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**Prioritising Investments in Health
Technology Assessment: Can We
Assess the Potential Value for
Money?**

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DISCUSSION PAPER 170

PRIORITISING INVESTMENTS IN HEALTH TECHNOLOGY ASSESSMENT: CAN WE ASSESS POTENTIAL VALUE FOR MONEY ?

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ABSTRACT

The objective was to develop an economic prioritisation model to assist those involved in (i) the selection and prioritisation of health technology assessment topics and (ii) commissioning of HTA projects. The model used decision analytic techniques to estimate the expected costs and benefits of the health care interventions which were the focus of the HTA question(s) considered by the NHS Health Technology Assessment Programme in England. Initial estimation of the value for money of HTA was conducted for a number of topics considered in 1997 and 1998. The main conclusion was that it is feasible to conduct ex ante assessments of the value for money of HTA for specific topics. However, a considerable amount of work is required to ensure that the methods used are valid, reliable, consistent and an efficient use of valuable research time.

INTRODUCTION

Given the large number of health technologies that could potentially be evaluated, no country has the resources available to undertake all the assessments it would ideally require. Some economies of effort can be realised through the closer collaboration of national health technology agencies, for example through the International Association of Health Technology Agencies (INAHTA). However, there is still a need to set priorities among the assessments that could be carried out (16,18).

Priorities could be set according to a range of criteria. An important criterion relates to the *value*, in improved information for decision making, from undertaking a given assessment. Some authors have referred to this as 'payback' (1). A number of authors have discussed the issue of payback from health technology assessments (HTAs) or approaches to prioritising the HTA effort. In a seminal paper, Eddy (9) outlined a model for determining priorities. Detsky (5) and Drummond *et al* (7) undertook *ex post* assessments of particular research studies. For example, Drummond *et al* estimated the costs and benefits of conducting the Diabetic Retinopathy Study (DRS), a large randomised controlled trial of laser photocoagulation treatment for diabetic retinopathy. They considered two states of the world, one with the study and one without, and estimated the likely impact of the trial results on the costs and effects of treatment.

Buxton and Hannay (1) defined payback in a broader sense, to encompass not only the impact of research on health and health care, but also knowledge more generally. They also suggested that research could meet a range of political and administrative needs, and illustrated their approach by conducting a number of *ex post* assessments of a range of research projects undertaken in the UK.

A number of authors have recognised the need for *ex ante* analysis of the value of research and the additional challenges this raises. Attempts by Buxton and Hannay to assess the payback from four proposed projects were not very successful. In addition, preliminary papers from the PATHS project (13) outlined a number of difficulties. However, if HTA agencies are to consider value for money or payback in making decisions about priorities for assessments, *ex ante* analyses are required and more exploration of the problems needed (16). This paper addresses these issues in the context of the support given by the National Coordinating Centre for Health Technology Assessment (NCCHTA) for decisions about priorities made by the Standing Group for Health Technology Assessment (SGHT), as part of the NHS Research and Development Programme in the United Kingdom.

THE NCCHTA AND PRIORITISATION

The National Coordinating Centre for Health Technology Assessment (NCCHTA) was established in 1996 to manage and develop the NHS Health Technology Assessment Programme. The principal tasks of the NCCHTA are: (i) identification of important (to the NHS) under-evaluated health technologies; (ii) supporting the SGHT and its advisory panels in

the clarification and prioritisation of these, through the provision of relevant information; (iii) commissioning research; (iv) monitoring and assessing commissioned research; (v) communicating openly about the processes and products of the HTA programme.

Each year approximately 1000 potential topics are identified by the NCCHTA, excluding topics where there is finished or ongoing research elsewhere. These are sub-divided into 6 broad areas, for discussion by 6 expert panels. The panels meet bi-annually to prioritise topics in: acute sector care; primary and community care; diagnostic and imaging; screening; pharmaceuticals and methodology. For the first meeting, the panels are given brief information about the technology area, the reason for evaluation, the source of demand for evaluation and the patient group. At this stage the information given to the panels can be very non specific. The panels select approximately 100 topics, for which vignettes/expert papers are prepared.

The vignettes summarise available clinical, epidemiological and cost information about the topic and broad research questions to be addressed. At the second round of panel meetings the 100 topics are discussed in detail. The technologies, target groups and initial research questions are refined and approximately two thirds of the topics are selected for consideration by the SGHT. The SGHT finally selects over 40 topics to be commissioned each year.

The decision making criteria at each of these stages include consideration of economic factors and potential value for money in terms of the importance of the question (economic burden of disease), the degree of current uncertainty, trajectory of diffusion of the technology, and the cost of research. However, paucity of data make it difficult to quantify all of these variables and relate them in an explicit economic framework to assess the potential value for money of research. Thus, there are potential benefits from the development of an economic model to provide structured economic information for the prioritisation process.

