A hybrid cohort individual sampling natural history model of age-related macular degeneration: assessing the cost-effectiveness of screening using probabilistic calibration

Karnon J, Czoski-Murray C, Smith KJ, Brand C

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 several screening strategies for age-related macular degeneration, in patients aged 50 years or more, using an innovative decision analytic model. Annual screening beginning at age 60 was the most cost-effective strategy, but there was high uncertainty surrounding this finding. The study was based on valid methodology and the authors’ conclusions appear to be appropriate.

Type of economic evaluation
Cost-utility analysis

Study objective
This study used an innovative decision analytic model to examine the cost-effectiveness of several screening strategies for age-related macular degeneration (AMD) in patients aged 50 years or older.

Interventions
The screening strategy was based on self-testing and included 15 combinations of starting ages and screening intervals. The starting ages were 50, 60 or 70 years and the screening intervals were every year, two years, three years, four years, or five years. A background strategy of no screening was also considered.

Location/setting
UK/primary care.

Methods
Analytical approach:
This study was based on a hybrid cohort-individual sampling model, with a lifetime horizon. The authors stated that the analysis was carried out from the perspective of the UK National Health Service (NHS).

Effectiveness data:
The clinical data came from a systematic literature review and was supplemented by the opinions of expert ophthalmologists. The details of the methods of the review were not given. The authors selected the studies that were most relevant for each model parameter. For example, the epidemiological data were taken where possible from UK studies or populations similar to that of the UK. Disease progression data were taken from both cohort studies and randomised controlled trials (RCTs), with the use of patient-level data when available. The treatment effect was mainly taken from patient-level data from RCTs. The screening detection data were from expert opinion, due to a lack of valid data. The model was calibrated on the basis of three parameters: visual acuity at presentation, age- and state-specific clinical diagnosis rate of age-related maculopathy, and age-specific rates of bilateral 6/60 vision or worse due to age-related maculopathy.

Monetary benefit and utility valuations:
The utility valuations were derived from values based on the time trade-off procedure and a UK-based study, in which patients completed three preference-based measures: the Health Utilities Index, European Quality of life (EQ-5D), and the Short Form (SF-6D) Health Survey.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at 3.5% per annum.

Cost data:
The economic analysis included the costs associated with screening, diagnosis, out-patient visits, treatment (e.g. photodynamic therapy, or genetic anti-vascular endothelial growth factor therapy), and both blindness and rapidly deteriorating vision. The unit costs and resource quantities were not reported. Most of the economic data were taken from published studies, but these sources were not clearly reported. All costs were in UK pounds sterling (£) and were discounted at an annual rate of 3.5%. The price year was 2006.

Analysis of uncertainty:
The issue of uncertainty was addressed in two ways. First, a series of one-way sensitivity analyses was carried out on the key model inputs using ranges of values derived from the literature or experts’ opinions. Second, a probabilistic sensitivity analysis was undertaken to generate credible intervals (CIs) around the mean estimates and cost-effectiveness acceptability curves.

Results
Only the results for non-dominated strategies were reported. The total costs per patient were £780 with no screening; £784 with five-yearly screening at age 60; £786 with four-yearly at age 60; £788 with three-yearly at age 60; £794 with two-yearly at age 60; £809 with annual at age 60; and £826 with annual at age 50. The QALYs were 16.49096 with no screening; 16.49300 with five-yearly at age 60; 16.49330 with four-yearly at age 60; 16.49369 with three-yearly at age 60; 16.49428 with two-yearly at age 60; 16.49530 with annual at age 60; and 16.49535 with annual at age 50.

The incremental cost per QALY gained (over the next most effective strategy) was £1,970 with five-yearly screening at age 60; £4,375 with four-yearly at age 60; £6,092 with three-yearly at age 60; £9,710 with two-yearly at age 60; £15,169 with annual at age 60; and £345,252 with annual at age 50. At a threshold of £20,000 to £30,000 per QALY gained, annual screening beginning at age 60 was the most cost-effective strategy.

In the one-way sensitivity analysis, using age-specific utility values, screening was predicted to be less cost-effective and screening every five years starting at age 60 was the preferred strategy. The addition of anti-vascular endothelial growth factor therapy for juxtafoveal or subfoveal wet AMD lesions improved the cost-effectiveness of screening significantly. The probabilistic sensitivity analysis showed that generally the CIs around the mean values were large showing high uncertainty around the mean values.

Authors’ conclusions
The authors concluded that, from the NHS perspective, annual screening beginning at age 60 was the most cost-effective strategy for the detection of AMD, but there was high uncertainty surrounding the optimal strategy.

CRD commentary
Interventions:
The selection of the comparators appears to have been appropriate because all the relevant screening strategies were considered.

Effectiveness/benefits:
Many details were provided about some of the studies used for the clinical data, but more detail on the design of these studies would have been useful. The authors stated that the clinical evidence came from a literature review, but its methods and conduct were not described. The inclusion and exclusion criteria and the pooling methods were also not reported. The authors appear to have selected the evidence that was the most relevant and patient-level data were often used. The sensitivity analyses were extensive and considered wide ranges of clinical values. The approach used to derive the QALYs was clearly described.

Costs:
The analysis of costs was consistent with the economic viewpoint in terms of the categories of costs. For example, some items such as over-the-counter products, which were bought by patients, were not included. The sources of data were not described in detail and the unit costs and quantities of resources were not clearly presented. The price year and the
use of discounting were reported. The cost estimates were varied in the sensitivity analysis.

Analysis and results:
The costs and benefits of the strategies were appropriately synthesised using an incremental approach. The issue of uncertainty was satisfactorily addressed in the sensitivity analysis, which used various approaches to assess the parameter uncertainty. The results of the sensitivity analyses were clearly presented and discussed. The authors highlighted some innovative aspects of their decision model. This combined an individual sampling sub-model to describe the more complex areas of disease progression (pre-clinical presentation) with a cohort-based sub-model to describe the less complex areas (post-clinical presentation). The model calibration was also innovative and large numbers of sets of input parameter values were sampled from predefined probability distributions.

Concluding remarks:
This study was based on valid methodology and the authors’ conclusions appear to be appropriate, but there was high uncertainty around the findings.

Funding
Supported by a grant from the UK National Health Service Health Technology Assessment programme.

Bibliographic details

PubMedID
19129156

DOI
10.1177/0272989X08327491

Original Paper URL
http://mdm.sagepub.com/cgi/reprint/29/3/304

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Aging; Calibration; Cohort Studies; Disease Progression; Humans; Macular Degeneration /diagnosis /physiopathology; Probability; Vision Screening /economics

AccessionNumber
22009102177

Date bibliographic record published
NHS Economic Evaluation Database (NHS EED)
Date abstract record published
11/11/2009