Cost-effectiveness of screening and optimal management for diabetes, hypertension, and chronic kidney disease: a modeled 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.

CRD summary
This study examined the cost-effectiveness of strategies for the screening and treatment of diabetes and hypertension to prevent end-stage kidney disease. The authors concluded that all the strategies were cost-effective for health care payers. In patients with diagnosed diabetes and uncontrolled blood glucose, intensive management and the addition of an angiotensin-converting enzyme inhibitor improved the clinical outcomes at lower costs than usual care. The study was well conducted and reported in detail, which enhances the validity of the authors’ conclusions.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of various strategies for the screening and treatment of diabetes and hypertension, to prevent end-stage kidney disease, compared with usual care.

Interventions
Three intensive management strategies for patients with suboptimally managed diabetes, hypertension, or both were considered. These were intensive glycaemic control for diabetic patients with or without hypertension, an angiotensin-converting enzyme (ACE) inhibitor for diabetic patients with or without hypertension, and intensive blood pressure control for patients with hypertension with or without diabetes.

Screening strategies were also modelled. Those aged between 50 and 69 years were screened annually, in primary care, for diabetes, hypertension, and proteinuria, with further tests to confirm diabetes or proteinuria. Intensive treatment was given on the basis of these results and any known conditions.

Each strategy was compared with the usual care in the authors' setting.

Location/setting
Australia/primary and secondary care.

Methods
Analytical approach:
The analysis was based on a Markov model, with a lifetime horizon. The authors stated that the perspective of a central health care funder was adopted.

Effectiveness data:
The clinical data appear to have been derived from selected relevant studies. The epidemiological data, patients’ characteristics, and screening uptake were from the Australian Diabetes, Obesity and Lifestyle Study (AusDiab), which was a population-representative cohort study. Treatment-related data were from published clinical trials and meta-analyses. The sensitivity and specificity of the screening options were from a published diagnostic study, conducted in several countries. The rate of cardiovascular disease events was the key input.

Monetary benefit and utility valuations:
The utility values were from the AusDiab, which used the Short Form (SF-36) Health Survey, and data from other published reports.

**Measure of benefit:**
Quality-adjusted life-years (QALYs) were the summary benefit measure and they were discounted at an annual rate of 5%.

**Cost data:**
The economic analysis included the costs of drugs, consultation visits, diagnostic tests, glycaemic control, hypertension control, protein control, dialysis, and transplants. The resource use data came from various published sources, including Australian reports and the UK Prospective Diabetes Study. The unit costs of tests and most other items were based on data from the Medical Benefits Schedule. All costs were in Australian dollars (AUD) and the price year was 2008. A 5% annual discount rate was applied to future costs.

**Analysis of uncertainty:**
A probabilistic sensitivity analysis was undertaken to assess the uncertainty underlying all the model inputs, simultaneously, using recommended distributions, and cost-effectiveness acceptability curves were generated. The impact of variations in the starting age for screening and screening participation was tested in a deterministic one-way sensitivity analysis.

**Results**
Compared with usual care, the cost savings were AUD 133 with intensive glycaemic control for diabetic patients and AUD 825 with an ACE inhibitor for diabetic patients. The additional costs were AUD 352 with intensive blood pressure control for hypertensive patients; AUD 1,345 with screening for diabetes and intensive glycaemic control; AUD 57 with screening for hypertension and intensive blood pressure control; and AUD 153 with screening for proteinuria and an ACE inhibitor for all diabetic patients and anyone who tested positive.

The additional QALYs were 0.075 with intensive glycaemic control for diabetic patients; 0.124 with an ACE inhibitor for diabetic patients; 0.136 with intensive blood pressure control for hypertensive patients; 0.097 with screening for diabetes and intensive treatment; 0.116 with screening for hypertension and intensive treatment; and 0.032 with screening for proteinuria and an ACE inhibitor.

Compared with usual care, the first two strategies were dominant, as they were more effective and less expensive. The incremental costs per QALY gained with the other strategies were AUD 2,588 with intensive blood pressure control for hypertensive patients; AUD 13,866 with screening for diabetes and intensive treatment; AUD 491 with screening for hypertension and intensive treatment; and AUD 4,781 with screening for proteinuria and an ACE inhibitor.

At a threshold of AUD 50,000 per QALY, the probability that the intervention was cost-effective was 85% with intensive glycaemic control for diabetic patients; 88% with an ACE inhibitor for diabetic patients; 82% with intensive blood pressure control for hypertensive patients; 57% with screening for diabetes and intensive treatment; 55% with screening for hypertension and intensive treatment; and 50% with screening for proteinuria and an ACE inhibitor.

The probability that it was cost-saving was 47% with intensive glycaemic control for diabetic patients; 54% with an ACE inhibitor for diabetic patients; 44% with intensive blood pressure control for hypertensive patients; 21% with screening for diabetes and intensive treatment; 31% with screening for hypertension and intensive treatment; and 29% with screening for proteinuria and an ACE inhibitor.

The deterministic sensitivity analysis showed that the cost-effectiveness for screening improved as the starting age increased.

**Authors’ conclusions**
The authors concluded that all the screening strategies improved health outcomes at an affordable cost for health care payers. In patients already diagnosed with diabetes, who had uncontrolled blood glucose, both the addition of an ACE inhibitor and intensive management improved clinical outcomes at lower costs than the usual care.
CRD commentary

Interventions:
The rationale for the selection of the comparators was clear as the intensive treatment and screening strategies were compared with the usual care in the Australian setting. A description of these strategies was provided.

Effectiveness/benefits:
No systematic review to identify the relevant sources of data was reported, but they appear to have been appropriately selected since country-specific databases and high-quality studies (either meta-analyses or clinical trials) were used for most of the model inputs. More detail on the clinical data was provided in an appendix. Most of the utility values were derived from an Australian database and were elicited using a validated questionnaire. QALYs were appropriately used as the benefit measure as they allow cross-disease comparisons and capture the impact of the interventions on a patient’s health.

Costs:
The economic analysis was consistent with the perspective in both the cost categories and the data sources. The resource use data were extensively presented and the average cost per patient and the price year were reported. The resource use data were from other countries and this could limit the results, given that this type of data is not very generalisable. An extensive sensitivity analysis was conducted and appropriate distributions were used for the probabilistic analysis of cost inputs. In general, the economic analysis was carried out satisfactorily.

Analysis and results:
The costs and benefits of the strategies were appropriately synthesised using an incremental approach. The issue of uncertainty was investigated in an extensive probabilistic analysis, with a deterministic analysis of specific inputs. The study findings were clearly presented and illustrated. A description of the key transition patterns in the Markov model was provided. The time horizon of the analysis was appropriate and conventional discounting was applied. The authors compared their results with those of other published economic evaluations, which were both similar and different.

Concluding remarks:
The study was well conducted and reported in detail, which enhances the validity of the authors’ conclusions.

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