 5 show how the transformation leads to the incorporation of concerns for severity and non-discrimination as was described in connection with Fig. 1.

3.2 Graded Willingness to Pay for a Quality-Adjusted Life-Year

The ‘transformation of utilities approach’ purports to accommodate concerns for severity of illness in terms of loss of quality of life. But the concept of severity of illness

also includes risk of premature death. Proportional shortfall of QALYs has been proposed as a measure of severity that incorporates both the quality and the time aspect of severity [18]. It is defined as $((QALE_N - QALE_D) / (QALE_N)) \times 100$, where $QALE_D$ is the expected number of remaining QALYs for the patients in question and $QALE_N$ is the normal (average) number of remaining QALYs for people of the same age and gender. For patients with stable conditions and no loss in length of life, proportional shortfall (PS) is given directly by the disutility of the condition. For instance, if the condition scores 0.7, PS equals 30 %.

Data from the 17 preference studies mentioned above, with a total of 116 paired comparisons, were recently used to estimate how societal willingness to pay for a QALY may plausibly vary with severity in terms of expected PS of QALYs [19]. Each of the 116 items consisted in a movement dU_A for a person in condition A, a movement dU_B for a person in a less severe condition B, and a number N indicating the number of cases of dU_B deemed equal in societal value to one case of dU_A according to the ‘median subject’ in the study. The median N was thus used as an estimate of the societal value of dU_A relative to dU_B (hereafter labelled SV_{AB}). When N was higher than the size of dU_A relative to dU_B —hereafter called the ‘utility ratio’—it was assumed that the discrepancy was due to concerns for severity. Formally, these concerns may be represented in terms of a severity factor (SF) such that

$$N = dU_A / dU_B \times SF \quad (2)$$

By rearranging Eq. 2 one gets:

$$SF = N \times dU_B / dU_A \quad (3)$$

For instance, if, in a given pair, $dU_A = 0.4$, $dU_B = 0.8$, and $N = 3$, $SF = 6$.

The magnitude of the SF in each pair (the discrepancy between the utility ratio and N) is plausibly a function of

Table 1 Societal values for health states, and societal values of increases in utility, for different values of n

Utility	$n = 2$		$n = 4$	
	Societal value	Value of 0.1 gain in utility	Societal value	Value of 0.1 gain in utility
0.00	0.00	0.25	0.00	0.36
0.10	0.25	0.18	0.36	0.19
0.20	0.43	0.13	0.55	0.13
0.30	0.56	0.11	0.68	0.09
0.40	0.67	0.08	0.77	0.06
0.50	0.75	0.07	0.83	0.05
0.60	0.82	0.055	0.88	0.041
0.70	0.875	0.048	0.921	0.032
0.80	0.923	0.041	0.953	0.025
0.90	0.964	0.036	0.978	0.022
1.00	1.00		1.00	

Table 2 Implied willingness to pay for a QALY when proportional shortfall is 90 % compared with 10 %, by different severity gradients

Severity gradient (<i>k</i>)	Relative WTP for a QALY ($k \times \text{Sdiff} + 1$)	WTP for a QALY when PS = 10 % if WTP at PS = 90 % is €70,000
0	1.0	70,000
1	1.8	38,000
3	3.4	21,000
5	5.0	14,000
10	9.0	8,000

PS proportional shortfall, QALY quality-adjusted life-year, Sdiff absolute difference in severity, WTP willingness to pay

how big the difference in severity is. If concerns for severity are weak, the severity factor will increase only slowly across pairs with increasing differences in severity (all else equal). If concerns for severity are strong, the severity factor will increase more rapidly across such pairs.

