Cost-effectiveness of screening women for abdominal aortic aneurysm

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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 the use of ultrasound screening for abdominal aortic aneurysm (AAA) in 65-year-old women.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population was a hypothetical cohort of 65-year-old women.

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

Dates to which data relate
The effectiveness data were derived from studies published between 1991 and 2005. No dates were explicitly reported for resource consumption. The price year was 2004.

Source of effectiveness data
The effectiveness evidence was derived from a review of published studies.

Modelling
A Markov simulation model, originally developed for men, was modified to estimate the cost-effectiveness of AAA screening in women. The model compared a strategy of screening for AAA versus a strategy of no screening. The model followed a cohort of patients from the time of screening until death, or 100 years of age. Yearly cycles were considered. Women receiving ultrasound screening were similar to the non-invited group regarding their risk for the different events. Women with a detected AAA had yearly revisits to follow the expansion of the aneurysm. They were offered elective open surgery if they were healthy enough, or when the AAA had grown to larger than 55 mm, had expanded rapidly, or had caused symptoms. Some women with detected AAA fulfilled the criteria for elective surgery at the time of screening and were offered surgery as soon as possible. A proportion of the AAA in the non-screened group would be detected opportunistically. Each year, patients with AAA were at risk of rupture or death, either related to the AAA or due to other causes. The model did not explicitly take false-negative AAAs or false-positive ultrasound measurements at screening into account. A graphical representation of the model was provided.

Outcomes assessed in the review
The outcomes estimated from the literature were:

- the prevalence of disease,
- the proportion of AAA qualified and fit for immediate surgery,
- the attendance rate,
- the proportion of opportunistically detected AAA,
- the AAAs yearly risk for non-ruptured AAA surgery,
- mortality for non-rupture AAA surgery,
- total mortality for ruptured AAA,
- the yearly risk of rupture among those with AAA, and
- relative long-term mortality for an AAA patient.

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

A systematic review of the literature was undertaken to identify relevant studies for populating the decision model. Much of the data were retrieved from the published decision model when important differences between men and women were found in the literature. The inclusion criteria for primary studies were as follows:

- only population-based or multi-centre studies;
- original clinical research report published after 1990 and written in English or a Scandinavian language;
- definition of an AAA should be given (≥ 30 mm);
- female-specific data should be available;
- only open repair was assessed in the model, and a distinction between surgery for ruptured and non-ruptured AAA should be possible.

The authors reported only limited information on the design of the primary studies. Four screening studies were used to obtain the ratio between men and women for AAA prevalence, while Swedish statistics were used for age- and gender-specific mortality rates.

**Sources searched to identify primary studies**

MEDLINE was searched through January 2005, combining the keywords "abdominal aortic aneurysm" with the terms "gender", "sex", "women" and "female".

**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**
Twenty primary studies provided clinical data.

**Methods of combining primary studies**
Not reported.

**Investigation of differences between primary studies**
Not reported

**Results of the review**
Data were reported for both women and men (the latter data are in brackets), because some data for women were adapted from data for men obtained from the previous model.

The rate of prevalence was 1.10% (5.50%).

The proportion of AAA qualified and fit for immediate surgery was 6.80% (6.80%).

The attendance rate was 72% (80%).

The proportion of opportunistically detected AAA was 13% (13%).

The yearly risk for non-ruptured AAA surgery in the screened group was 3.12% (3.90%).

The AAAs yearly risk for non-ruptured AAA surgery in the non-screened group was 1.12% (1.40%).

The mortality rate for non-ruptured AAA surgery was 3.50% (3.10%).

The total mortality for ruptured AAA was 86.30% (79%).

The yearly risk of rupture among those with AAA in the screened group was 2.40% (0.80%).

The yearly risk of rupture among those with AAA in the non-screened group was 5.70% (1.90%).

The relative long-term mortality for an AAA patient was 3.59 (2.05).

**Measure of benefits used in the economic analysis**
The summary benefit measure used was the expected number of life-years saved with screening in comparison with no screening. This was obtained from the decision model. Rupture incidence and AA-related mortality rates were also reported. An annual discount rate of 3% was applied.

**Direct costs**
The perspective of the study was not explicitly stated, but both direct medical and non-medical costs were considered. The analysis considered the costs associated with screening (invitation, ultrasound and travelling to screening), follow-up (yearly control visits for patients with a detected AAA), elective AAA surgery and surgery for a ruptured AAA. The unit costs were reported separately from the quantities of resources used for most items. Resource use appears to have been based on authors' opinions. The costs came from a study published in 2002 and from hospital price lists. Discounting was relevant, as the long-term costs were estimated, and an annual rate of 3% was used. The costs were updated to 2004 values (the price year) using the Swedish Consumer Price Index.

