

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

Briefing paper for methods review working party on discounting

The briefing paper is intended to provide a brief summary of the issues that are proposed for discussion by the Methods Review Working Party to inform an update to the Institute's Guide to Methods of Technology Appraisal. It is not intended to reflect a comprehensive or systematic review of the literature. The views presented in this paper are those of the authors and do not reflect the views of the Institute.

1 Review of the 'Guide to Methods of Technology Appraisal'

The Institute is reviewing the 'Guide to the methods of technology appraisal', which underpins the technology appraisal programme.

The original Methods Guide was published in February 2001, and a revised version was published in 2007. The Methods Guide provides an overview of the principles and methods used by the Institute in assessing health technologies. It is a guide for all organisations considering submitting evidence to the technology appraisal programme and describes appraisal methodology.

The revised draft of the Methods Guide will be available for a 3-month public consultation, expected to begin in June 2011. We encourage all interested parties to take part in this consultation.

2 Background

2.1 *Introduction to discounting*

The concept of discounting in health economics has been the source of much debate over the last two decades. This paper attempts to summarise the main principles of discounting in health technology assessment, but it is not an exhaustive review of the literature on the topic.

Discounting is an economic method which is used to assess benefits and costs that may occur in different time periods. In order to allow comparison, costs and benefits are converted to present values by applying a discount rate to the entire duration of both benefits and costs. Discounting reflects the view that people generally prefer to receive benefits or goods now, but pay for them later (time preference). Discounting also attaches declining weights to benefits and cost over time to reflect the opportunity cost (that is, the cost of paying up-front for treatment and the value of other treatment that is displaced as a result). The discount rate is generally based on values of social opportunity cost and/or social time preference (Fox-Rushby, 2005).

The mathematical implementation of discounting is relatively simple: for every year where costs are incurred and benefits received, the future value of costs and benefits are multiplied by a discount factor (DF) as follows:

$$DF(T) = \frac{1}{(1 + r)^T},$$

where r is the discount rate and T is the future year to which the present value refers. The discounted present value is then obtained by adding up the reduced future values over the entire time horizon. The above equation is based on the assumption that costs and outcomes are valued periodically (e.g. every year) throughout the time horizon. A different equation is used for implementation of discounting in the case of continuous evaluations.

Figure 1 shows an example of the effect of applying a fixed rate discount to health benefits over a long time horizon. Owing to the compound effect of

discounting, the choice of a particular rate can have a substantial effect on the outcome of the economic modelling.

The impact of discounting varies depending on when costs are incurred during the time horizon and also on when health benefits are gained. The nature of the health-care intervention therefore has a bearing on the effect of discounting. For instance, discounting has the potential to have a substantial differential impact on costs and benefits in cases where costs are incurred upfront and benefits occur in the far future. This is particularly evident in public health programmes such as screening and paediatric vaccination (Severens 2004).

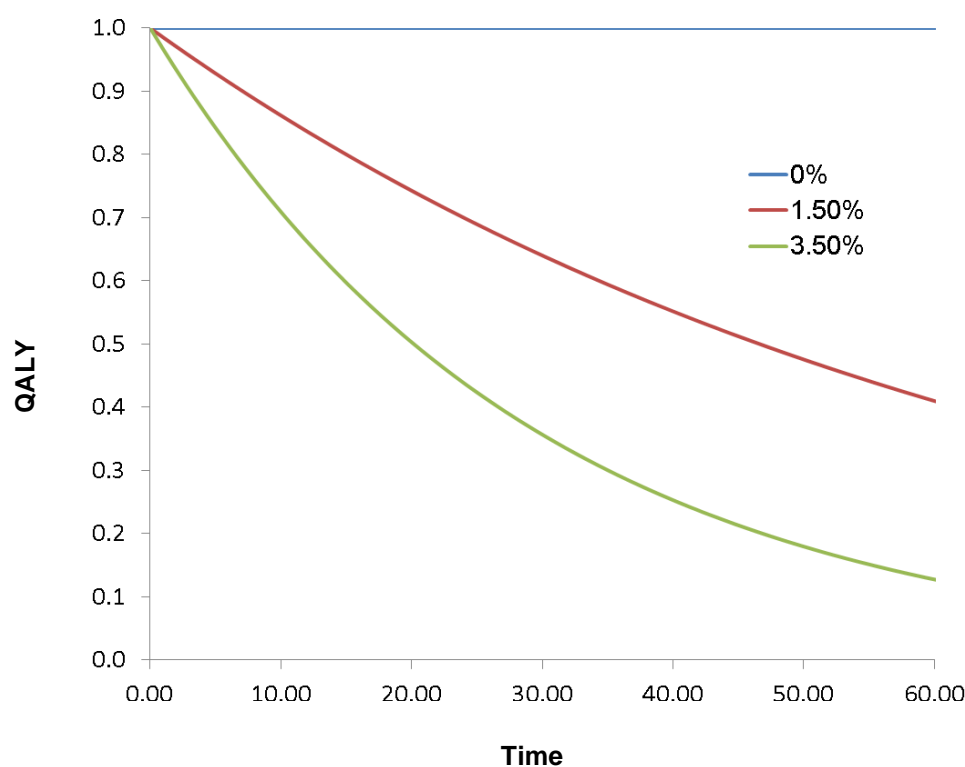


Figure 1: The impact of compound discounting. The graph shows the effect when the discount rate is varied over a time horizon of 60 years, starting at 1 QALY and the reduction in values in subsequent years. Note that discount rates are fixed throughout the period and no change in health states is assumed throughout the time horizon.

