Screening for diabetic retinopathy in James Bay, Ontario: a cost-effectiveness 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
Three screening programmes for diabetic retinopathy (DR) were examined. One was performed by retinal photography with a portable digital camera. Another was performed by travelling retina specialists (stated to be the current practice in the authors' setting). The third was no screening.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis and cost-utility analysis.

Study population
The study population comprised a hypothetical cohort of 650 diabetic patients (average age 50 years) from the communities of western James Bay (Ontario, Canada).

Setting
The setting was secondary care. The study was performed in Ontario, Canada.

Dates to which data relate
The effectiveness evidence was collected from studies published between 1981 and 2000. The dates to which the cost data related were not reported. The price year was 1998.

Source of effectiveness data
The effectiveness data were derived from a non-systematic review of published studies and some authors' assumptions.

Modelling
A Markov model was used to estimate the benefits and costs of the programmes under comparison. The model was run for 5 years and the results were projected forward for another 5 years.

Outcomes assessed in the review
The model parameters assessed were:

the proportion of patients that would be examined under the screening programme performed by the travelling specialists;

the sensitivity of the alternative methods;
the positive predictive values (PPV) for both screening programmes; and

the utilities associated with one year of life of a diabetic patient and one year of life of a diabetic patient with severe vision loss due to DR.

Other epidemiological and demographic parameters were also assessed in the review.

Study designs and other criteria for inclusion in the review
Not reported. The authors stated that designs such as cross-sectional, observational and multi-centre prospective randomised trials were presented by the studies in the review. Data from personal communications were also included in the review.

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
At least 17 studies appear to have been included in the review.

Methods of combining primary studies
Not reported. The authors appear to have used the data from the primary studies selectively.

Investigation of differences between primary studies
The differences were not investigated.

Results of the review
In total, 55% of the cohort would be screened if screening were performed by the travelling retina specialists. It was assumed that the coverage would be 80% for the camera strategy.

The sensitivity of the retinal-camera test was 80% and that of the retina-specialist test was 95%.

The utility associated with one year of life of a diabetic patient was 0.85.

The utility associated with one year of life of a diabetic patient with severe vision loss due to DR was 0.59.

Methods used to derive estimates of effectiveness
The authors made assumptions to estimate some effectiveness parameters.

Estimates of effectiveness and key assumptions
The authors made the following assumptions:
the life expectancy of 50-year-old diabetic patients in the hypothetical cohort was 10 years;

all patients requiring treatment underwent it; and

80% of diabetic patients would be screened if the portable digital camera were used for the screening programme.

**Measure of benefits used in the economic analysis**

The model outcomes used in the economic analysis were:

- the number of years of vision lost when the screening programmes or no screening programme were performed;
- the incremental number of years of vision gained with each of the screening programmes in comparison with no screening; and
- the number of quality-adjusted life-years gained with the screening programmes in comparison with no screening.

The authors also assessed the proportion of patients that developed severe vision loss in both programmes and in the absence of a screening programme. The benefits were estimated for a 10-year period. The utilities used when estimating the QALYs were obtained from a non-systematic review of the literature.

**Direct costs**

The resource quantities and the costs were not reported separately. The authors stated that the direct costs considered in the economic analysis were for personnel, transportation and equipment related to the implementation and running of each screening programme. However, more detailed information about the costs included within each cost category was not provided. The direct costs were obtained from the Regional Health Planning Office and a hospital located in the authors’ setting. Therefore, the costs appear to have been estimated from actual data, although the dates to which the costs related were not reported. The price year was 1998. The study appears to have reported the average costs. Discounting was performed at a rate of 5%, which was relevant since the costs considered at analysis were incurred during 5 years. The authors stated that they did not adjust for inflation.

**Statistical analysis of costs**

No statistical analyses of the costs were performed.

**Indirect Costs**

No indirect costs were considered.

**Currency**

Canadian dollars (Can$).

**Sensitivity analysis**

Sensitivity analyses were performed to assess the robustness of the results when some of the model parameters were varied. The parameters investigated were the proportion of individuals screened with the screening programme using the digital camera (50, 65 and 80%), and the sensitivity of the specialist-based screening programme (0.80) and the digital camera programme. Some other epidemiological estimates appear to have been considered in the sensitivity analyses. The area of uncertainty investigated was variability in the data. The analyses used appear to have been one-way sensitivity analyses.

**Estimated benefits used in the economic analysis**

The estimated benefits used for the 10-year period considered in the economic analysis were as follows.
The numbers of years of vision lost were 105 with the retina-specialist programme, 93 with the retinal-camera programme, and 161 with no screening.