METHODS

A pilot study was conducted to assess the feasibility of providing broad cost and outcome information for the first round of the prioritisation process. Three criteria were set to judge the quality and potential value of the data. First, there is complete incidence, cost and outcome data on each of the topics considered by a panel. Secondly, the data could be collected and estimated in a consistent fashion. Thirdly, the topic is sufficiently defined to identify relevant patient groups and interventions. Although a wide range of data was collected, the criteria specified above were not met. Subsequent development work was conducted to develop a model for the ex ante analysis of the value for money of commissioning assessments in specific topic areas. To date, this has been constrained to the provision of information to the second stage of the prioritisation process.

The approach and economic prioritisation model (EPM) to support the NCCHTA and SGHT at the second stage were based on previous methodological expositions (9) and empirical work to evaluate the costs and benefits of a clinical trial ex-post (7). This section outlines the key features of the approach. A technical description of the model is given in Appendix 1.

Objectives

The overall purpose of the model was to provide additional information to the SGHT and its advisory panels. Specific uses of the information were to assist those involved in (i) the selection and prioritisation of health technology assessment (HTA) topics and (ii) commissioning of HTA projects. The objectives for the development of an economic prioritisation model were to: (i) collect, structure and analyse comparative information to assess the relative value-for-money of potential HTA questions/topics, in terms of the costs and benefits of HTA to society; (ii) provide relevant and useable information to those involved in the decision making process, to improve the allocation of resources between potential HTA areas; (iii) identify critical factors that determined the value for money of specific assessments, that should be considered in the process of commissioning, disseminating and implementing HTA evidence.

Perspective

The EPM was constrained to consideration of HTA funded by the NHS R&D programme. It was assumed that the principal objective of HTA is to provide information and evidence to influence health care practice and improve the efficiency of health care provision. The perspective of the model included consideration of the costs and benefits to: (i) the research funding body; (ii) the providers of health and social care services; and (iii) the patients who are likely to receive the health care interventions targeted.

The broader costs and benefits of HTA to society (such as value of knowledge per se, the development of research skills, political and administrative benefits, or the costs and benefits to other research funding agencies) were excluded. The main logic for exclusion of these items was that, first, they are difficult to assess differentially between competing health technology assessments. For example, benefits to the research infrastructure from HTA's would accrue irrespective of the particular technology evaluated. In addition, inclusion of political benefits among the criteria for investment leads to the question of whether these should also be considered in economic evaluation of specific health technologies. Traditionally, these evaluations focus on the benefits in improved health, not the broader political gains (8, 10).

Time frame

The period covered by the model was the estimated time from commissioning of the research (year 1) and initial dissemination of the research findings, to substitution of the health care intervention of interest by other new technologies. A maximum timeframe of 20 years for the lifetime of the health care intervention in question was also imposed, on the grounds that the impact of costs and benefits beyond this were likely to be negligible because of discounting.

Approach

The model used decision analytic techniques to estimate the expected costs and benefits of the health care interventions which were the focus of the HTA question(s). It compared the health technology of interest with relevant comparators from standard or usual care. The expected costs were estimated for one year incidence or prevalence cohorts of treated patients. These data were then combined with available information about the:

- likely rates of utilisation of the new technologies;
- probability that the new intervention will be proven effective or ineffective by the HTA;
- maximum lifetime for the new technology;
- probability of additional new technologies and rates of utilisation;
- transition costs of adopting the new intervention;
- cost of the HTA.

The model was used to determine the level of uncertainty about clinical and economic evidence, and the critical factors which would affect the potential value for money of the HTA, for each topic.

Value of HTA and the EPM

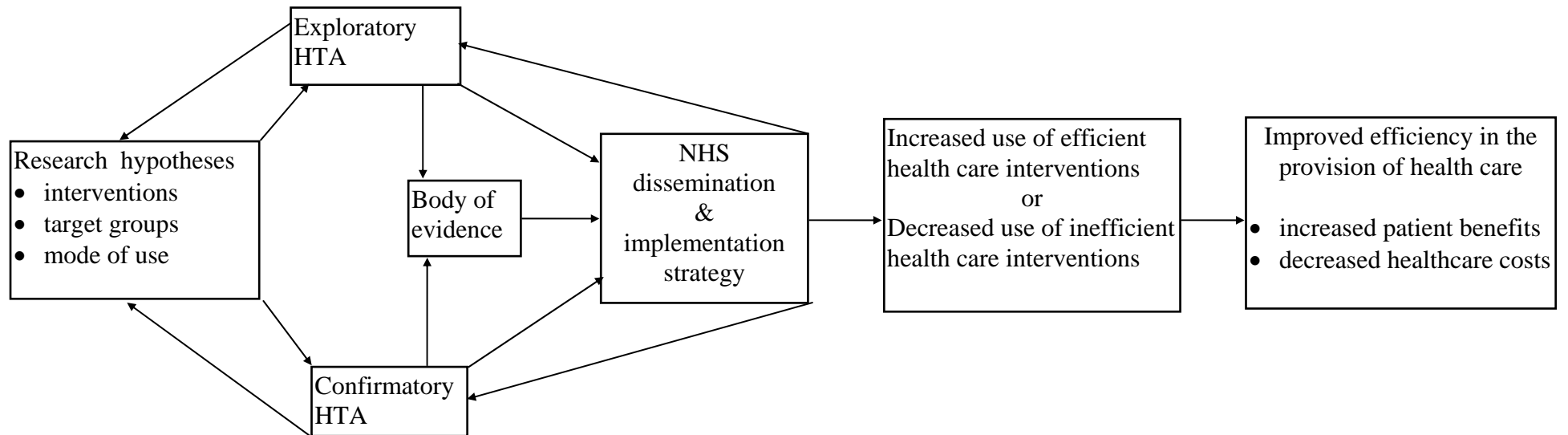
The final value of HTA was limited to the potential impact of the results on the efficiency of health care provision (9). Furthermore, HTA was only deemed to be of value if it was instrumental in bringing about changes in health care policy and practice which improved the efficiency of health care provision. Figure 1 illustrates the processes through which HTA can change the efficiency of health care provision. Figure 2 illustrates the range of factors which may modify the impact of HTA on the provision of health care. The flow diagram in Figure 3 illustrates the conceptual structure of the EPM