2.1.1 Choice of time preference rate

NICE currently bases its discount rate for costs and benefits on the recommended rate set by the HM Treasury for public sector investment appraisal. This rate is a social time preference rate, rather than an individual

preference rate. The social time preference is defined as the value society attaches to present, as opposed to future, consumption. The social time preference rate comprises two components (Green Book, 2003):

- the rate at which future consumption is discounted over present consumption, on the assumption that no change in per capita consumption is expected. This rate is made up of two elements: catastrophic risk (L) and pure time preference (δ),

and

- an additional component, if per capita consumption is expected to grow over time, reflecting the fact that these circumstances imply future consumption will be plentiful relative to the current position and thus have lower marginal utility. This effect is represented by the product of the annual growth in per capita consumption (g) and the elasticity of marginal utility of consumption (μ) with respect to utility.

Mathematically the social time preference (r) is represented by the following equation:

$$r = (L + \delta) + (\mu * g)$$

The current HM Treasury social time preference rate is made up of the following values: $r = (0.01 + 0.005) + (1.0 * 0.02) = 3.5$ per cent.

The rate of personal time preference has been studied in a UK-wide study, TEMPUS (Cairns and van der Pol, 2000). In this study the personal time preference was found to be higher than the social time preference value used by the Treasury (median discount rate ranging from 3.8% to 6.4%). The relationship between individual time preference and the social rate of discount has been debated over the years; however the TEMPUS study was not designed to address the normative question of the appropriate discount rate to use in economic evaluations. Nevertheless, Cairns and van der Pol argue that the personal preferences could be seen as an input into discussion about the appropriate rate of social discount.

2.1.2 Differential, uniform and time-varying discounting

In spite of being mathematically simple, health economists have had a long-standing debate on how discounting should be applied in the case of non-monetary units such as QALYs which measure health benefits (see for instance Cairns, 1992; Lipscomb 1996, Brouwer 2005; Drummond 2007; Gravelle 2007; Claxton 2010). The principal focus of the debate is whether health benefits should be discounted at the same rate as costs (uniform discounting) or at a lower rate (differential discounting). Furthermore, studies have shown that individuals' time preference can change during the time-horizon, which gives rise to an argument for the use of geometric discounting in long-term models, whereby discount rates are reduced as a function of time (time-varying discounting) (Severens and Milne, 2004).

Uniform discounting is based on the premise that time has an identical effect on both costs and benefits, that is, the nature of the future event is not relevant. A key argument for applying uniform discounting is that if health benefits were to be discounted at a lower value than costs, it would lead to a situation whereby successively delaying an intervention would appear to increase the cost effectiveness (lower the ICER) (Keeler and Cretin, 1983). On the other hand, arguments against uniform discounting include the assumption that the relationship between perceived value of life years and costs remain independent of time, which may not be the case (Gravelle, 2006). Furthermore, it has even been suggested that health benefits should not be discounted at all, because quality of life may already be incorporated into an individual's time preference, especially when utility is measured using the time trade off or standard gamble method (Krahn, 1993).

Generally it is argued that for consistency, uniform discounting should be applied, however in a recent publication (Nord, 2011) argues that much of the debate has focused on logical and arithmetic arguments, with little regard to societal values and empirical research, which may justify differential rates of discounts for costs and health benefits.

In a recent paper (Claxton, 2011) the authors argue that rates should be equal for health benefits and costs in situations where the cost-effectiveness

threshold is expected to remain constant. The authors also support the idea that the discount rate applied to health benefits should probably be lower than the current 3.5% recommended by the NICE methods guide.

2.2 Relevance of topic to NICE technology appraisals

Because many economic analyses considered in the technology appraisals programme have a time horizon reflecting whole of the remaining life expectancy of the cohort under consideration (in some cases several decades) discounting is required to reflect the present value of future costs and benefits.

NICE's recommendations relating to discounting have varied historically. Before the publication of the first methods guide, NICE recommended discounting of costs at 6% and health benefits at 1.5%. This reflected Department of Health policy at the time. In 2003, the Treasury updated its guidance for appraisal and evaluation in central government in a publication named the 'Green Book'. The updated guidance introduced a new rate of 3.5% which was based on social time preference. In the 2004 version of the methods guide, NICE reduced the discounting of costs to 3.5%, in line with the 'Green Book', and at the same time stipulated that costs and benefits should be discounted at an equal rate. Therefore the discount rate for benefits also changed to 3.5%.

