Informing the efficient use of health care and health care research resources: the case of screening for abdominal aortic aneurysm in Sweden
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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
The study examined a screening programme using ultrasound investigation for abdominal aortic aneurysm (AAA).

Type of intervention
Screening.

Economic study type
Cost-utility analysis.

Study population
In the screening strategy, the target population was all men in the year they turned 65 years of age.

Setting
The setting was primary care. The economic study was carried out in Sweden.

Dates to which data relate
The effectiveness evidence and resource use evidence were derived from studies dating from 1991 to 2005. The price year was 2003.

Source of effectiveness data
The effectiveness data were derived from a review or synthesis of published studies and estimates of effectiveness based on opinion. The authors stated that the model was presented in greater detail in two other publications (Henriksson and Lundgren, 2005, see ‘Other Publications of Related Interest’ below for bibliographic details).

Modelling
A decision-analytic model was constructed in Microsoft Excel to investigate the cost-effectiveness of a screening programme and to characterise uncertainty surrounding parameters in the model by assigning distributions. This type of model was justified as enabling the integration of evidence from different relevant sources (i.e. synthesis of existing and newly collected data). A probabilistic Markov model was used to model disease progression and resource use from a lifetime perspective for the strategies of screening and no screening.

Outcomes assessed in the review
The outcomes included:
the prevalence of AAA;
the proportion of AAAs of different sizes (small, medium, large);
the annual probability of opportunistic detection of AAA;
the annual probability of rupture of AAAs of different sizes;
the annual probability of growth in size (small to medium, medium to large);
the proportion of diagnosed patients having elective surgery;
the probability of mortality with elective and emergency operations;
the probability of reaching surgery after rupture; and
the proportion complying with an invitation to participate in screening.

**Study designs and other criteria for inclusion in the review**

It was implied but not stated that a systematic review was performed. Criteria for inclusion and exclusion were not stated. The available evidence was listed as consisting of randomised controlled trials in other countries including individuals not aged precisely 65 years, data from epidemiological studies, and data from comprehensive Swedish vascular databases.

**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**

Seventeen primary studies were included in the review.

**Methods of combining primary studies**

The results of the individual primary studies were combined using a random-effects meta-analysis.

**Investigation of differences between primary studies**

Not reported.

**Results of the review**

The results were as follows:

0.049, lognormal (standard error, SE: -2.96, 0.18), for prevalence of AAA >/= 3.0cm;

0.614, lognormal (SE: 0.46, 0.16), for proportion of AAAs being small;

0.571, lognormal (SE: 0.29, 0.54), for proportion of AAAs being medium given not small;
0.051 for the annual probability of opportunistic detection of AAA;

0.005, beta (1, 183), for annual probability of rupture of small AAAs;

0.015, beta (1, 62), for annual probability of rupture of medium AAAs;

0.156, beta (5, 27), for annual probability of rupture of large AAAs;

0.115, beta (16, 36), for annual probability of growth from small to medium;

0.159, beta (283, 283), for annual probability of growth from medium to large;

0.838, beta (31, 6), for proportion of diagnosed patients with AAA > 5.5 cm having elective surgery;

0.051, lognormal (SE: -2.93, 0.16) for probability of mortality with elective operations;

0.215, lognormal (SE: -1.29, 0.10), for probability of mortality with emergency operations;

0.363, lognormal (SE: -0.56, 0.19), for probability of reaching surgery after rupture;

0.774, lognormal (SE: 1.23, 0.08), for proportion complying with an invitation to participate in screening.

**Methods used to derive estimates of effectiveness**
Authors’ assumptions were used.

**Estimates of effectiveness and key assumptions**
The sensitivity and specificity of ultrasound investigation was assumed to be 100%.

**Measure of benefits used in the economic analysis**
Quality-adjusted life-years (QALYs) were used in the economic analysis. The utility weights were drawn from Burstrom et al. 2001 (see ‘Other Publications of Related Interest’ below for bibliographic details) using the EQ-5D instrument and were measured in a "normal" population. These weights were employed for all health states in which individuals were alive and were specific to the age groups 65 - 69 years, 70 - 79 years and >80 years. Beta distributions were defined for these inputs.