Process of HTA impact on health care provision

Figure 1 starts at the point where there is a set of HTA questions or hypotheses to be addressed. These can be evaluated by exploratory HTA or confirmatory HTA. Exploratory HTA is defined as primary HTA to tackle questions or hypotheses that have not previously been subjected to rigorous or systematic evaluation. Confirmatory HTA is defined as primary HTA or synthesis of available evidence, which adds to the existing body of rigorous or systematic evaluations for specific questions. These questions may have been the subject of previous evaluation. Confirmatory HTA may be required if the results of earlier evaluations were thought to be uncertain due to perceived flaws in study design, such as inadequate sample size or use of inappropriate endpoints, or there are two or more studies where the results are contradictory (4).

The intermediate outputs of either exploratory or confirmatory HTA at this stage are the generation of new HTA questions or hypotheses and additions to the existing body of evidence. This intermediate set of outputs are highly uncertain and remote from the final outcome of efficiency of health care provision. In addition, the impact of these factors is likely to be low and not amenable to reliable quantification or valuation. For these reasons the generation of

Figure 1 Process of HTA impact on health care provision



additional questions or hypotheses were not included as a variable in the economic prioritisation model.

Adoption of HTA information

A prerequisite for HTA results to be translated into action to improve efficiency, is that the results are disseminated *and* recognised as relevant and useable evidence by health care policy makers and health care professionals. However, this is not sufficient to ensure that the results will be translated into appropriate action. A number of factors were assumed to affect the adoption of HTA results and the provision of health care (Figure 2).

First, it was assumed in the EPM that the nature of the existing body of evidence and the HTA results will affect the process of adoption. Changes in the practice of health care policy makers and professionals are positively, if weakly, related to the quantity and quality of available evidence (22, 17, 11, 3, 21, 15). If the HTA is exploratory rather than confirmatory and existing evidence is low or contradictory, the impact of a specific HTA on practice may also be low. Even if the design of the exploratory HTA is sufficient to address the evaluation question with a high degree of certainty, there may still be uncertainty about the quality/validity of the evidence. In this case health care decision makers may prefer to wait for additional confirmatory HTA before implementing the results. In contrast, HTA to confirm the existing body of evidence may have a relatively higher impact on practice and the efficiency of health care provision. Results which are positive and conclusive are more likely to have an impact on the provision of health care than results which are negative or equivocal.

Secondly, it was assumed that the methods of dissemination and implementation will affect the extent to which HTA results are known and accepted by health care policy makers and professionals. If health care professionals are to practice evidence based medicine they must access and interpret a wide range of HTA based information. It is also well documented that health care professionals (for a variety of reasons) do not review all relevant published evidence relating to their practice. For HTA results to be accepted and have an impact on practice, they need to be interpreted and presented in a systematic and accessible manner. It was assumed that HTA which incorporates a coherent and broad ranging dissemination or implementation plan is more likely to change practice than HTA which does not.

Thirdly, it was assumed that the adoption of HTA results is affected by factors outside the HTA process. These include, the transitional costs of implementing the results of HTA, in terms of investment in new skills or facilities or dis-investment in existing skills and facilities, the advent of new interventions and HTA information, the national and local political and organisational context, and the belief systems of health care professionals.