**Statistical analysis of costs**
The costs were treated deterministically.
Indirect Costs
The indirect costs were not considered, probably because the patients were older than 65 years.

Currency
US dollars ($).

Sensitivity analysis
One- and two-way sensitivity analyses were carried out to assess the robustness of the cost-effectiveness results to variations in the clinical and economic model inputs. The sources of the alternative values were not explicitly reported, but they appear to have been based on authors’ opinions.

Estimated benefits used in the economic analysis
The expected life-years were 14.402 with no screening and 14.412 with screening (difference 0.011).

The rupture incidence was 0.29% with screening and 0.43% with no screening.

The AAA-related incidence of death was 0.26% with screening and 0.41% with no screening.

Cost results
The expected costs per person were $54.90 with no screening and $117.90 with screening (difference $63).

The higher costs of invitation, screening, follow-up and elective surgery in the screening group were only partially offset by the lower costs of rupture surgery.

Synthesis of costs and benefits
An incremental cost-effectiveness ratio was calculated to combine the costs and benefits.

The incremental cost per life-year gained with screening over no screening was $5,911.

The results of the sensitivity analysis suggested that the base-case results were generally robust to variations in the model inputs. For example, a prevalence of 0.6% resulted in a cost per life-year gained of $9,253, while a relative rupture risk of 0.8% in the invited group and 1.9% in the noninvited group (same as for men) led to a cost per life-year gained of $17,099.

The maximum value of the cost-effectiveness ratio was achieved when costs in added years of life were considered ($32,626). The lowest estimate was obtained with an assumed relative long-term mortality of 2.05 (same as for men) for patients with AAA ($3,422).

Authors’ conclusions
Screening women for abdominal aortic aneurysm (AAA) could be cost-effective under some conditions in Sweden. It was pointed out that caution would be required when interpreting the results of the analysis given the limited evidence surrounding AAA in women.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparators was clear and was consistent with the objective of the study. No screening was used as the comparator, and the analysis focused on women. You should decide whether they are valid interventions in your own setting.
Validity of estimate of measure of effectiveness
The effectiveness data were obtained from a review of the literature, the methods and conduct of which were partly reported. Inclusion criteria for the primary studies were presented. However, there was limited information on the studies used to estimate the clinical inputs. Moreover, the methods used to extract and combine the primary estimates were not described, and the issue of heterogeneity across the primary studies was not addressed. The issue of variability in the data was addressed in the sensitivity analysis. A key assumption appears to have been the exclusion of false positives and false negatives for the screening option. Thus, it was difficult to judge the validity of the clinical estimates used in the study.

Validity of estimate of measure of benefit
The summary benefit measure was appropriate for the disease considered in the study. In addition, it has the further advantage of being comparable with the benefits of other health care interventions. The use of a discount rate was appropriate. The impact of the screening strategy on quality of life was not considered.

Validity of estimate of costs
The perspective of the study was unclear. However, both direct medical and non-medical costs were considered in the analysis. The source of the data was reported for most items, but a breakdown of the costs was not provided as some costs were presented as macro-categories. This could limit the possibility of replicating the analysis in other settings. Resource use was based on assumptions and clinical patterns in the authors' setting. The price year was explicitly stated, which will facilitate refutation exercises in other time periods. The cost estimates were varied in the sensitivity analysis. Discounting was relevant and was carried out appropriately.

Other issues
The authors discussed extensively the results of the only published clinical trial of screening for AAA women. They also explored possible explanations for those conclusions that suggested that screening was neither clinically indicated nor economically efficient. The authors also highlighted the lack of precise epidemiological data on the age-specific prevalence in women. The sensitivity analysis suggested that the cost-effectiveness of screening worsened rapidly for rates of prevalence lower than 1%. The issue of the generalisability of the study results to other settings was not addressed, although the results of the sensitivity analysis were reported clearly, which might help transfer the conclusions of the analysis to other countries. The study referred to the general population of women aged 65 years and this was reflected in the authors' conclusions.

Implications of the study
The study results appear to support the implementation of routine screening for AAA in women. However, the authors noted that future prospective evaluations on screening for AAA should include women.

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