**Direct costs**
Although a lifetime perspective was used, discounting was not described. For the calculation of costs, quantities and uncertainty around estimates, the reader was referred to Henriksson and Lundgren (2005). Mean cost parameters were reported for invitation to screening, ultrasound investigation, private cost ultrasound investigation, and elective and emergency operations. Gamma distributions were defined for actual resource use considered to be associated with sampling uncertainty. In the model, actual resource use was sampled then multiplied by deterministic unit costs. The source of the data was not reported.

**Statistical analysis of costs**
The costs were treated stochastically.

**Indirect Costs**
Not relevant.
Currency
Euros (EUR).

Sensitivity analysis
A probabilistic sensitivity analysis was employed; the distributions around parameters have already been stated. A second-order Monte Carlo simulation was also used and the cohort was simulated through the model during 40 Markov cycles (each cycle representing a year). In each simulation, parameter values were drawn randomly from the defined probability distributions, and the cohort of hypothetical individuals was run through the model with mean costs and QALYs being calculated for both strategies. This procedure was repeated 1,000 times, generating 1,000 estimates of mean costs and mean QALYs for both strategies.

Estimated benefits used in the economic analysis
The base-case showed a mean incremental QALY gain of 0.020.

Cost results
The base-case showed a mean incremental cost of screening of EUR 194.

Synthesis of costs and benefits
The estimated benefits and costs were combined in an incremental cost-effectiveness ratio of EUR 9,700 per QALY gained.

The incremental net benefit (INB) for screening, the cost-effectiveness acceptability curve (CEAC) showing the probability of INB for screening being positive for different QALY valuations, and the cost-effectiveness acceptability frontier were also calculated.

The INB for screening was positive for a willingness to pay more than EUR 9,700 for a QALY. The CEAC showed that screening had the highest net benefit in most of the simulated iterations for QALY values greater than EUR 10,000.

Authors' conclusions
As long as decision-makers place a higher value than EUR 9,700 on a quality-adjusted life-year (QALY), it is beneficial for society to implement screening.

CRD COMMENTARY - Selection of comparators
The comparator of no screening represented current practice in Sweden, as well as the recommended policy of the Swedish Council of Technology Assessment (SBU) following assessment of the screening strategy. You should decide whether this is a relevant strategy in your own setting.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature was undertaken, but it was implied that this was done as an update of the review undertaken by the SBU in 2003. A random-effects meta-analysis was used to combine the results from different primary studies. The methods and conduct of the review and meta-analysis were not reported here, but the estimates of effectiveness appear to have been derived credibly. An assumption of 100% sensitivity and specificity of the screening technique was not justified, nor was a sensitivity analysis performed on this variable; this might have affected the results.

Validity of estimate of measure of benefit
The estimation of benefits was modelled in a lifetime decision analytic model, which was appropriate for the study.
Validity of estimate of costs
All the categories of cost relevant to the perspective adopted appear to have been included in the analysis. On the basis of this paper alone, it was uncertain whether costs were omitted from the analysis because the costs and the quantities were not reported separately. It was unclear whether the costs of complications during and post surgery were included. The quantities of resource use were sampled in the probabilistic sensitivity analysis, but no justification for the number of simulations was given. Neither the unit costs nor their sources were reported, although prices were stated to relate to 2003. The conversion rate from Swedish kroner to euros was not provided. Discounting was appropriate since the costs and benefits arose over 40 years, but it was not reported.

Other issues
From the information provided in the paper under review, it is difficult to appraise the model and its results, or to assess whether the methods and sources were appropriate or inappropriate. Much of the detailed information about the model was not presented in this publication, thus the reader is referred to the prior publication of the model and the technical report. The authors made appropriate comparisons of their findings with those from other studies. The issue of generalisability to other settings was not relevant to the authors as they were concerned with applying data from other settings to their own. The results were not presented selectively and the authors' conclusions reflected the scope of the analysis. The authors acknowledged some limitations to the study. In particular, there was no analysis of structural uncertainty in the model, there was a possible lack of transparency and too much freedom for the analyst in models in general, and the value of a health outcome may be crucial to the conclusions.

Implications of the study
The findings were contrasted with those of the SBU, the authors noting that their approach incorporated other evidence in the absence of primary studies of a programme inviting men to screening at age 65 years in Sweden. The authors also conducted a value-of-perfect-information analysis and found that, for a QALY value of EUR 30,000 the value of further research was EUR 300,000. The majority of uncertainty stemmed from rupture probability. The authors suggested that a cohort study of men with diagnosed AAA should be a research priority.

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Other publications of related interest
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