

Sensitivity analysis in economic evaluation: an audit of NICE current practice and a review of its use and value in decision-making

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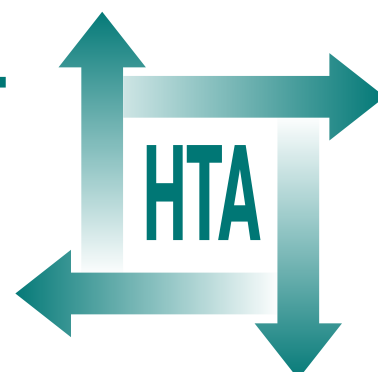
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Executive summary

Health Technology Assessment 2009; Vol. 13: No. 29
DOI: 10.3310/hta13290

Health Technology Assessment
NIHR HTA programme
www.hta.ac.uk





Executive summary

Introduction

Economic analyses are increasingly being used to inform technology adoption and reimbursement decisions in health care in the UK and in other countries. The growing influence of economic analyses within reimbursement agencies such as the National Institute for Health and Clinical Excellence (NICE) emphasises the importance of methodological rigour in cost-effectiveness work.

The starting point for this work was that the appropriate characterisation of uncertainty is an essential component in an economic analysis of a health technology. However, it is unclear whether good practice is being adopted in such analyses, and the influence of sensitivity analysis, and probabilistic sensitivity analysis (PSA) in particular, on NICE decision-making is unknown.

Research questions

- How do we define good practice in sensitivity analysis in general and PSA in particular? (Phase 1)
- To what extent has good practice been adhered to in the independent economic evaluations undertaken for NICE over recent years? (Phase 2)
- What policy impact does sensitivity analysis have in the context of NICE? (Phase 3)
- What views do policy-makers have on sensitivity analysis and uncertainty, and what use is made of sensitivity analysis in policy decision-making? (Phase 4)

Phase 1: Literature review

Using a review of the literature, the meaning of 'good practice' in the broad area of sensitivity analysis was explored. The literature review revealed that all forms of sensitivity analysis, notably both deterministic and probabilistic approaches, have their supporters and their detractors. The review has summarised arguments for and against alternative approaches, with an outline of good practice (see Recommendations for practice and policy) for each form of analysis.

- Deterministic sensitivity analysis: explanation for the source of ranges used should be provided, along with justification for choice of variables included.
- Analysis of extremes: clear presentation of analysis is required to allow generalisability to be assessed.
- Threshold analysis: A definition of the threshold applied in the analysis must be clearly stated and justified.
- Probabilistic sensitivity analysis: distributional assumptions should be justified and be consistent with any logical bounds on parameter values, and, where correlations are expected, joint distributions should be used.

Phase 2: Audit of cost-effectiveness work for NICE

An audit has been undertaken of the 15 most recent NICE multiple technology appraisal judgements and their related reports. This aspect of the work has reviewed and audited how sensitivity analysis has been undertaken by independent academic teams for NICE. The quality of the PSA has been judged using the criteria defined in Phase 1.

Practice in relation to univariate sensitivity analysis is highly variable, with considerable lack of clarity in relation to the methods used and the basis of the ranges employed. Further, the presentation of such analyses revealed room for improvement with the use of diagrams, such as tornado figures, very rare. In relation to PSA, there is a high level of variability in the form of distribution used for similar parameters, and the justification for such choices is rarely given. Virtually all analyses failed to consider correlations within the PSA, and this is an area of concern.

Phase 3: Review of NICE policy documents

This phase comprised a review of the policy and guidance documents issued by NICE relating to the topics selected in Phase 2. This review aimed to assess the policy impact of the sensitivity analysis and the PSA in particular.

This review found that uncertainty is considered explicitly in the process of arriving at a decision by the NICE Technology Appraisal Committee. The focus of attention is predominantly parameter uncertainty. The cited ranges of incremental cost-effectiveness ratios (ICERs) in the policy documents, and the most value in supporting decision-making, appear to have come from the deterministic analyses. This may, in part, reflect an issue of poor understanding of PSA or may reveal the value of deterministic approaches, especially in the search for subgroups. An association between high levels of uncertainty and negative decisions was suggested in the documents.

