The cost-effectiveness of mammographic screening strategies

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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
Mammographic screening for breast cancer. A total of seven strategies were considered:

1) Annual mammography for ages 40 to 79 years;
2) Annual mammography for ages 50 to 79 years;
3) Biennial mammography for ages 50 to 79 years;
4) Annual mammography for ages 40 to 49 years with biennial mammography for ages 50 to 79 years;
5) Annual mammography for ages 40 to 64 years with biennial mammography for age 65 to 79 years;
6) Biennial mammography for ages 40 to 49 years with annual mammography for ages 50 to 79 years; and
7) Annual mammography for high-risk women and biennial mammography for normal-risk women aged 40 to 49 years with biennial mammography for ages 50 to 79 years.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
Women undergoing mammographic screening for breast cancer.

Setting
Hospital. The economic study took place in the United States.

Dates to which data relate
The probability and cost of the outcomes were obtained from previously published data, ranging in date from 1982 to 1992. The price year was not stated.

Source of effectiveness data
Effectiveness data were derived from a review of previously completed studies.

Modelling
A Markov model was constructed to estimate the costs and outcomes associated with two hypothetical populations of women: one undergoing mammographic screening for breast cancer and the other undergoing observation without screening.

Outcomes assessed in the review
The clinical probabilities related to asymptomatic women in a screening mammography programme and women in an observation programme with palpable masses, and reductions in breast cancer mortality due to annual and biennial mammography.

Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
A total of 16 studies were included.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
For asymptomatic women in a screening mammography programme the probability of the positive predictive value of a biopsy based on mammography was .31; for a false-negative mammogram result, .09; for suggestion of short-interval follow-up at prevalence screen, .09; for suggestion of short-interval follow-up at incident screen, .03; for biopsy because of change within 1 year, .007; and for cancer diagnosed within 1 year in patients undergoing short-interval follow-up, <.001.

For women in an observation programme with palpable masses the probability of a cyst that requires no biopsy was .22; for a mass that requires biopsy, .78; positive predictive value for biopsy, .34; and for death from breast cancer in those with the disease, 0.25.

Reductions in breast cancer mortality due to annual and biennial mammography for the different age categories were reported, respectively, as: 40-49 years, 23% and 4%; 50-59 years, 32% and 30%; 60-69 years, 32% and 27%; 70-79 years, 32% and 23%.
Measure of benefits used in the economic analysis
The benefit measure was years of life saved. A Markov model was used to determine the number of years of life saved under each of the screening strategies.

Direct costs
Costs were discounted in the sensitivity analysis. Quantities (except for the frequency of mammography) were not reported separately from the costs. Health service costs were considered, namely cost of screening, fine-needle aspiration of palpable mass, needle core biopsy of occult lesion, excision biopsy of palpable lesion, and definitive treatment. The perspective adopted in the cost analysis was not explicitly specified. A Markov model was used to derive the costs associated with each strategy. The source of cost data was the community-based data or the literature. The date of the price data was not explicitly specified.

Indirect Costs
Not considered.

Currency
US dollars ($).

Sensitivity analysis
Three one-way simple sensitivity analyses were performed:

(1) the assumed reduction in breast cancer mortality for the 40-49 age group was varied from the baseline of 4% up to 20% for biennial mammographic screening,

(2) the reduction in mortality among women aged 40-49 years undergoing annual screening was varied from the baseline of 23% down to 4%, while the breast cancer mortality reduction with biennial screening in women aged 50-79 years was held constant,

(3) annual mammography for women aged 40-79 was examined; the reduction in breast cancer mortality among screened women in their 40's was varied from the baseline of 23% down to 4%, while the reduction in mortality for screened women aged 50 years and older was held constant.

Estimated benefits used in the economic analysis
The marginal effectiveness of screening relative to observation alone using each of the seven strategies ranged from .0701 for the biennial screening for women aged 50-59 to 0.1096 years saved for the annual screening for women aged 40-79. Marginal effectiveness was highest for the group receiving annual mammography from ages 40 to 79. It was reduced by 13% for annual mammography between ages 40 and 49 with biennial mammography between ages 50 and 79. Marginal effectiveness was lowest for biennial mammography from ages 50 to 79. The discount rate applied in the sensitivity analysis was 5%.

Cost results
The marginal cost of screening ranged from $1,120 for the biennial screening for women aged 50-59 to $2,972 for the annual screening for women aged 40-79. The discount rate applied in the sensitivity analysis was 5%.

Synthesis of costs and benefits
Marginal analysis was performed. The most cost-effective screening strategy was biennial mammography for women aged 50 to 79 years, with a marginal cost per year of life saved of $16,000. The least cost-effective strategy was that in which high risk women aged 40 to 49 years receive annual mammography while normal risk women in the same age
group receive biennial examinations and all women aged 50-79 years are screened annually, ($31,900). Discounting increased the marginal cost of years of life saved for all the screening strategies, but had a greater effect on protocols that included women in their 40's.

Authors' conclusions
Screening programmes that include women in their 40s can be as cost-effective as some which exclude such women. Choice of a screening strategy depends on financial resources and desired effectiveness.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator is clear.

Validity of estimate of measure of effectiveness
The internal validity of the estimates of effectiveness may be weakened by the lack of a comprehensive literature review, and quality assessment of the primary studies included in the review.

Validity of estimate of costs
Quantities (apart from the frequency of screening) were not reported separately from the costs and insufficient details were provided of the methods of cost estimation. The study lacked a prospective cost analysis.

Other issues
The study ignored the anxiety, fear and discomfort associated with the screening process itself and the disutility of false positives, which indicates that the cost-utility approach might have been more appropriate.

Source of funding
None stated

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Other publications of related interest
A published erratum appears in JAMA 1996;275(2):112


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