Cost–utility of a screening programme for early age-related macular degeneration

A preliminary model-based assessment of the cost–utility of a screening programme for early age-related macular degeneration

J Karnon,[1*] C Czoski-Murray,[1] K Smith,[1] C Brand,[2] U Chakravarthy,[3] S Davis,[1] N Bansback,[1] C Beverley,[1] A Bird,[4] S Harding,[5] I Chisholm[6] and YC Yang[7]

[1] School of Health and Related Research (ScHARR), University of Sheffield, UK
[2] Sheffield University Teaching Hospitals, Sheffield, UK
[3] Royal Victoria Hospital, Belfast, UK
[4] Moorfields Hospital, London, UK
[5] Royal Liverpool University Hospital, Liverpool UK
[6] Southampton University Hospitals NHS Trust, Southampton, UK
[7] Wolverhampton Eye Infirmary, Wolverhampton, UK

* Corresponding author. Present address: School of Population Health and Clinical Practice, University of Adelaide, Australia

Executive summary

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Executive summary

Introduction

Age-related macular degeneration (AMD) is the leading cause of blindness in people aged over 60 years in the western world. It is estimated that around 25% of the over-60s in the UK have some degree of visual loss because of AMD. AMD is divided into early and late. In early disease, visual acuity is normal. Late disease consists of choroidal neovascularisation (wet) and geographic atrophy (dry). Treatment options for dry AMD are still at a relatively early stage of evaluation and at present no treatment for dry AMD is routinely available. Wet AMD occurs as a result of bleeding and scarring and leads to more rapid sight loss. Current treatments for wet AMD seek to prevent further visual loss rather than cure or restore vision, although newer interventions have shown promising results that indicate that vision improvement may be possible.

The National Screening Committee have defined a set of criteria to inform the suitability of screening for a condition. The condition must be important, and the natural history and epidemiology must be understood. The screening test should be simple, safe, precise and acceptable to the general population, and there should be a defined diagnostic process following a positive test. Treatment for screen-detected disease should lead to better outcomes than treatment provided at the point of clinical diagnosis.

Aims and objectives

The aim of this study was to estimate the cost-effectiveness of screening for AMD by developing a decision analytic model that incorporated and assessed all of the above criteria. At the outset it was recognised that there was likely to be significant uncertainty in key areas of the model, and an objective of the study was to identify the major areas of uncertainty, and so inform future research priorities in this disease area.

Methods

Systematic literature reviews of the major electronic databases took place in March 2004 and were updated in January 2005. These reviews covered the epidemiology and natural history of AMD, the screening and treatment effectiveness and health-related quality of life relating to AMD. A hybrid cohort–individual sampling model was implemented to describe the range of pathways between the incidence of age-related maculopathy (ARM) and death via clinical presentation and treatment at different stages of the disease.

Significant shortfalls in the data available from the literature were apparent, so a range of primary data sources were also used to populate the model. To obtain estimates for the value of parameters deemed to be within an expert's remit, data describing some parameters were elicited from relevant experts. The data identified informed probability distributions describing the uncertainty around the model parameters.

To incorporate joint parameter uncertainty (i.e. correlations between parameters), the AMD natural history model was calibrated probabilistically. Randomly sampled sets of input parameters were assigned weights representing the accuracy of their predictions of a set of observed model outputs.

The analysis of the AMD screening model estimated the costs, numbers of quality-adjusted life-years (QALYs) and cases of blindness in a general population sample of 50-year-olds over the remainder of their lifetime, for 16 alternative screening options (including no screening). The reference case analysis incorporated current treatment options of laser photocoagulation and photodynamic therapy. Sensitivity analyses describing six alternative sets of intervention strategies, based on horizon scanning of potential future treatments for AMD, were also undertaken.

Results

There remains significant uncertainty about whether any form of screening for AMD is cost-effective. However, annual screening from age 60 years seems to provide the highest mean net benefits, but this is based on a cost-effectiveness estimate that has very poor precision (high levels

of uncertainty). The probabilistic sensitivity analysis shows that the 95% credible interval for annual screening from age 60 years ranges from this option dominating the previous option to an incremental cost per QALY of over £0.5 million. Plotting a cost-effectiveness acceptability frontier shows that although annual screening from age 60 years has the highest net benefits at a value of QALY of £30,000, the associated probability of this option being the most cost-effective option is only around 20%.

The sensitivity analyses around potential future treatment options indicate that screening may become more cost-effective with the new treatments.

Conclusions

The conclusions focus on the interpretation of the results from the perspective of defining the major areas of uncertainty, which were defined as:

- Disease progression (due to the available data, the model was built around progression of visual acuity, despite a preference for contrast sensitivity).
- Rates of clinical presentation (informed by local data from the Sheffield photodynamic therapy (PDT) clinic and responses from a survey of general ophthalmologists). Problems with this approach included a small sample of patients, the fact that the PDT database was not validated, a limited response to the survey of ophthalmologists and inconsistencies in the responses received.
- Screening test and optician effectiveness (elicited data described the probability that individuals undertaking the simple screening test at home who notice an abnormality would then present at an optician's). The model assumes that optometrists accurately refer all cases of dry and wet AMD on to hospital ophthalmologists, while not referring any cases of early ARM.
- Treatment effectiveness (a lack of long-term follow-up data inevitably requires the use of weak assumptions to extrapolate the observed effectiveness data).
- Costs of blindness (a binary threshold for costs associated with blindness was incorporated, but such costs would be more appropriately described on a continuum).

Future research may be best targeted at assessing how routine data may be used to describe clinical presentation rates of ARM. Other potential studies include a pilot study of the effectiveness of screening and opticians' referral patterns for AMD and a costing study of blindness as a continuum of association with deterioration in vision.

Publication

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NIHR Health Technology Assessment Programme

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The research findings from the HTA Programme directly influence decision-making bodies such as the National Institute for Health and Clinical Excellence (NICE) and the National Screening Committee (NSC). HTA findings also help to improve the quality of clinical practice in the NHS indirectly in that they form a key component of the 'National Knowledge Service'.

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The research reported in this issue of the journal was commissioned by the HTA Programme as project number 03/06/01. The contractual start date was in April 2004. The draft report began editorial review in March 2006 and was accepted for publication in February 2008. As the funder, by devising a commissioning brief, the HTA Programme specified the research question and study design. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

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