Cost effectiveness analysis of screening for sight threatening diabetic eye disease

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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
Systematic photographic screening for sight threatening diabetic eye disease. The systematic programme used a mobile screening unit visiting inner city general practices together with a dedicated hospital assessment clinic. Screening comprised three-field, non-stereoscopic photography using mydriasis; 35 mm transparencies; and validated grading. Sight threatening eye disease was defined as any of the following: moderate preproliferative retinopathy or worse; circinate exudates within the macula; any exudate within 1 disc diameter of the foveola; other diabetes related disease such as vascular occlusion.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
Diabetic patients.

Setting
Hospital and primary care. The economic analysis was carried out in the UK.

Dates to which data relate
Effectiveness and resource use data corresponded to studies published between 1991 and 1996 (data collection occurring in the same time span). The price year was 1996-97.

Source of effectiveness data
Effectiveness data were derived from a review of the literature (mainly based on the results reported in different publications from the Liverpool diabetic eye study established in 1991).

Outcomes assessed in the review
The review assessed baseline prevalence of sight threatening eye disease, sensitivity, specificity and compliance.

Study designs and other criteria for inclusion in the review
The main sources of effectiveness data (except for the specificity of the opportunistic programme) were two studies within the Liverpool diabetic eye study established in 1991. The first study was a cross sectional observational study of 320 diabetic patients registered with 4 general practices who were examined by a consultant ophthalmologist specialising in medical retinal diseases using slit-lamp biomicroscopy. The second study comprised an analysis of the
implementation of systematic screening in Liverpool and involved a structured, closed response questionnaire, administered by trained observers to the first 1,363 diabetic patients recruited.

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

**Criteria used to ensure the validity of primary studies**
Only one other study outside the Liverpool diabetic eye study was used as the reference for the specificity of the opportunistic programme. No criteria were reported to have been used.

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

**Number of primary studies included**
Two studies within the Liverpool diabetic eye study (reported in three papers) plus one single study outside the Liverpool diabetic eye study were included in the study.

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

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

**Results of the review**
The results of the review were as follows:

Baseline prevalence of sight threatening eye disease was 14.1%.

Sensitivity of the systematic programme was 89% (95% CI: 80% - 98%), specificity of the systematic programme was 86% (95% CI: 82% - 90%), and compliance rates of the systematic programme, 80%.

Compliance for the opportunistic screening was 78%.

The combined sensitivity of the opportunistic programme was 63%.

The specificity of general practitioners in the opportunistic screening programme was 89%, diabetologists 96%, and optometrists 94%.

The combined specificity for the opportunistic screening programme was 92%.

**Measure of benefits used in the economic analysis**
The benefit measure was the number of true cases detected.

**Direct costs**
A discount rate was used to estimate the annual capital costs. Quantities were reported separately from the costs. Cost items were reported separately. Cost analysis for the intervention covered the direct costs of photographic screening (capital charges and depreciation, etc.), grading (overheads, stationary, etc.), assessment clinic (overheads, stationary, etc.), and external quality control. The cost analysis for the comparator consisted of the cost of screening (staff time, etc.) and cost of follow-up. A health service perspective was adopted in the cost analysis. The cost analysis was based on the ingredient approach rather than costing based on recording individual patient resource use, since it was deemed that the costs in screening programmes are largely fixed or semi-fixed. The costs of systematic screening were calculated on actual resource use with a call-recall system. The average estimates of time spent on direct ophthalmoscopy by six practitioners who regularly carried out screening were used to calculate the general practitioner and diabetologist components. General practitioner costs per minute including overheads were taken from a study published in 1996. The price year was 1996-97.

**Indirect Costs**
Not considered.

**Currency**
UK pounds sterling ( ).

**Sensitivity analysis**
A series of one-way and two-way sensitivity analyses was used on key variables (apparently not costs) to determine the effect on cost-effectiveness of alternative strategies. 95% confidence intervals were used in the sensitivity analyses performed on sensitivity and specificity of the tests. Threshold values were also calculated.

**Estimated benefits used in the economic analysis**
The number of true cases detected was 346 in the opportunistic programme and 502 in the systematic screening programme, resulting in an incremental value of 156.

**Cost results**
The discount rate used to calculate the annual capital costs was 6%. The total cost of screening tests extrapolated for an opportunistic screening programme for a target population of 5,000 (with compliance rate of 78%) was 99,981 versus 104,996 for a systematic screening programme for a target population of 5,000 (with compliance rate of 80%), resulting in an incremental value of 5,015.

**Synthesis of costs and benefits**
An average cost-effectiveness ratio (as the total cost divided by the number of cases detected) and an incremental cost-effectiveness ratio (as the extra cost needed to generate each additional true positive result) were calculated, after replacing opportunistic with systematic screening. The value of the average cost-effectiveness ratio was 289 for the opportunistic screening programme versus 209 for the systematic screening programme. The incremental cost-effectiveness ratio for replacing opportunistic by systematic screening was 32. Systematic screening remained more cost effective than opportunistic screening for all values of disease prevalence.

**Authors' conclusions**
The authors concluded that replacing existing programmes with systematic screening for diabetic eye disease is justified.

**CRD COMMENTARY - Selection of comparators**
A justification was given for the choice of the comparator (the strategy of opportunistic screening). It was the existing
practice in Britain at the time of the study. You, as a database user, should consider which health technology is used widely in your own setting.

**Validity of estimate of measure of effectiveness**

The internal validity of the effectiveness results cannot be guaranteed due to the non-randomised nature of the design of the two Liverpool studies, plus the fact that no systematic review of the literature appears to have been performed. Furthermore, no quality appraisal was performed on the only study beyond the Liverpool studies included in the review.

**Validity of estimate of measure of benefit**

The estimate of benefits was obtained directly from the effectiveness analysis. This choice of estimate was discussed; the use of this proxy measure depends on the inference that correctly and appropriately identified cases can be treated and blindness prevented. It was acknowledged that this kind of measure does not necessarily show the full effectiveness of a programme, as it reflects process rather than final outcome. The number of false positive results was higher in the intervention (481 versus 268) which would have increased resource implications.

**Validity of estimate of costs**

The positive features of the cost analysis were as follows: quantities were reported separately from the costs; adequate details of methods of cost estimation were given; the price year and the perspective adopted in the cost analysis were specified. However, the validity of the cost results may have been adversely affected by the following characteristics: the effects of alternative procedures on indirect costs were not addressed; cost results may not be generalisable outside the study setting since no sensitivity analysis appears to have been performed on cost data.

**Other issues**

The authors' conclusion may need to be treated with some caution due to the limitations of the study design. However, the uncertainties in the effectiveness data were addressed by sensitivity analysis, which might enhance the validity of the results. The authors could also have conducted sensitivity analysis on cost data to establish the general robustness of the cost-effectiveness results. The issue of generalisability to other settings or countries was addressed in terms of the sensitivity analysis. Some comparisons were made with other studies.

**Implications of the study**

Further work is required to measure cost-effectiveness against long term end points such as numbers of patients treated, years of sight saved, quality of life, or numbers of blind registrations. Cost-effectiveness analysis would also be valuable when applied to other current techniques, including dual modality screening, optometry based programmes, digital photography, and automated neural net systems.

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