Figure 2 Adoption and utilisation of HTA results

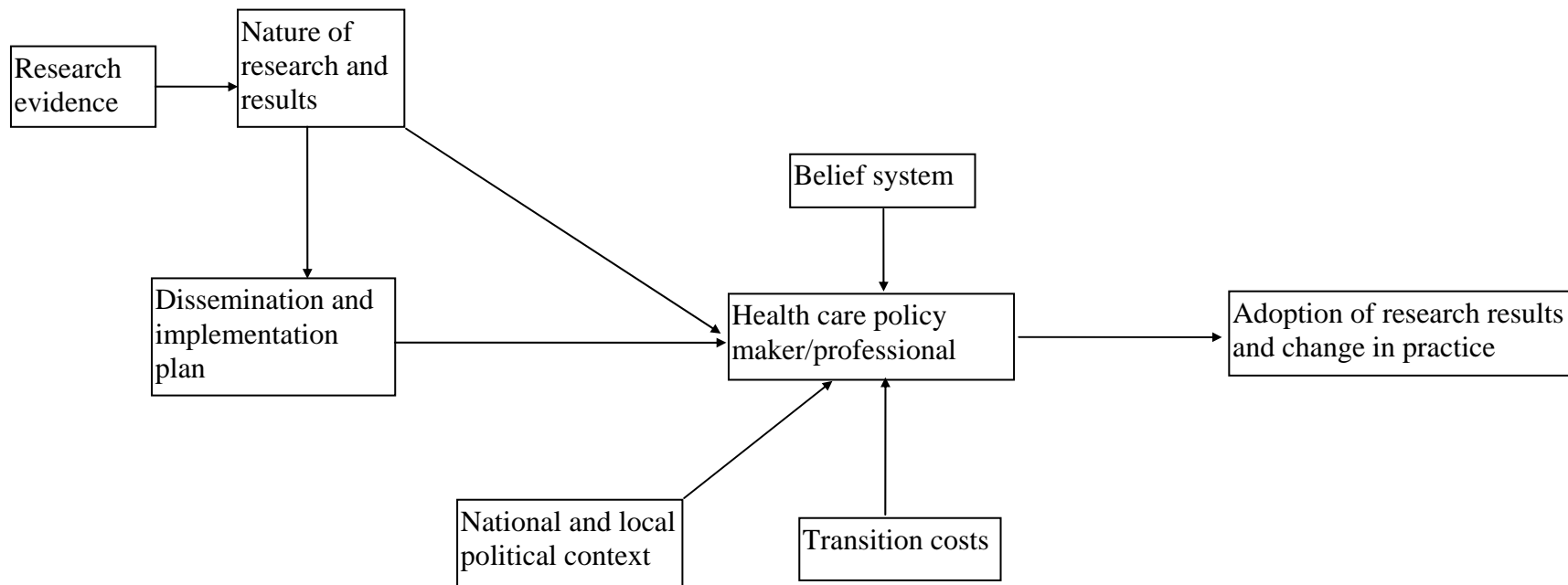
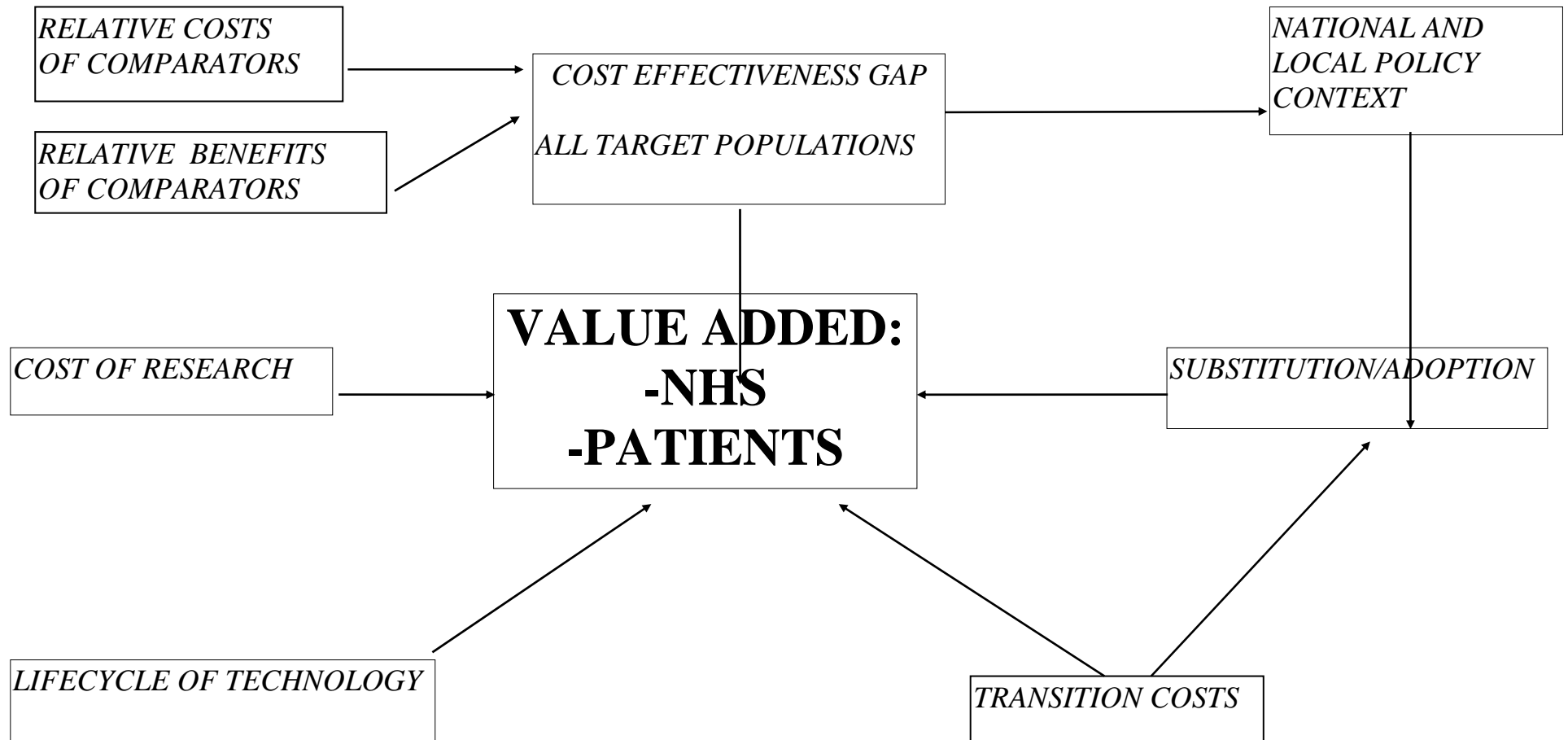