Within the UK, the Joint Committee on Vaccination and Immunisation (JCVI) follows a decision making process similar to that of NICE. Owing to the typically long time lag between vaccination and the benefit accrued, the discount rate used for economic evaluation of vaccinations is particularly important. The JCVI analyses use a 3.5% discount rate for costs and benefits based on the Green Book, but generally present sensitivity analyses using 1.5% and 0% discount rates to inform decision making.

Discounting practices in other countries vary. As a general rule, guidelines recommend *examining* the impact of discounting in a sensitivity analysis, and several guidelines also recommend *reporting* undiscounted costs and effects.

However, it is often less clear how these sensitivity analyses are subsequently used in the decision making process and firm decision rules are often lacking.

2.3 What the methods guide currently says

The 2008 edition of the methods guide includes the following text.

- “5.6.1 Cost-effectiveness results should reflect the present value of the stream of costs and benefits accruing over the time horizon of the analysis. For the reference case, an annual discount rate of 3.5% should be used for both costs and benefits. When results are potentially sensitive to the discount rate used, consideration should be given to sensitivity analyses that use differential rates for costs and outcomes and/or that vary the rate between 0% and 6%.*
- 5.6.2 The need to discount to a present value is widely accepted in economic evaluation, although the specific rate is variable across jurisdictions and over time. The Institute considers it appropriate to discount costs and health effects at the same rate. The annual rate of 3.5%, based on the recommendations of the UK Treasury for the discounting of costs, should be applied to both costs and health effects.”*

Following the publication of the methods guide, the NICE board discussed how discounting should be implemented in the special case of treatments that are expected to offer curative benefits experienced over a very long time horizon. The NICE Board, having given consideration to the circumstances where it expects advisory bodies to use the sensitivity analysis on the impact of discounting of health effects, issued the following clarification in section 5.6 of the Guide to the Methods of Technology Appraisals (additions shown in bold):

- “5.6.2 The need to discount to a present value is widely accepted in economic evaluation, although the specific rate is variable across jurisdictions and over time. The Institute considers it appropriate to **normally** discount costs and health effects at the same rate. The*

*annual rate of 3.5%, based on recommendations of the UK Treasury for the discounting of costs, should be applied to both costs and health effects. **Where the Appraisal Committee has considered it appropriate to undertake sensitivity analysis on the effects of discounting because treatment effects are both substantial in restoring health and sustained over a very long period (normally at least 30 years), the Committee should apply a rate of 1.5% for health effects and 3.5% for costs.***

It is important to note that the change to the text reflects a clarification of how the Committee should deal with sensitivity analyses in these particular circumstances. It does not constitute a change to the reference case.

3 Proposed issues for discussion

What is the appropriate discount rate to be applied in the reference case and should costs and health benefits be discounted at the same rate?

In the case of a very long time horizon, should discounting rates for costs and/or health benefits deviate from the standard rates, for instance through application of variable discount rates or reduced discount rates?

Should discount rates for health benefits be lower in specific circumstances, for instance when calculating health benefits for interventions that provide a cure to an otherwise terminal illness?

How should the discount rate be explored in sensitivity analyses?

How should the Committee deal with ICERs that are highly sensitive to the discount rate?

4 References

Brouwer WBF, Niessen LW, Postma MJ *et al.* (2005) Need for differential discounting of costs and health effects in cost effectiveness analyses. *British Medical Journal*, 331:446-448.

- Cairns J. (1992) Discounting and health benefits: another perspective. *Health Economics*, 1:76-79.
- Cairns JA, van der Pol MM. (2000) The estimation of marginal time preference in a UK-wide sample (TEMPUS) project. *Health Technology Assessment*, 4(1).
- Claxton K, Paulden M, Gravelle H, *et al.* (2011) Discounting and decision making in the economic evaluation of health care technologies. *Health Economics*, 20:2-15.
- Drummond M, Sculpher M, Torrance S, *et al.* (2007) *Methods for the Economic Evaluation of Health Care Programmes*. Oxford Medical Publications, Oxford.
- Fox-Rushby J, Cairns J. (2005) *Economic Evaluation*. Open University Press, London.
- Gravelle H, Brouwer W, Niessen L, *et al.* (2007) Discounting in economic evaluations: stepping forward towards optimal decision rules. *Health Economics*, 16:307-317.
- HM Treasury. (2003) *Green Book*. (http://www.hm-treasury.gov.uk/data_greenbook_index.htm)
- Keeler EB, Cretin S. (1983) Discounting of life-saving and other nonmonetary effects. *Management Science*, 29:300-306.
- Krahn M, Gafni A. (1993) Discounting in the economic evaluation of health care intervention. *Medical Care*, 31:403-418.
- Lipscomb J, Torrance G, Weinstein M. (1996) In *Time preference. Cost-effectiveness in Health and Medicine*. Oxford University Press, Oxford.
- Nord E. (2011) Discounting future health benefits: the poverty of consistency arguments. *Health Economics*, 20:16-26.
- Severens JL, Milne RJ. (2004) Discounting health outcomes in economic evaluation: the ongoing debate. *Value in Health*, 7(4):397-401.

5 Author/s

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