Phase 4: Interviews with NICE Committee members

Qualitative interview data from NICE Technology Appraisal Committee, collected as part of an earlier study, have been analysed. This work has assessed the value attached to the sensitivity analysis components of the economic analyses conducted for NICE (see Chapter 5).

The findings suggest considerable value in deterministic sensitivity analysis. Such analyses serve to highlight which model parameters are critical to driving a decision. Strong support was expressed for PSA, principally because it provides an indication of the parameter uncertainty around the ICER value. A concern expressed about PSA was that it can under-report the true level of uncertainty through the selection of a subset of parameters for inclusion in the analysis. Some Committee members expressed the view that where uncertainty is greater, the decision should tend towards a negative. Finally, the communication of sensitivity analysis results is less than optimal. A more detailed and clearer explanation of the sensitivity analysis is required.

Limitations

The focus for this work was on cost-effectiveness work undertaken by the independent academic teams for NICE, and so the cost-effectiveness work from industry, as part of the single technology assessment process, has not been reviewed. The review focused exclusively on documentary evidence – the models underlying the cost-effectiveness analyses were not available for scrutiny. The policy impact assessment was based only on documentary evidence again – observation of Committee discussions, and deliberations and/

or interviews with Committee members around the specific topics might have revealed further insights on this issue. Finally, the interview data were taken from an earlier study in which the scope was broader than sensitivity analysis and uncertainty, and the data were collected in 2003/4, before the 2004 NICE *Guide to the methods of technology appraisal* was published.

Recommendations for practice and policy

In seeking to address parameter uncertainty, both deterministic and probabilistic sensitivity analyses should be used. For methodological and structural uncertainties, repeated analyses should be run using different models in which uncertainties regarding model structure exist or different methods in which there are uncertainties regarding methods.

In terms of the process of conducting and implementing sensitivity analyses, good practice would involve a clear and full justification of the choice of included variables, along with a clear explanation of the information source used to specify the ranges. The use of threshold analysis is to be supported, especially where the value of a particular parameter is indeterminate, but there is a need to provide a clear rationale for, and definition of, the threshold applied.

In relation to PSA, distributions should be placed around all important model parameters, and any excluded parameters must be justified. The distributional assumption for each variable should be justified and should relate to the nature of the variable. The distribution should be consistent with any logical bounds on parameter values given its nature (e.g. utility scores with an upper bound of 1). There might be value in clearer methodology guidelines on which distributions are appropriate for which parameters. Where correlation between variables is expected, joint distributions should be used and independence should not be assumed.

On the use of sensitivity analyses in policy-making, there may be benefits from an explicit recognition of the role of such analyses in supporting the search for subgroups. This issue of the possible association between level of uncertainty and the likelihood of a negative decision requires some further discussion. The data reported here suggest that when the level of uncertainty was high, the NICE Committee was likely to tend towards a

negative decision. Finally, the challenge of effective communication between analysts and policy-makers cannot be ignored. It is evident that some cost-effectiveness work, especially around the sensitivity analysis components, represents a challenge in making it accessible to those making decisions. This speaks to the training agenda for those sitting on such decision-making bodies, and to the importance of clear presentation of analyses by the academic community.

Publication

Andronis L, Barton P, Bryan S. Sensitivity analysis in economic evaluation: an audit of NICE current practice and a review of its use and value in decision-making. *Health Technol Assess* 2009;**13**(29).



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The research reported in this issue of the journal was commissioned and funded by the HTA programme on behalf of NICE as project number 07/56/01. The protocol was agreed in May 2007. The assessment report began editorial review in November 2008 and was accepted for publication in November 2008. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

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ISSN 1366-5278

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Published by Prepress Projects Ltd, Perth, Scotland (www.prepress-projects.co.uk), on behalf of NETSCC, HTA.

Printed on acid-free paper in the UK by Henry Ling Ltd, The Dorset Press, Dorchester.