The incremental numbers of years of vision gained with the screening programmes, compared with no screening, were 56 with the retina-specialist programme and 67 with the retinal-camera programme.

The numbers of QALYs gained with the screening programmes, compared with no screening, were 14.6 with the retina-specialist programme and 17.4 with the retinal-camera programme.

The proportion of patients that developed severe vision loss was between 0.5% and 0.6% with both programmes, and 0.9% in the absence of a screening programme.

The health benefits were discounted at a rate of 5%. The authors stated that dilation required to improve image quality was considered in the analysis, although they did not report how.

**Cost results**
The total programme costs per person were Can$842 for the retina-specialist programme, Can$403 for the retinal-camera programme and Can$0 for no screening.

These costs were calculated for a 5-year period.

**Synthesis of costs and benefits**
The estimated benefits and costs were combined through incremental cost-effectiveness ratios. These were calculated as the differences in benefits over the differences in costs when the screening programmes were compared to the alternative of no screening. The retinal-camera programme dominated the retina-specialist programme since it presented higher benefits and lower costs. As the authors stated, compared with no screening, the cost per year of vision saved over 10 years with the retinal-camera programme was Can$3,900, while the cost per QALY saved over 10 years was Can$15,000. The results of the sensitivity analyses showed that the conclusions did not vary when the parameters were modified.

**Authors' conclusions**
A portable retinal camera is a more cost-effective means of screening for diabetic retinopathy (DR) than a retina specialist is in isolated Canadian communities.

**CRD COMMENTARY - Selection of comparators**
The authors compared a proposed screening strategy with the current screening strategy and no screening. The screening strategies were particular to an outlying community in Canada. You should decide if these are relevant to your setting.

**Validity of estimate of measure of effectiveness**
The authors did not state that a systematic review of the literature had been undertaken. They used data from the available studies selectively and did not report any investigation of the differences found between the primary studies included in the review. The authors made some assumptions to estimate the effectiveness parameters. Some, but not all, of the authors' assumptions were justified with reference to the medical literature. However, the authors performed sensitive analyses to assess the robustness of the results when some assumptions and other model parameters were modified.

**Validity of estimate of measure of benefit**
The estimation of benefits was modelled using a Markov model. The model was run for 5 years and the results
obtained were projected forward for another 5 years. The authors did not provide evidence that the benefits obtained
during the first 5 years would be the same as for the last 5 years. Therefore, it is unclear whether this projection was a
correct approach to estimate the benefits. It seems more reasonable that the model should have directly considered a
10-year period. No justification for this method of conducting the analysis was provided. The benefits were discounted
at a rate of 5%, which was appropriate.

Validity of estimate of costs
All the categories of costs relevant to the perspective adopted appear to have been included in the analysis. However, it
cannot be stated whether all the relevant costs for each category were considered due to a lack of reporting. Only the
screening costs were calculated, not treatment costs. The costs and the quantities were not reported separately and the
dates to which the costs related were not stated. These issues hinder extrapolation exercises to other settings. The price year
was reported. No sensitivity analyses on the costs appear to have been performed. Moreover, the time considered when
estimating the costs was not the same as that used when estimating the benefits. Since the authors did not state that
there were no costs incurred after year 5, the approach undertaken for the economic analysis does not appear to have
been appropriate. This introduces uncertainty into the reliability of the conclusions.

Other issues
The analysis of the results was not appropriate. The two screening strategies were compared with no screening when
one screening strategy should have been compared with the other. Ideally, one would wish to know the incremental
costs and effects and cost-effectiveness ratios from the least effective programme to the next, excluding dominated
programmes (programmes that are more expensive and less effective). It appears that the retinal-camera option
actually dominated the retinal-specialist programme. The authors’ conclusions did not adequately reflect the results.
The authors did not make appropriate comparisons of their findings with those from other studies. Nor did they
address the issue of the generalisability of the results to other settings, although this may be unlikely due to the
specific conditions of the authors’ setting (i.e. isolated locations in Canada). The authors highlighted that eye care
services must be provided regardless of the screening programme, and this was not considered in the analysis.

Implications of the study
The authors made no recommendations for changes in policy or practice, or the need for further research.

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None stated.

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Other publications of related interest
Laupacis A, Feeny D, Detsky AS, Tugwell PX. How attractive does a new technology have to be to warrant adoption

Mittmann N, Trakas K, Risebrough N, Liu BA. Utility scores for chronic conditions in a community-dwelling

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MeSH
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