Differences in severity were measured as absolute differences—i.e. the difference between u_1 and u_3 —hereafter called Sdiff. For each of the studies, SF was modelled as a linear function of Sdiff:

$$\text{SF} = k \text{ Sdiff} + 1 \quad (4)$$

where the constant was set to be 1 such that zero difference in severity produces a SF of 1. The factor k is called the severity gradient. It may be used to estimate a span in societal valuations of health benefits accruing to people at high and low levels of severity, respectively. To illustrate how the factor k works, consider the following equation resulting from inserting Eqs. 4 in 2:

$$\text{SV}_{\text{AB}} = \text{d}U_{\text{A}}/\text{d}U_{\text{B}} \times (k \text{ Sdiff} + 1) \quad (5)$$

Consider a hypothetical case where the utility start levels for improvements A and B are 0.1 and 0.9, respectively. The severity levels are then 0.9 and 0.1, respectively, or 90 and 10 % in terms of PS if there is no loss in life expectancy involved. Sdiff is 0.8. Assume for simplicity that $\text{d}U_{\text{A}}$ and $\text{d}U_{\text{B}}$ are equal. Assume regression analysis of preference data suggest a severity gradient of 3. The societal value of A relative to B is then estimated to be $3 \times 0.8 + 1 = 3.4$. This would suggest that the societal willingness to pay for a QALY provided to people at initial utility level 0.1 might reasonably be set to be around 3–4 times the societal willingness to pay for a QALY provided to people at initial utility level 0.9.

Arguably, concerns for severity may be assumed to be the same on the quality of life and the length of life dimension (for the full argument, see Nord and Johansen [19], p. 283, first column). Under this assumption, a gradient in willingness to pay for a QALY at different levels of utility loss is directly transferable to willingness to pay at different levels of PS. For example, in the illustrative

case above, the willingness to pay factor of around 3–4 when start utility is 0.1 compared with 0.9 will apply also to QALYs for people with a PS of 90 % compared with people with a PS of 10 %.

For each of the 17 studies, the severity gradient ' k ' was estimated by ordinary least squares regression. The size of the gradient varied very much across studies (total range of 0–88) but was in most cases in the order of 3–10. As noted above, the severity gradient may be used as an indicator of the span in societal valuations of equally sized health benefits for people at high versus low levels of severity. This again may be translated into estimates of willingness to pay for a QALY depending on severity in terms of PS. Table 2 indicates the span for some plausible values of the severity gradient. If, for example, the societal willingness to pay for a QALY is €70,000 when PS is 90 %, and the severity gradient is 5, the data suggest that the willingness to pay for a QALY given a PS of 10 % may reasonably be set at €14,000.

4 Discussion

With a few exceptions [20–22], CVA has not been used in published studies so far. One reason is that it has taken time in many health economics research environments for concerns for equity to be recognized as being of more than secondary importance (compared with concerns for efficiency). Another reason is that CEA in terms of QALYs for two or three decades has been well established in terms of both standardized methods and published results and thus offers possibilities of comparing a wide range of interventions and technologies with each other. CVA is naturally far from being in that position. A third reason is that in the early work of Nord and colleagues [15, 16], the evidence basis for CVA in terms of public preference data in cardinal terms was quite limited. With the recent statistical analyses of the 17 studies mentioned above, this situation is significantly changed. But there is still great variation across preference studies with respect to the estimated values of the parameters ' n ' (in transforming utilities) and ' k ' (in estimating willingness to pay for a QALY). This is the same as saying that there is great variation regarding the strength with which concerns for fairness are indicated. There are thus no grounds for suggesting a universally applicable 'best estimate' of the strength of such concerns. For one thing, any 'best estimate' will, as a minimum, have to be country specific.