Figure 3 Economic prioritisation model



Analysis of data

The principal analysis of data was estimation of the expected net costs and benefits of HTA, and the level of uncertainty surrounding these estimates. The model calculated point estimates of the expected value for money of a specified piece of HTA. To address uncertainty in the data, a minimum and maximum range of estimates of expected value for money were also derived. These were based on a number of sensitivity analyses to vary each of the parameters from across a range of plausible values. In addition, threshold analyses were conducted to find the minimum (maximum) value at which a variable would need to be set for the net expected costs and benefits of the HTA to be zero, or equivalent to the expected costs and benefits of not undertaking the HTA.

PRELIMINARY RESULTS

Initial estimation of the value for money of HTA was conducted for the topics considered by the pharmaceutical panel in the second stage of prioritisation in 1997 and 1998. Table 1 summarises the results of the analyses. The HTA topics are deliberately anonymised but included a diverse range of topics such as therapies for people with mental health problems or ophthalmologic diseases. In the preliminary analysis the data estimates were derived in a short time scale. Because of the time constraints, default values or assumptions were used for several of the variables used in the model. These are specified below.

1. The likely rates of utilisation of new technologies were assumed to vary according to the true effectiveness of the technologies and the evidence of effectiveness. It was assumed that the level of existing evidence about new technologies will be relatively low or uncertain, leading to low rates of utilisation (5% of health care provision for effective technologies and 3% for ineffective technologies). The addition of evidence about effectiveness from new HTA will increase the annual rate of utilisation of effective technologies (to 16% per annum) and decrease the annual rate of utilisation of ineffective technologies (to 2% per annum) (22, 20, 14, 12). The current rate of utilisation of the technology in question was based on information from the vignettes, or was assumed to be 5% for effective technologies and 3% for ineffective technologies if no data was available.
2. It was assumed that a proportion of the technologies in question were ineffective. The chance of the technology being effective was assumed to be equal to the rate of new pharmaceutical compounds which are successful in phase III clinical trials. This has been estimated at 67% (6).
3. A maximum lifetime for the new technology was given at 20 years. During this time the technology will be gradually replaced by additional new technologies which will enter health care practice and be utilised at the rates given in 1 above.
4. The transition costs of adopting the HTA results and implementing the new intervention were assumed to be zero unless it was clear that utilisation of the health care intervention would require significant (dis)investment in staff, equipment or facilities.

Table 1 Expected costs and benefits of HTA: results of payback analyses, pharmaceutical panel, 1997-8

Topic no.	Net expected cost (range) of HTA £'s million		Net expected benefit of HTA (improved symptom control)		ICER	Critical determinants of costs/benefits of HTA		
						Cost/benefit of interventions	Effectiveness of interventions	Utilisation of interventions
98-A	+307	(-695, +1678)	0.6 m	people with ISC	494-3020	YES	NO	YES
98-B	+434	(-88, +956)	58000	people with ISC	2917-16457	YES	YES	NO
98-C	-315	(-823, +844)	0		NA	YES	NO	YES
98-D	+2	(-45, +50)	0	years with ISC	0-746	YES	YES	YES
98-E	+104	(-118, +339)	2518	cases averted	41000-224133	YES	YES	YES
98-F	-9	(-409, +652)	7030	people with ISC	0-92745	YES	NO	YES
98-G	+1122	(+357, +1887)	13432	people with ISC	26600-140500	YES	NO	YES
98-H	+136	(-775, +600)	1819	people with ISC	74876-0.3 m	YES	YES	YES
98-I	+27309	(+10769, +43849)	290484	people with ISC	37072-150954	YES	YES	NO
98-J	-59	(-28, -117)	0		NA	YES	YES	YES
98-K	+364	(-549, +15079)	4378	cases averted	83082-3.4m	YES	NO	YES
98-L	-860	(-239, -1238)	0		0	NO	NO	NO
98-M	+181	(-647, +1005)	5781	cases averted	27568-173804	YES	YES	YES
97-A	-1005	(-1947, +223)	0		NA	YES	YES	YES
97-B	+42	(+11, +50)	1160	life years gained	9353-53323	YES	YES	YES
97-C	+55	(-41, +84)	448	deaths averted	0-187500	YES	YES	YES
97-D	+182	(+2, +337)	13019	deaths averted	1313-25892	YES	YES	YES
97-E	-167	(-167, +118)	0		NA	NO	YES	NO
97-F	+333	(+318, 358)	3414	deaths averted	48990-104730	NO	YES	YES
97-G	+9	(+8, +10)	81	deaths averted	94174-117949	YES	YES	NO
97-H	-0.2	(-2, +3.8)	0	cases averted	0-4445	YES	YES	YES
97-I	+68	(-51, +70)	1252	life years gained	0-55910	NO	YES	YES
97-J	+1924	(-75, +1924)	3380	life years gained	0-569183	NO	YES	YES
97-K	+200	(+19, +259)	8740	life years gained	0-29558	NO	NO	NO
97-L	+15	(-203, +15)	0		NA	NO	YES	YES

