

Cost effectiveness of the NHS breast screening programme: life table model

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STUDY QUESTION

How cost effective is the breast screening programme conducted by the United Kingdom's health service?

SUMMARY ANSWER

Regular breast screening of 364 500 women aged 50-70 years, with 75% screening uptake and another 15 years of follow-up after the end of screening, was associated with 2040 additional quality adjusted life years (QALYs) gained at an additional cost of £42.5m (€49.8m; \$64.7m) in total, or £20 800 per QALY gained.

WHAT IS KNOWN AND WHAT THIS PAPER ADDS

Despite reports of the incremental cost effectiveness of different screening strategies for breast cancer, no published studies have compared mammographic screening with no screening since the 1986 Forrest report. We have shown that the NHS breast screening programme is moderately likely to be cost effective at the standard cost effectiveness threshold of £20 000 used by the National Institute for Health and Care Excellence (NICE).

Main results

Under the base case scenario (using model input parameters relating to the benefits, harms, and costs of screening and costs of breast cancer treatment), the NHS breast screening programme was predicted to result in 1521 fewer deaths from breast cancer and 2722 overdiagnosed breast cancers. Discounting future costs and benefits at a rate of 3.5% resulted in 6907 added person years of survival in the screened cohort at a cost of 40 946 additional years of survival after a breast cancer diagnosis. The gain in person time survival over 35 years was 9.2 days per person and 2.7 quality adjusted days per woman screened.

Differences in outcomes between screened and unscreened cohorts of 364 500 women (with 75% screening uptake in screened cohort)

	Difference (interquartile range)†
Breast cancer cases	2722 (2153 to 2829)
Breast cancer deaths	-1521 (-1075 to -1600)
Deaths from other causes	729 (546 to 784)
Deaths from all causes	-792 (-525 to -823)
Person years of survival*	6907 (4798 to 7328)
Person years of survival after diagnosis of breast cancer*	40 946 (36 194 to 43 710)
Quality adjusted life years*	2040 (847 to 2974)
Cost (£m)*	42.5 (36.8 to 49.9)

Data are numbers unless stated otherwise.

*Discounted at 3.5% per year.

†Interquartile range for outputs from probabilistic sensitivity analysis.

Design

Life table model.

Sources of effectiveness

Input parameters relating to the benefits and harms of screening were taken from the results of the Independent UK Panel Review of Breast Screening.

Data sources

Data for breast cancer incidence, breast cancer mortality, and all cause mortality were obtained from the Office for National Statistics. The estimated overall cost of the screening programme was obtained from an estimate published by the NHS breast screening programme. Costs of treating primary and metastatic breast cancer were taken from NHS treatment reference costs and NICE. Estimates of the quality of life associated with age and with living after a breast cancer diagnosis were taken from published studies.

Results of sensitivity analysis

We recalculated the model 5000 times, sampling randomly the input parameters from a range of likely values that reflect the uncertainty in those parameter estimates. In 588 (12%) model runs, the screening programme was associated with a reduction in QALYs. In an additional 2152 (43%) runs, the cost per QALY exceeded the £20 000 threshold commonly used by NICE to determine whether an intervention should be funded by the NHS. The probability that the screening programme is cost effective compared with no screening was 45% (2260 scenarios) at a threshold of £20 000 per QALY. This analysis was repeated for another five scenarios for the effect of screening on breast cancer incidence. The more screening advanced the diagnosis of breast cancer, the greater the incremental cost effectiveness ratio. A greater reduction in breast cancer incidence after cessation of screening was associated with a greater reduction in the incremental cost effectiveness ratio.

Limitations

The cost effectiveness estimates were particularly sensitive to the values used for death from breast cancer, relative overdiagnosis of the condition, and long term quality of life after a diagnosis of breast cancer. These are parameters for which there is little evidence from randomised trials of modern digital mammography coupled with modern surgery, radiotherapy, and adjuvant chemotherapy.

Study funding/potential competing interests

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Research: Possible net harms of breast cancer screening (*BMJ* 2011;343:d7627)

Research methods and reporting: Comparative effectiveness research in cancer screening programmes (*BMJ* 2012;344:e2864)

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