Probabilistic cost-effectiveness modeling of different breast cancer screening policies in Slovenia
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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.

CRD summary
The study examined the cost-effectiveness of alternative strategies of population-level screening against breast cancer in Slovenia. The screening modalities varied depending on screening interval and age eligibility criteria. The authors demonstrated that the most cost-effective strategy was screening women aged 40 to 80 years every 3 years, while strategies of annual screening were not cost-effective. The quality of the study methodology was good, with appropriate selection of the sources used in the model and a clear discussion of the study results.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective of the study was to examine the cost-effectiveness of alternative strategies of population-level screening against breast cancer in Slovenia. The screening modalities varied depending on screening interval and age eligibility criteria.

Interventions
A total of 36 different screening mammography policies were considered with respect to the following eligibility criteria: age at the beginning of screening, age at the end of screening, and the interval between two screenings. All possible combinations of starting ages 40, 45 and 55 years, ending ages 65, 70, 75 and 80 years, and screening intervals of 1, 2 and 3 years were considered. The screening strategies were compared against a baseline option of no-screening.

Location/setting
Slovenia/primary care.

Methods
Analytical approach:
This economic evaluation was based on a time-dependent Markov model that simulated the natural course of breast cancer and the impact of alternative screening strategies on the costs and benefits. A lifetime horizon was chosen. The authors stated that the perspective of the health care sector was adopted.

Effectiveness data:
The epidemiological data (incidence and mortality rates) and clinical data (transition probabilities) used in the economic model were derived from the Cancer Registry of Slovenia. The authors also made some assumptions that were supported by published studies. For example, the duration of the so-called sojourn time (i.e. the period when the cancer is screen-detectable but shows no clinical symptoms) and the accuracy of screening were defined on the basis of some published reports. Screening attendance and recall rates were based on studies conducted in other countries, given the lack of Slovenian data.

Monetary benefit and utility valuations:
Quality-of-life estimates were based on published studies. The utility weights were provided, but details of the sources of these values were not given.

Measure of benefit:
The summary benefit measure was the quality-adjusted life-years (QALYs). These were estimated using the decision model. An annual discount rate of 3% was applied.

Cost data:
The health services included in the analysis were the costs of a mammography examination, diagnostic interventions for clinically detected breast cancer, invasive and noninvasive diagnostic recall, and treatment interventions. These costs were derived from the Institute of Oncology Ljubljana. Treatment patterns used to calculate the costs of therapies were derived from the Cancer Registry of Slovenia. Long-term costs were discounted at an annual rate of 3%. The costs were in euros (EUR). The price year was 2004.

Analysis of uncertainty:
A deterministic univariate sensitivity analysis was performed in order to assess the robustness of the model results to variations in the clinical and economic inputs. A probabilistic sensitivity analysis was undertaken, with probabilistic distributions assigned to model inputs in order to generate cost-effectiveness acceptability curves and a cost-effectiveness acceptability frontier. All model inputs were varied except breast cancer incidence and cost of mammography examination, which were, respectively, constant in recent years and fixed.

Results
Extensive results for costs, QALYs and cost-utility ratios were presented as supplementary material on the journal's website.

The incremental analysis showed that screening from ages 50 to 65 years every 3 years had the lowest cost per QALY gained over no screening. The strategies on the cost-effectiveness frontier were screening every 3 years from age 50 to 65 years, from age 40 to 70 years, from age 40 to 75 years, from age 40 to 80 years, from age 45 to 65 years and age 45 to 70 years, and screening every 2 years from age 40 to 80 years.

The probabilistic analysis, which used cost-effectiveness acceptability curves, showed that using the commonly quoted threshold of EUR 38,500 per QALY, the optimal strategy would be screening women aged from 40 to 80 years every 3 years. Screening women aged from 40 to 80 years every 2 years was the preferred option for a threshold higher than EUR 41,815 per QALY. The analysis also suggested that, in general, strategies of annual screening were not cost-effective, owing to the increased costs and decreased benefits of false positives.

The one-way sensitivity analysis showed that the most influential model inputs were discount rate, rate of progression from ductal carcinoma in situ to invasive cancer, recall rate, relative mortality in regional stage, rate of invasive diagnostics and cost of mammography.

Authors' conclusions
The authors concluded that the most cost-effective screening strategy for breast cancer is screening women aged 40 to 80 years every 3 years, while strategies of annual screening are not cost-effective.

CRD commentary
Interventions:
The rationale for the choice of the comparators was clear. In particular, the no-screening strategy was selected to resemble the most likely Slovenian situation, in which only opportunistic screening takes place. The inclusion of the 36 screening strategies covers all possible options. This wide range of strategies enhances the relevance of the comparators in other settings.

Effectiveness/benefits:
The derivation of clinical estimates was transparent as the authors reported not only the key sources used, but also the assumptions required in the analysis and the approach used to calculate some estimates such as stage-specific relative mortality from breast cancer. The use of local sources represents a strength of the analysis since epidemiological data are often country-specific. Data on screening accuracy and attendance rate were taken from studies conducted in other countries, given the lack of Slovenian sources, but they were extensively varied in the sensitivity analysis. The authors discussed the impact of quality adjustment on the calculation of the benefit measure, which supports the
appropriateness of QALYs as the summary benefit measure.

Costs:
The categories of costs included in the analysis were consistent with the perspective adopted in the study. The source of the costs was reported, but details on the unit costs and resource quantities were not presented. The probabilistic analysis also covered economic data, except for the price of mammography. Other data on price year and use of discounting were reported.

Analysis and results:
The synthesis of the costs and benefits was appropriate. The results of both the base-case and the sensitivity analysis were presented graphically through a cost-effectiveness frontier and cost-effectiveness acceptability curves, owing to the very high number of strategies under examination. More information can be found in the supplementary appendix on the journal's website. A model validation was also performed. The authors discussed the potential drawbacks of mass screening in terms of overdiagnosis and false positives. Furthermore, the authors noted some typical limitations of a modelling analysis, such as the difficulties of simulating the management of breast cancer. Moreover, the authors acknowledged the question about the applicability of foreign data to derive some model inputs for their specific setting. Finally, in terms of the external validity of the study results to other settings, the authors noted that most epidemiological estimates were country-specific, thus the transferability of these findings might be limited.

Concluding remarks:
The study methodology was of a good quality, with an appropriate selection of sources for model data. The results of the analysis were discussed and the sensitivity analysis should have ensured the appropriateness of the authors’ conclusions.

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Bibliographic details

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
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