Notes: ISC = improved symptom control ICER = incremental cost effectiveness ratio

Overall, it was possible to conduct analyses for 80% of the topics considered by the pharmaceutical panel in 1997 and 60% in 1998. It was not possible to conduct analyses for some of the topics due to uncertainty about the topic, the interventions or the patient groups to be targeted. For all of the topics analysed there were sufficient data to generate base case or best guess estimates of costs, and to generate a range of costs for sensitivity analysis. In all the analyses the outcome data available were not sufficient to generate one consistent measure of patient benefit (such as the quality-adjusted life year) for all the topics. This meant that the outcomes or benefits reported ranged from measures such as case averted to deaths averted or life years gained for the 1997 panel topics, and people with improved symptom control to cases averted in the 1998 panel topics. In addition, there was insufficient information about possible ranges in levels of effectiveness on which to base a sensitivity analysis. The approach taken was to use threshold analysis to determine critical levels of effectiveness at which the net benefits of the analysis would be zero.

The results from both years' analyses indicate that, using information routinely available in the literature and from the vignettes, it was not possible to estimate the absolute value of HTA with any certainty for this stage of the prioritisation process. Of the topics analysed in 1997, the results for 58% were considered uncertain (i.e. switched from net saving to net cost or vice-versa) compared with the results for 73% in 1998. Overall, the results were uncertain for 65% of the HTA questions or topics analysed.

As might be predicted, the relative costs of the interventions or technologies compared to existing costs of care and likely levels of utilisation were critical factors in the majority of the analyses in two respects. First the level of costs extend into the model for the new technology and standard or existing care determined whether the analysis switched from net saving to net cost in the majority of cases (69%, 1998 and 58%, 1997). Secondly, a threshold level for one or more cost variables was found in 68% of topics (93%, 1998 and 50%, 1997)

The probability that the technology would be found to be effective with the HTA was a critical factor in determining the expected costs and/or benefits for 47% (1998) to 92% of topics (1997) topics. Threshold analysis also indicated that the impact of the HTA on the rates of utilisation of the new technology and existing care was a critical factor in 75%-80% of the analyses.

DISCUSSION

The preliminary results suggest that it is feasible to conduct *ex ante* assessments of the potential value for money of HTA for some topic areas. However, the work to date raises a number of issues for further consideration. An underlying set of questions relate to whether continued development of the approach, the model and data inputs is a worthwhile activity, compared to the methods of prioritisation currently used by the NHS R&D programme or alternative approaches. These questions require consideration of a number of factors directly relating to the approach taken and development of the model and the relative efficiency of alternative approaches and models.

Validation of the model and analyses

The first issue is whether the approach and subsequent economic prioritisation model presented here are valid in terms of the methodological framework and attributes. There are several components to be addressed. First, is it legitimate to restrict the scope of the model to the impact of HTA on the provision and outcomes of health care, given the likely cost of undertaking the research? As mentioned above, this excludes the broader economic benefits of HTA to other sectors of society (13). Some of these broader consequences may already be taken into account in the decision making process. It is not clear whether quantification and inclusion of these factors in the analysis would have a significant impact on the overall results, such that the prioritisation or choice of topics to be commissioned would change.

Model specification

The model currently uses a deterministic framework for the analyses with the results determined by specified inputs and relationships, rather than a Bayesian or stochastic approach to determine the value of information (2, 16). This means that the complex process of HTA, dissemination and utilisation can be analysed in a relatively simple model. The advantages are that deterministic models require relatively fewer data than stochastic models, and require fewer resources to run each analysis. The disadvantages are that for problems where there are complex relationships and distributions of data it is difficult to assess the robustness of the results. In particular a deterministic formulation restricts analysis of the extent to which the results are uncertain due to a real lack of evidence rather than inaccuracy in the model inputs or relationships. However, the work to date has indicated that in the UK setting, there is a lack of data with which to populate a deterministic model. This problem would be intensified if a stochastic model were to be implemented. In particular, use of an incorrect distribution incurs a risk that the results of a stochastic analysis may be even less reliable than a deterministic one. The extent of the risk of inaccuracy of the results of the analyses and the subsequent impact on the efficiency of the prioritisation process is unclear.

