The influence of absolute cardiovascular risk, patient utilities, and costs on the decision to treat hypertension: a Markov decision analysis

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Antihypertensive therapy based on blood pressure treatment was studied. Details of the treatments considered were not provided.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised hypothetical cohorts for 20 different strata of gender, age (30 - 79 years, in 10-year age bands) and cardiovascular risk. For cardiovascular risk, low- and high-risk profiles were derived using data from the Health Survey for England 1997 and a Framingham risk function (Anderson et al., see Other Publications of Related Interest).

Setting
The setting was primary care. The economic analysis was conducted in the UK.

Dates to which data relate
The effectiveness data were gathered from published literature. However, the dates to which the effectiveness data related were not reported (references are available from the authors). The cost data were gathered from studies published between 1990 and 2002. The price year was 2002.

Source of effectiveness data
The effectiveness data were obtained from published literature.

Modelling
The decision whether to treat hypertension was modelled as a Markov model using DATA for Healthcare software (version 3.5). Models for 20 different strata of gender, age and two risk profiles (low- and high-risk) were created. The number and definition of the health states were not reported. The duration of each time cycle was one year. The time horizon of the model was the patient's lifetime. Monte Carlo simulations (10,000) were undertaken to enable the distribution of the costs, effectiveness and cost-effectiveness to be identified.

Outcomes assessed in the review
The outcomes assessed in the review and used as model inputs were the probabilities of clinical events.

**Study designs and other criteria for inclusion in the review**
Not reported.

**Sources searched to identify primary studies**
Not reported.

**Criteria used to ensure the validity of primary studies**
Not reported.

**Methods used to judge relevance and validity, and for extracting data**
Not reported.

**Number of primary studies included**
Not reported.

**Methods of combining primary studies**
Not reported.

**Investigation of differences between primary studies**
Not reported.

**Results of the review**
Not reported in the paper. The results were reported in an appendix, which is available from the authors.

**Methods used to derive estimates of effectiveness**
The authors made several assumptions about the health states and probabilities.

**Estimates of effectiveness and key assumptions**
The authors did not report the estimates of effectiveness. The key assumptions were:

- nonfatal stroke was subdivided into affected and unaffected, while nonfatal myocardial infarction was not subdivided;
- myocardial infarction and unaffected stroke were equivalent in terms of utilities;
- any second cardiovascular event was fatal;
- for patients treated, but whose blood pressure remained uncontrolled, the relative risk reduction (12%) was half that when blood pressure was treated and controlled (24%);
- the same probabilities for cardiovascular event recurrence applied to all age, gender and risk strata.

**Measure of benefits used in the economic analysis**
The authors used gains in life expectancy and the quality-adjusted life-years (QALYs) as the benefit measures. The utilities were obtained using the standard gamble method from 148 hypertensive patients who participated in an observational study (n=52) and a randomised controlled trial of newly diagnosed hypertensive patients (n=96). Median values were used. The health outcomes were discounted at 1.5%.

**Direct costs**
The perspective adopted was that of the NHS. Only the direct costs were included in the analysis. Details on the cost items were provided in an appendix. However, it is likely that the direct costs included hypertensive treatment, stroke care and myocardial infarction care. The cost data were gathered from studies published between 1990 and 2002. The costs and the quantities were not reported separately. The costs were discounted at a rate of 6%. All the costs were reported in 2002 values.

**Statistical analysis of costs**
No statistical analysis of the costs was reported. However, Monte Carlo simulations were carried out to consider the probabilistic distribution of the costs.

**Indirect Costs**
The indirect costs were not included.

**Currency**
UK pounds sterling ( £).

**Sensitivity analysis**
One-way sensitivity analyses were performed on the discount rate for benefits (0 and 6%), the utility value for affected stroke, and the utility value of treatment (using the 25th percentile value).

**Estimated benefits used in the economic analysis**
Compared with no treatment, antihypertensive treatment increased the life expectancy of hypertensive individuals in all strata of age, gender and cardiovascular risk, by between 1.6 and 10.3%. The gains were greatest in young individuals and those at high absolute risk of a cardiovascular event.

In all age, gender and risk strata, treatment was more effective than non treatment as the number of QALYs associated with treatment was always higher than the QALYs associated with no treatment.

**Cost results**
In all strata, except the oldest high-risk men and women, the treatment was more costly than no treatment.

**Synthesis of costs and benefits**
An incremental cost-utility ratio was calculated to combine the costs and benefits of the treatment option relative to no treatment.

The incremental cost per QALY among low-risk groups ranged from 1,030 to 3,304.

The cost-effectiveness results for low-risk individuals were sensitive to the utility of receiving antihypertensive treatment.

The treatment of high-risk groups was highly cost-effective, such that it was the dominant strategy in the oldest age.
group. It resulted in incremental costs per QALY ranging from 34 to 265 in younger age groups.

The estimated costs per QALYs in the high-risk group were robust to the variations explored in the sensitivity analysis.

**Authors' conclusions**
This study demonstrated that the treatment of hypertension in patients at high risk of cardiovascular disease is highly cost-effective. In patients at lower risk of cardiovascular disease, the consideration of patient preferences and costs when making decisions about antihypertensive treatment is of critical importance, both in terms of individual choice and policy recommendations. However, even in low-risk groups, antihypertensive treatment proved to be cost-effective relative to no treatment.

**CRD COMMENTARY - Selection of comparators**
The reason for the choice of the comparator (no treatment) was clear. However, the authors did not provide details of the types of antihypertensive treatments considered in the study. You should decide whether it represents a valid comparator in your own setting.

**Validity of estimate of measure of effectiveness**
The principal input parameters for the model were derived from published studies. However, it was unclear whether the review was conducted systematically to identify relevant research and minimise biases. The authors did not report the methods used to derive the estimates of effectiveness. Some estimates were investigated by sensitivity analyses, using ranges that appear to have been appropriate. No effectiveness results were reported. The authors also made some assumptions that were not tested in the sensitivity analysis.

**Validity of estimate of measure of benefit**
The estimation of benefits was modelled. The decision analysis model used to derive the measure of health benefit was appropriate. Appropriate methods were used to measure the health-related quality of life and patients' preferences (using the standard gamble method). The use of QALYs and life-years simplifies comparisons with the benefits of other health care interventions.

**Validity of estimate of costs**
The authors limited the estimation of costs to the NHS perspective. A societal perspective would have been more appropriate, but the potential inclusion of the indirect costs was not discussed. The costs and the quantities were not reported separately. No details were given on the cost items included in the direct costs. No statistical analysis was performed. Consequently, there is uncertainty as to whether all the relevant costs were included in the analysis. These facts hinder the reproducibility of the results to other settings. Since the time horizon of the model was the patient's lifetime, discounting was undertaken and a sensitivity analysis on the discount rate was performed. The price year was reported, thus aiding reflation exercises.

**Other issues**
The generalisability of the results was discussed, but few comparisons were made with studies dealing with the same topic. In particular, the authors compared their findings with those from a Spanish study and provided an explanation for the differences in the estimated cost-effectiveness ratios. The authors highlighted the limitations of their study and do not appear to have reported their results selectively.

**Implications of the study**
Since individual absolute cardiovascular risk for most patients in primary care is nearer to the "low-risk" profile used in the study, the authors suggested that the same model could form the basis of a decision aid for use by individuals.
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Other publications of related interest


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