But in various ways, CVA is now emerging internationally as a recommended form of economic evaluation, even if the term itself is not used. When the Norwegian Medicine Agency [23] issued updated guidelines for the economic evaluation of pharmaceuticals in 2002, it

signalled that weighting of QALYs by severity would be a next element to introduce in formal evaluations. In the Netherlands, policy makers have, in principle, decided to let willingness to pay for a QALY increase with PS [24] and to investigate further through preference studies what exactly the gradient should be. In the UK, the Department of Health and NICE have taken a similar step towards grading of the willingness of the NHS to accept costs per QALY, using absolute shortfall rather than PS (referred to as ‘burden of illness’) as the preferred measure of severity [25]. Hopefully, the two modelling studies presented above, based on the review of 17 preference studies in nine different countries, will be helpful in follow-up of these initiatives. Further studies of public preferences will, in principle, also be helpful. But it should be borne in mind that reference studies can never provide firm answers to political questions. At the end of the day, it is really a task for politically responsible parties to have open and fair deliberations regarding the importance of equity concerns and to decide the extent to which they should be weighed in formal economic evaluations of healthcare in their jurisdiction.

As noted above, work on CVA has hitherto focused on concerns for severity—with respect to both loss of quality of life and risk of death—and on concerns for realization of potentials for functional status and freedom of symptoms. Another important issue for societal decision makers, related to the idea of realizing potentials, is the following: If risk of fatal events can be reduced in two different groups of people, one of which scores 1.0 on a 0–1 utility scale and the other has a disability associated with a utility score of 0.7, expected gained life-years in the former group will count more than expected gained life-years in the latter group if QALYs are used as the measurement unit. But it is unlikely that societal decision makers in countries where QALYs are in use think it less valuable to protect the lives of disabled people than to protect the lives of otherwise healthy people. Nord [10, 15] thus suggested that, in formal economic evaluation, any gained life-year in less than perfect health should count as 1 whole year as long as the health state in question is good enough for the person in question to consider it ‘liveable’, i.e. preferable to dying. This would be another element in formal CVA. It is not covered by the two technical approaches described in Sect. 3.

Williams [26] suggested in 1997 that QALYs should be assigned more value the more the beneficiaries’ expected health over the whole lifetime falls short of a normal amount of health (including longevity) over a whole life. This fair innings approach has lately been picked up by others [27]. It is essentially a proposal to include a societal concern for equity in the formal economic evaluation. The fair innings approach may thus be seen as yet another

variant of CVA in the general sense of that term. However, so far, support for this approach in terms of results from public preferences is scarce.

More recent approaches to including societal values in formal economic evaluation include Richardson et al.’s [28] ‘social cost-utility analysis’ (<http://www.ispor.org/EducationalVideos/Preferences/JeffRichardson-2012/JeffRichardson-2012.htm>) and ‘relative social willingness to pay’. In the latter, respondents are asked to evaluate programs on behalf of society. Respondents are asked about trade-offs between programs in terms of dollars rather than numbers of patients. However, respondents are not asked for their personal willingness to pay. Instead, the opportunity cost of funds spent on one service is presented as an offsetting reduction in funds for a second service. The amount spent on each service therefore indicates relative, not absolute, value. However, the two services combine to produce one QALY, which allows the calculation of a QALY-like unit of value on a 0–1 scale.

5 Conclusion

According to the consensus statement from the ISPOR QALY workshop in Philadelphia in 2009, ‘concerns for fairness may cause social resource allocation preferences to deviate considerably from the ranking that consideration of costs per QALY would suggest’. CVA has the potential of ranking health interventions and programs in a way that is more consistent with societal values. Data on the strength of public concerns for equity is, in my view, now sufficient to be of interest to societal decision makers. The data may, within a context of fair and open deliberations, help decision makers roughly indicate the societal value of a QALY in different circumstances and thus determine a tentative grading of willingness to pay for a QALY.

Conflicts of interest The author declares no conflicts of interest.

References

1. Nord E, Richardson J, Macarounas-Kirchman K. Societal evaluations of health states. *Int J Technol Assess Health Care*. 1993;9:463–78.
2. NICE. Social value judgements. London: 2005.
3. Williams A. The measurement and valuation of health: a chronicle. Discussion paper 136. Centre for Health Economics. York: The University of York; 1995.
4. Shah K. Severity of illness and priority setting in health care: a review of the literature. *Health Policy*. 2009;93:77–84.
5. Daniels N. *Just health care*. New York: Cambridge University Press; 1985.
6. Nord E. The relevance of health state after treatment in prioritising between patients. *J Med Ethics*. 1993;19:37–42.
7. Pinto JL, Perpinan JM. Health state after treatment: a reason for discrimination? *Health Econ*. 1999;8:701–7.

