The cost-effectiveness of nationwide breast carcinoma screening in Finland, 1987-1992
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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
Population-based breast carcinoma screening performed every second year covering women aged 50-59 years and continuing the service up to age 64 years.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
Women aged 50-59 years.

Setting
Secondary care. The economic analysis was performed in Finland.

Dates to which data relate
Effectiveness data were based on the period 1987-1992. Resource use data for the treatment of localised and nonlocalised cancers corresponded to patients examined in 1981 and 1977-1980; resource use data and corresponding data collection dates were not reported for other elements of costing. 1995 prices were used.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
The retrospective costing was not undertaken directly on the same patient sample as that used in the effectiveness study.

Study sample
Power calculations were not used to determine the sample size since the study was a population-based study. The number of invitees was 89,893, the number of participants was 76,389 and the number of controls (no-screening group) was 68,862. The programme started gradually and so those women born in odd calendar-years served as controls.

Study design
This was a national cohort study of women invited for screening during the years 1987-89 with follow-up to the end of 1992. Loss to follow-up was not reported.
Analysis of effectiveness
The principle used for the analysis of the clinical study was intention to treat. The primary health outcome used was life-years saved. The controls were matched by age and municipality of residence.

Effectiveness results
The relative risk of death from breast carcinoma among the invitees compared with those not invited was 0.76 (95% CI: 0.53 - 1.09) which indicated a 24% protective effect due to screening, which was not statistically significant. In 1987-1992, the total number of undiscounted LYS in the sample of 89,893 invitees was 56; the corresponding discounted value was 46.

Clinical conclusions
Only 8% of the total LYS emerged during the actual follow-up period in the base-case estimation. The fact that, on average, the follow-up was 4 years and was a statistically non-significant effect, markedly reduced the possibility of estimating the exact number of LYS.

Modelling
To the end of 1992 annual original data were used to determine cumulative breast cancer mortality in the screening and control groups in the national programme. From the beginning of 1993, an estimation model was used to estimate the total life years saved (LYS) by adding the LYS in 1987-92 to the LYS estimated by the model from 1993 onward (projecting until the year 2020).

Measure of benefits used in the economic analysis
Life years saved (LYS) was the outcome measure used in the economic analysis. The LYS were estimated under three optional models.

In the base case model, screening was assumed to lower cumulative relative mortality by 0% in the first year after diagnosis, by 12% in the second year and by 24% in the third and fourth years. In the fifth year, the cumulative relative mortality reduction was assumed to equal the reduction of the fourth year plus 12% of the marginal relative mortality. After the fifth year, cumulative relative mortality reduction was assumed to remain constant.

In the second case model, the screening effect was estimated to be equal to that of the first model during the first four years after diagnosis. In the fifth year, the cumulative relative mortality reduction was assumed to be the reduction of the fourth year plus 18% of the marginal relative mortality. In the sixth year, cumulative relative mortality reduction was assumed to be the reduction of the fifth year plus 12% of the marginal relative mortality. In the seventh year, the cumulative relative mortality reduction was assumed to be the reduction of the sixth year plus 6% of marginal relative mortality. After the seventh year, annual mortality in the screening and no-screening groups was assumed to remain the same.

In the third case model, annual mortality was assumed to remain the same in the screening and no-screening groups after the end of screening in 1992.

Direct costs
Costs were discounted. Generally, quantities were not reported separately from the costs. Costs included all relevant resource costs of screening evaluated from the societal perspective. The costs were derived from the internal accounts of the four main screening centres in Finland. Film material cost and postage were the actual amounts paid. For the equipment cost, a 5-year depreciation method and a 4% interest rate were used. Repair cost was the average annual cost during previous 3 years. The health care cost of recall assessment consisted of the costs of repeated or detailed mammograms, ultrasound and ultrasound plus fine-needle aspiration biopsy. The estimated health care cost for surgery in false-positive cases was based on the procedures performed at two major hospitals for breast cancer surgery in
Finland. The saving due to early treatment was based on data on the difference in stage distribution with and without screening. The cost of treating localised and nonlocalised cancers came from a Finnish study of the cost of treating all breast cancers in one locality in 1981 for which the use of health resources was followed up for 5 years after diagnosis or until death. The non-medical costs consisted of transportation costs. The transportation cost for the surgery in false-positive cases was assumed to be twice as high as for the mammography screening. The transportation cost of treating localised and nonlocalised cancers was estimated to be twice as high as in the base mammography screening. 1995 price data were used.

**Indirect Costs**
Costs were discounted. Generally, quantities were not reported separately from the costs. The time cost was the opportunity cost of time actually spent on the mammography, as well as the transportation and waiting time. The cost data were collected by questionnaire from 1,400 attendees at the screening examination, a stratified random sample. 1,294 answers (92%) were received. For women who were employed at the time of examination and used working time for the examination, the opportunity cost of time was time spent multiplied by the hourly wage rate. Evaluation of time cost was based on the results of the cost survey of the screening attendees and the data on average sick leave caused by the operation. 1995 price data were used.

**Currency**
1995 Finnish marka values were converted to US$ (US$ 1.00=FIM 4.37).

**Sensitivity analysis**
To assess the uncertainty of the cost-effectiveness ratios, they were estimated under different model assumptions such as a discount rate of 5%, no transportation and time cost, no overtreatment cost and including surgery costs only for clinically evaluated, unnecessary false positives. In addition, univariate sensitivity analysis was performed in which the base case model parameters were changed by +5%.

**Estimated benefits used in the economic analysis**
In the base case the total number of discounted LYS was 578. In the second case, the total number of LYS was 585. In the third case the total LYS was estimated to be 271. Discount rate was 3%.

**Cost results**
The total costs of screening in the base case were $11 million, i.e., $14.3 million per 100,000 participants, with 84% of the total cost consisting of the base mammography screening. Altogether 82% of the total costs were health care costs. The discount rate was 3%.

**Synthesis of costs and benefits**
The cost per LYS was $18,955 in the base case. Under different model assumptions, the cost-effectiveness ranged from $15,502 to $40,308. The largest deviation caused by the change in costs, +30% compared with the base case, occurred when time cost was counted for all attendees irrespective of working status. The largest deviation caused by the change in effects, +123% compared with the base case, was when the cumulative relative breast cancer mortality reduction was assumed to be constant after the end of screening (1992) in the study and control groups.

**Authors’ conclusions**
The authors concluded that in the base case the cost of breast cancer mammographic screening per LYS was $18,955. However, the cost-effectiveness ratio was very sensitive to estimated LYS. They suggested that this inaccuracy in the estimation of life-years was the main reason why the cost of breast cancer mammographic screening per LYS ranged from $15,502 to $40,308 under different model assumptions.
CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator is clear.

Validity of estimate of measure of benefit
As acknowledged by the authors, the short follow-up period may have adversely affected the accuracy of the estimates.

Validity of estimate of costs
Resource quantities were not reported separately from costs. Adequate details of methods of cost estimation were given.

Other issues
The authors' conclusion seems to be justified given the extensive sensitivity analyses performed to tackle uncertainties in the data. The issue of generalisability to other settings or countries was addressed by the sensitivity analyses. Appropriate comparisons were made with other studies.

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