The cost-effectiveness of various modes of screening for primary open angle glaucoma

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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
Modes of screening/case-finding for glaucoma defined in terms of various combinations of three main tests (ophthalmoscopy (O), tonometry (T), and perimetry (P)) with associated referral criteria (relatively lax (Ix) or relatively severe (sv)).

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
White Caucasians over 40 years of age.

Setting
Primary care. The economic study was carried out in London, UK.

Dates to which data relate
The epidemiological data were extracted from literature published between 1966 and 1995, and personal communication from 1995. The cost data and some resource use data were obtained either from literature published between 1983 and 1994 or from personal communication from 1995. The fiscal year was 1992 (converted to 1995).

Source of effectiveness data
Effectiveness data were derived from a synthesis of previously published reports or studies and expert opinion obtained by personal communication.

Modelling
The main components were:

(a) population distributed in terms of the three main characteristics affecting the probability of having glaucoma, ie, condition of optic disc, level of intraocular pressure, and presence of visual field defects;

(b) distribution of glaucomas in relation to these characteristics;

(c) defined modes of screening, with associated referral criteria;

(d) calculation of the number of referrals and true positives for each mode; and
(e) total costs of screening for each mode.

Outcomes assessed in the review
The review assessed epidemiological outcomes including the prevalence of undetected primary open angle glaucoma (POAG) by different population groups.

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
25 reports or studies were used as references for the outcomes assessed in the review.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
The prevalence of POAG was 1.2%. Based on the literature, it was assumed that undetected POAGs would be half of all POAGs. A wide range of epidemiological outcomes were reported.

Methods used to derive estimates of effectiveness
Effectiveness was also derived from expert opinion obtained by personal communication.

Estimates of effectiveness and key assumptions
10% of the population have IOP >20mmHg; 15% have "suspicous" optic discs (eg CD ratio >4%); 4% would fail 66 point test on Henson CFS 2000 visual field screener.

56% of glaucomas have an IOP of > 20mmHg; 60% have CD ratio >0.4%; 83% have a visual field defect which would be exhibited by such a field screener.

Measure of benefits used in the economic analysis
The total of true positives in a population of 10,000 hypothetical patients was the main benefit measure. Sensitivity,
specificity, and positive predictive value were among the outcomes calculated in the model.

**Direct costs**
An interest rate was considered in the depreciation of medical instruments. The quantities were not fully reported separately from the costs although cost items were reported separately. The cost analysis covered: cost per hour of optometrist ($43($67) - including all overheads for premises etc); capital costs (tonometer $4,500($6,975), field screener $5,000($7,550)); and cost of secondary examination at a clinic ($40($62) per patient visit prior to diagnosis). The sources of resource use and cost data were literature published between 1983 and 1994 and personal communications from 1995. The price date was 1995. The cost analysis only covered the costs of diagnosis and not the costs of subsequent treatment and monitoring.

**Indirect Costs**
Not considered.

**Currency**
UK pounds sterling (). A conversion to US dollars was carried out based on an exchange rate of 1= $1.55.

**Sensitivity analysis**
A simple one-way sensitivity analysis was performed on the prevalence of POAG, sensitivity values, predictive values, the costs of examination, and the definition of true positive.

**Estimated benefits used in the economic analysis**
The total true positives in a population of 10,000 hypothetical patients was 84 cases including 34 cases of chronic simple glaucoma (CSG), 26 cases of low or normal pressure glaucoma (NPG), and 24 cases of other treatable cases. Sensitivity values ranged from 36% for ophthalmoscopy (lx) to 95% for OTP (lx). Specificity values ranged from 86% for ophthalmoscopy (lx) to 99% for a number of screening modes. Positive predictive values ranged from 4% for ophthalmoscopy (lx) to 48% for OTPrc (sv).

**Cost results**
The interest rate considered in the depreciation of medical instruments was 6%. The average total cost associated with each screening mode was not reported.

**Synthesis of costs and benefits**
The cost per true positive for each screening mode was calculated as the measure of cost-effectiveness. The least-cost modes were TP ($760 per true positive) and T>22 ($894 per true positive), but they had less than 60% sensitivity. The screening modes of OTPhr(sv) and OTP(sv) had a better balance of sensitivities (80% and 87%, respectively) and cost per true positive ($1,234 and $1,418, respectively, or $736 and $962 if the costs of primary ophthalmoscopy are excluded, this test always being conducted by optometrists for other reasons). The sensitivity analysis established that glaucoma prevalence was potentially the most sensitive parameter in the model.

**Authors' conclusions**
The authors concluded that "glaucoma screening of people over age 40 years could be justifiable, provided that it is worth more than about $850 to detect a new case. Whilst based on UK values, the analysis could be applied to different primary health care settings in other countries. The modes of glaucoma testing which can provide the best balance between sensitivity and cost are those which use ophthalmoscopy and tonometry routinely on patients over the age of about 40 years, together with perimetry either routinely or on glaucoma high risk groups. Screening is most likely to be economic when conducted (as systematised "case-finding") in conjunction with overall eye examinations, thus
minimising the costs of ophthalmoscopy and overheads. The cost per glaucoma detected can be as low as $850 at 1995 prices, with sensitivity for those tested of \( \geq 80\% \). If the real worth of detecting a new case is considered likely to exceed this, there is reason to promote and improve potentially economic systems of detection.”.

CRD COMMENTARY - Selection of comparators
No specific mode of screening was regarded as a comparator.

Validity of estimate of measure of benefit
The estimate of benefit appears to be internally valid.

Validity of estimate of costs
Resource utilisation was not fully reported separately from the costs. Adequate details of the methods of cost estimation were given.

Other issues
Despite some limitations, the exercise provides a description, in quantified form, of the main factors, both technical and economic, which determine the cost-effectiveness of glaucoma screening.

Source of funding
None stated.

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