Decision rules

The data in Table 1 indicate that the results of the majority of analyses were uncertain. In addition, for most cases, the input values for the effectiveness and utilisation rates and the costs and benefits of interventions were critical factors. Changes within a plausible range for these variables can switch the results from net saving to net cost (or vice versa). Even if the input data were accurate and a consistent outcome measure could be generated, it is not clear how these results should be interpreted and whether they add value to the prioritisation process. In particular, decision rules need to be developed to determine which topics should be prioritised for further consideration. The results for the majority of topics indicate a range from net saving to net cost, with a correspondingly large spread of expected cost/outcome estimates. This makes the application of standard economic criteria of expected value difficult to apply.

One approach would be to categorise the results on the basis of uncertainty, for example, clearly worthwhile funding, uncertain, obviously not worthwhile. The worthwhile category might include those projects where there are always net savings with positive benefits, or cost/QALY ratios which are all within a predefined range. The uncertain category would include those topics where the results are sensitive to changes in input parameters or for which thresholds can be determined for the critical factors. The obviously not worthwhile range would include those topics where there were always net costs with zero or negative benefits, or where the cost/QALY ratios were all outside the predefined range. Within the uncertain category, projects could then be ranked by level of uncertainty. For example, those projects where no threshold values for some of the variables, such as utilisation rates, were defined could be given a lower priority than those where thresholds could be defined. This would require the assumption that HTA should be targeted at topics where there is a greater level of uncertainty about current evidence and/or the impact of the HTA on health care provision.

Data availability and quality

Epidemiological and economic data were not available for the formal quantification of some topics, using routine information sources in the UK. Furthermore the data were uncertain for one or more parameter for each topic. The time constraints imposed by the current prioritisation process employed by the NCCHTA mean that the value of HTA cannot be formally quantified for all the topics. The need for rapid estimation of the value for money of HTA for a number of topics, and the available research resources imposed constraints on the quantity and quality of data collected. Information about the likely impact of new technologies had to be constrained to symptom control or improvement, cases cured or prevented, or life years lost/deaths averted for some diseases. The problems in estimating a consistent outcome measure and plausible ranges of values have a number of major implications for the analyses. First, it was not possible to compare incremental cost-effectiveness ratios across topics, in isolation from detailed information about the disease group and impact of therapy. Secondly, the sensitivity analysis of incremental ratios was driven mainly by changes in cost rather than variations in both costs and benefits. These difficulties were compounded by the use of default values for parameters such as annual utilisation rates and probabilities of actual and proven (in)effectiveness. The information for the default values were derived from a limited number of published sources dealing with the utilisation and success rates associated with pharmaceutical interventions.

A literature review is currently underway to collect additional information with which to refine these estimates and, if possible, generate default values which are at least specific to the general themes of the individual panels, if not disease or broad therapeutic groups. However, this still leads to the question of whether the use of default values is plausible and valid for some or all of the topics considered. The analyses to date indicate that the results were sensitive to these values. Inaccurate specification of the default values could bias both the point estimates and the analysis of uncertainty. Refinement of the values for specific topics may reduce the uncertainty in the inputs to the model and the interpretation of the results. However, it is clear that uncertainty in the values of all the variables in the model is an inherent factor which determines the need for HTA and thus methods of prioritising the HTA agenda.

In conclusion, it is clear that it is feasible to conduct ex ante assessments of the value for money of HTA for specific topics. However, a considerable amount of work is required to ensure that the methods used are valid, reliable, consistent and are an efficient use of valuable research time. In particular, the relative value of alternative analytic techniques such as option pricing (19), data envelopment analysis and stochastic simulations to determine the efficient allocation of research resources needs to be explored. In addition, the value of providing decision makers with quantitative estimates of the 'payback' of health technology assessments needs to be compared to softer qualitative approaches to prioritisation of research portfolios (16, 18).

1. APPENDIX 1: DETAILS OF THE PRIORITISATION MODEL

Expected costs and outcomes of treated disease

The model is built in blocks, starting with estimation of the expected costs and outcomes of the new intervention and one or more forms of existing treatment. The model uses either lifetime costs of treatment for one year incidence cohorts (acute diseases of less than 1 year duration), or the annual costs for one year prevalence cohorts (chronic diseases of greater than 1 year duration).

Transition costs

The adoption of HTA results and the utilisation of specific health care interventions could incur (dis)investment costs not directly included in the expected costs of treatment. If incurred, these need to be added to the expected costs of the technology assessed. In addition, transition costs may affect the rate of adoption and utilisation of interventions. This is included in the model indirectly, by weighting standard utilisation rates for health care interventions or through the estimation of rates specific to the interventions studied.