8. Drummond M, Brixner D, Gold M, Kind P, McGuire A, Nord E. Toward a consensus on the QALY. *Value Health*. 2009;12(Supplement 1):S31–5.
9. Caro J, Nord E, Siebert U, McGuire A, McGregor M, Henry D, de Pouvourville G, Atella V, Kolominsky-Rabas P. The efficiency frontier approach to economic evaluation of health-care interventions. *Health Econ*. 2010;19:1117–27.
10. Nord E. The trade-off between severity of illness and treatment effect in cost-value analysis of health care. *Health Policy*. 1993;24:227–38.
11. Nord E. *Cost-value analysis in health care*. New York: Cambridge University Press; 1999.
12. Patrick DL, Bush JW, Chen MM. Methods for measuring levels of well-being for a health status index. *Health Serv Res*. 1973;8:228–45.
13. Nord E. Methods for quality adjustment of life years. *Soc Sci Med*. 1992;34:559–69.
14. Dolan P. The measurement of individual utility and social welfare. *J Health Econ*. 1998;17:39–52.
15. Nord E. A value table for cost-value analysis of health care. *J Nor Med Assoc*. 1996;116:3246–9 (Text in Norwegian).
16. Nord E, Pinto JL, Richardson J, Menzel P, Ubel P. Incorporating societal concerns for fairness in numerical valuations of health programs. *Health Econ*. 1999;8:25–39.
17. Nord E, Johansen R. Transforming EQ-5D utilities for use in cost-value analysis of health programs. *Eur J Health Econ*. 2014. doi:[10.1007/s10198-014-0576-6](https://doi.org/10.1007/s10198-014-0576-6).
18. Stolk E, Pickee S, Ament A, Busschbach J. Equity in health care prioritization: an empirical inquiry into social value. *Health Econ*. 2005;74:343–55.
19. Nord E, Johansen R. Concerns for severity in priority setting in health care: a review of trade-off data in preference studies and implications for societal willingness to pay for a QALY. *Value Health*. 2014. doi:[10.1016/j.healthpol.2014.02.009](https://doi.org/10.1016/j.healthpol.2014.02.009).
20. Elvik R. The validity of using health state indexes in measuring the consequences of traffic injury for public health. *Soc Sci Med*. 1995;40:1385–98.
21. Nord E, Wisløff F, Hjorth M, Westin J. Cost-utility analysis of Melphalan plus Prednisone with or without Interferon-alpha2b in newly diagnosed multiple myeloma. *Pharmacoeconomics*. 1997;12:89–103.
22. Nord E, Dalgard OS. Economic evaluation of course in coping with depression. *J Nor Med Assoc*. 2006;126:586–8 (Text in Norwegian).
23. Norwegian Medicine Agency. *Guidelines for pharmacoeconomic evaluations*. Oslo: 2002.
24. Van de Wetering EJ, Stolk EA, van Exel NJA, Brouwer WBF. Balancing equity and efficiency in the Dutch basic benefits package using the principle of proportional shortfall. *Eur J Health Econ*. 2103;14:107–15.
25. Department of Health. *A new value-based approach to the pricing of branded medicines*. London: Government response to consultation; 2011.
26. Williams A. Intergenerational equity: an exploration of the ‘fair innings’ argument. *Health Econ*. 1997;6:117–32.
27. Ottersen T. Life time QALY prioritarianism in priority setting. *J Med Ethics*. 2013;39:175–80.
28. Richardson J, Lezzi A, Sinha K, Khan MA, McKie J. An instrument for measuring the social willingness to pay for health state improvement. *Health Econ*. 2013. doi:[10.1002/hec.2950](https://doi.org/10.1002/hec.2950).