The cost-effectiveness of treating all patients with type 2 diabetes with angiotensin-converting enzyme inhibitors

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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
Treatment of patients with Type 2 diabetes with angiotensin-converting enzyme (ACE) inhibitors.

Type of intervention
Screening and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients 50 years of age with newly diagnosed Type 2 diabetes mellitus not already receiving ACE inhibitors for other reasons.

Setting
Hospital. This study was carried out in the Czech Republic and the USA.

Dates to which data relate
Effectiveness data were derived from studies published between 1992 and 1999. Cost data were derived from 1998 sources. The price year was 1998.

Source of effectiveness data
Effectiveness data were derived from a review of the literature.

Modelling
A Markov model was used to evaluate the cost-effectiveness of the three clinical strategies for managing Type 2 diabetes. A lifetime time horizon was used.

Outcomes assessed in the review
The review assessed the following outcomes: baseline prevalence, annual rate and relative risk of progression, treatment discontinuation, adherence to screening, and annual rate of death from ESRD.

Study designs and other criteria for inclusion in the review
Effectiveness data were derived from primary studies, three of which were randomised trials.
Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Summary statistics from studies.

Number of primary studies included
Approximately 12 studies were included.

Methods of combining primary studies
Narrative method.

Investigation of differences between primary studies
The authors noted that two randomised trials excluded patients in whom treatment failed.

Results of the review
The distribution of initial health states was as follows:

79% of patients had normoalbuminuria, 18% had microalbuminuria, and 3% had gross proteinuria.

The annual rate of progression to the next health state with ACE inhibitors was 0.011 for patients with normoalbuminuria, 0.026 for patients with microalbuminuria, and 0.034 for patients with gross proteinuria.

The annual rate of progression to the next health state without ACE inhibitors was 0.035 for patients with normoalbuminuria, 0.11 for patients with microalbuminuria, and 0.056 for patients with gross proteinuria.

The relative risk for progression with ACE inhibitors was 0.32 for patients with normoalbuminuria, 0.24 for patients with microalbuminuria, and 0.61 for patients with gross proteinuria.

The proportion of patients actually screened each year was 50%.

25% of patients starting ACE inhibitor therapy discontinued this treatment in the first three months. Another 2% of patients discontinued treatment each year.

The annual rate of death from ESRD was 27%.

Measure of benefits used in the economic analysis
Quality adjusted life years (QALYs) were used as the measure of benefits. An annual discount rate of 3% was used for health benefits. The authors used utilities from a 1993 study to reflect the imperfect quality of life in patients with diabetes. Quality of life for patients with ESRD was further adjusted by using a weight obtained from a mixed sample of patients undergoing transplantation, haemodialysis, or peritoneal dialysis.

Direct costs
Costs were discounted at an annual rate of 3%. Quantities and costs were reported separately. Direct costs included costs associated with ACE inhibitor therapy, screening or treatment of ESRD. The quantity/cost boundary adopted was...
that of the health service. The estimation of quantities and costs was based on actual data. The annual cost of ACE inhibitor therapy was based on the average wholesale price of lisinopril in 1998. The costs of screening for microalbuminuria and gross proteinuria were based on the Medicare Clinical Diagnostic Fee Schedule for 1998. The annual cost of treating patients with ESRD was based on total Medicare payments in 1996. The price year was 1998.

**Statistical analysis of costs**
Not reported.

**Indirect Costs**
Not included.

**Currency**
US dollars ($).

**Sensitivity analysis**
A sensitivity analysis was performed on the following parameters: age at diagnosis of diabetes, cost of ACE inhibitors, relative risk for progression, quality of life adjustments, screening adherence, treatment discontinuation, and discount rate.

**Estimated benefits used in the economic analysis**
The 'treat all' strategy was associated with the lowest likelihood of ESRD (1.2%) or death (14.6%) and the highest likelihood of normoalbuminuria (57%) at 10 years. The number of life years gained was 15.39 with the 'screen for gross proteinuria' strategy, 15.59 with the 'screen for microalbuminuria' strategy, and 15.63 with the treat all strategy. The number of QALYs gained was 11.59 with the 'screen for gross proteinuria' strategy, 11.78 with the 'screen for microalbuminuria' strategy, and 11.82 with the 'treat all' strategy.

**Cost results**
Total costs amounted to $19,520 with the 'screen for gross proteinuria' strategy, $14,940 with the 'screen for microalbuminuria' strategy, and $15,240 with the 'treat all' strategy.

**Synthesis of costs and benefits**
The screen for gross proteinuria was dominated by the other strategies. The marginal cost-effectiveness of the 'treat all' strategy, relative to the 'screen for microalbuminuria' strategy was $7,500 per QALY gained. The marginal cost-effectiveness of the 'treat all' strategy was sensitive to age at diagnosis of diabetes, cost of ACE inhibitors, relative risk for progression to microalbuminuria, and quality of life adjustment for ACE inhibitors. The results were not sensitive to screening adherence, treatment discontinuation, or the discount rate.

**Authors' conclusions**
Treating all middle-aged diabetic patients with ACE inhibitors is a simple strategy that provides additional benefit at modest additional cost. The strategy assumes that patients meet the older diagnostic criteria for diabetes and makes sense only for those who are not bothered by treatment.

**CRD COMMENTARY - Selection of comparators**
The rationale for the choice of the comparators was clear. You, as a user of this database, should verify whether these health technologies are relevant to your setting.
Validity of estimate of measure of benefit
A relevant measure of benefits was used. The effectiveness data used to construct the decision tree were derived from, what may have been, a non-systematic review of the literature. The internal validity of the data derived from the literature cannot be fully assessed given the limited information provided about the review and the quality assessment of the primary studies. The authors did not consider the sensitivity and specificity of the screening tests for microalbuminuria and gross proteinuria, nor did they consider that a certain proportion of patients in the screening strategies would be prescribed ACE inhibitors for other reasons. This would be equivalent to allowing patients to cross over from the screening strategies to the ‘treat all’ strategy. Effectiveness data were derived from a small number of studies. First, only one study tested the ability of ACE inhibitors to slow the transition from normoalbuminuria to microalbuminuria. Getting this point estimate right is important since the marginal cost-effectiveness of the ‘treat all’ strategy was sensitive to progression rates. Second, the effect of ACE inhibitors in slowing or preventing ESRD in patients with Type 2 diabetes and gross proteinuria was inferred from a trial involving patients with Type 1 diabetes. Third, no single study has related the use of ACE inhibitors in patients with new-onset Type 2 diabetes directly to the development of ESRD. Fourth, transition rates from normoalbuminuria to microalbuminuria and from microalbuminuria to gross proteinuria were derived from two studies that excluded patients in whom treatment failed.

Validity of estimate of costs
Only direct costs were considered. Indirect costs, such as productivity lost or gained were not considered. Some cost estimates were derived from the Medicare fee schedule and do not therefore represent true opportunity costs. In addition, these cost estimates are unlikely to be generalisable to other settings.

Other issues
Given that the study focused on a relatively healthy population, no significant side effects of ACE inhibitors were detected. Given that the study takes into account imperfect adherence to screening guidelines, the results may be more applicable to routine clinical practice than a clinical trial. Adequate comparisons with other relevant studies were not made. The generalisability of these results to other settings or countries was not discussed. The authors do not appear to have presented their results selectively. The study enrolled patients aged 50 years with newly diagnosed Type 2 diabetes and this was reflected in the authors’ conclusions.

Implications of the study
The currently recommended strategy of screening for microalbuminuria is the least expensive, but not the most effective, and should be replaced by the ‘treat all’ strategy.

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