Lifetime of new and future interventions

The model estimates the expected value of HTA over the lifetime of the health care intervention in question. This is either a maximum of 20 years or based on estimates specific to the intervention. The maximum of 20 years reflects the effects of discounting the costs and outcomes over the life of the intervention. Year 1 of the lifetime for the technologies assessed starts when the results of the HTA project are reported.

Utilisation rates of interventions

To calculate the expected costs and outcomes of treatment for each year, the costs and outcomes of each intervention considered are multiplied by the estimated net rate of utilisation for that year. The model can use either standard estimates of utilisation rates or specific estimates of utilisation. Utilisation rates are estimated for the intervention to be compared to existing treatment with and without HTA. Each of these categories are subdivided into the rates which would apply if the intervention was effective or not effective. The utilisation rate for each year is estimated from the annual rate of utilisation, the probability of the intervention being proven (in)effective by HTA, or being (in)effective for the case where HTA is not undertaken, the probability that the dissemination and implementation plan for the HTA results is effective and the probability of substitution by future interventions not yet evaluated.

Equations A-E illustrate the calculation of net utilisation rates for the case where the proposed HTA will be undertaken, and equations F-H where the proposed HTA is not undertaken. It is assumed that the HTA design will be adequate to deliver results which are unequivocal. For the

purposes of this model, effectiveness of new technology or treatment is defined as equivalence to, or superiority over, standard or existing care:

Case with HTA

- A. The annual utilisation rate of an effective new technology, when HTA indicates it is effective
 $= A_e + (A_{Re} * P_{Ee} * IR) - (UFR_{net} * 0.5)$, $0 < A < 1$;
- B. The annual utilisation rate of an effective new technology, when HTA indicates it is ineffective
 $= A_e + (A_{Ri} * P_{Ie} * IR) - (UFR_{net} * 0.5)$, $0 < B < 1$;
- C. The annual utilisation rate of an ineffective new technology, when HTA indicates it is ineffective
 $= A_i + (A_{Ri} * P_{Ii} * IR)$, $0 < C < 1$;
- D. The annual utilisation rate of an ineffective new technology, when HTA indicates it is effective
 $= A_i + (A_{Re} * P_{Ie} * IR)$, $0 < D < 1$;
- E. The annual utilisation rate of standard or existing technology, with HTA
 $= (1 - A - B - C - D - (Z * 0.5))$, $0 < E < 1$;

Case without HTA

- F. The annual utilisation rate of an effective new technology, with no HTA
 $= (A_e * P_e) - (Z * 0.5)$, $0 < F < 1$;
- G. The annual utilisation rate of an ineffective new technology with no HTA
 $= (A_i * P_i)$, $0 < G < 1$;
- H. The utilisation rate of standard or existing technology, with no HTA
 $= (1 - F - G - (Z * 0.5))$, $0 < H < 1$;

Where:

- A_e = the annual probability of utilisation of an effective technology, given existing evidence;
 A_i = the annual probability of utilisation of an ineffective technology, given existing evidence;
 A_{Re} = the maximum incremental probability of utilisation of an effective technology, new evidence;
 A_{Ri} = the maximum incremental probability of utilisation of an ineffective technology, new evidence;
 P_{Ee} = the probability the new HTA indicates an effective new technology is effective;
 P_{Ei} = the probability the new HTA indicates an ineffective new technology is effective;
 P_{Ii} = the probability the new HTA indicates an ineffective new technology is ineffective;
 P_{Ie} = the probability the new HTA indicates an effective new technology is ineffective;
 P_e = the probability the new technology is effective;
 P_i = the probability the new technology is ineffective;
 IR = the probability that dissemination and implementation of new HTA results changes practice.
 Z = the substitution of health care technologies by future developments

Costs of HTA

For the purposes of this model it is assumed that there is no HTA ongoing which could address the questions of interest. The net expected costs (NEC) and benefits (NEB) of conducting the HTA are calculated as:

$$NEC = [CR + (Dt*((ECnt*A) + (ECnt*B) + (ECMAXnt*C) + (ECMAXnt*D) + (ECst*E))] - [(Dt*((ECnt*F) + (ECMAXnt*G) + (ECst*H))],$$

$$NEB = [(Dt*((EBnt*A) + (EBnt*B) + (EBMINnt*C) + (EBMINnt*D) + (EBst*E))] - [(Dt*((EBnt*F) + (EBMINnt*G) + (EBst*H))]$$

where,

CR = cost of HTA; Dt = discount rate, time t;

ECnt = Expected treatment cost of an effective new intervention at time t;

ECMAXnt = Expected maximum cost of an ineffective new technology at time t;

ECst = Expected cost of standard or existing treatment at time t;

EBnt = Expected benefit of an effective new intervention at time t;

EBMINnt = Expected benefit of an ineffective new technology at time t;

EBst = Expected benefit of standard or existing treatment at time t;

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