Cost-effectiveness of digital mammography breast cancer screening  
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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
This study aimed to determine the cost-effectiveness of digital mammography screening, compared with film mammography screening, for the detection of breast cancer (BC) in women aged 40 years or more than 65 years. The study showed that screening for BC using all-digital mammography is not cost-effective, while age-targeted screening with digital mammography has the potential to be cost-effective. The quality of the study methodology was good and the authors’ conclusions appear valid.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective of the study was to determine the cost-effectiveness of digital mammography screening, compared with film mammography screening, for the detection of breast cancer (BC) in two groups of women: those aged ≥40 years and those aged ≥65 years (Medicare population).

Interventions
The study examined film mammography in all women aged ≥40 years, digital mammography in all women aged ≥40 years, and targeted digital mammography. The latter includes age-targeted mammography (digital for women younger than 50 and film for women aged ≥50) and age- and density-targeted mammography (digital for women younger than 50 or those aged ≥50 years with radiographically dense breasts, and film for all others). For women aged ≥65 years, the health interventions compared were all-film mammography, density-targeted mammography (digital for women with dense breasts and film for others) and all-digital mammography screening.

Location/setting
USA/secondary care.

Methods
Analytical approach:
This economic evaluation used a validated, computer-based BC natural history model in order to assess the costs and benefits of the alternative diagnostic strategies. The time horizon of the analysis was lifetime. The authors stated that the perspectives of the health care payer (i.e. Medicare) and society were adopted.

Effectiveness data:
The clinical estimates were derived from a selection of known relevant studies. Key estimates on diagnostic accuracy came from the Digital Mammography Imaging Screening Trial (DMIST), a study that involved 49,528 women presenting for screening mammography in the USA and Canada. Other estimates used in the model to estimate the natural history of patients with BC came from published studies, details of which were not given in this article (readers were referred to an appendix on the website).

Monetary benefit and utility valuations:
The utility estimates were derived from age-specific, US female average health state values from Medical Expenditure Panel Survey data, which applied the EuroQoL EQ-5D with US scoring.

Measure of benefit:
The summary benefit measure was the quality-adjusted life-years (QALYs). These were estimated using the decision
model and discounted at an annual rate of 3%. Other model outputs, such as screen- and clinical-detected cancers and cancer deaths, were also reported.

Cost data:
The economic analysis included the costs of mammography, subsequent diagnostic work-up, BC treatment and personal time associated with distinct visits for diagnostic work-up. The resource use data came from the DMIST. Diagnostic and screening costs were derived from Medicare reimbursements. BC treatment costs were obtained from previous publications. Personal costs were valued on the basis of average wages plus non-health benefits for women aged ≥35 years. The long-term costs were discounted at an annual rate of 3%. The price year was 2005 and the costs were in US dollars ($).

Analysis of uncertainty:
The issue of uncertainty was addressed by carrying out a one-way sensitivity analysis of all model inputs. The ranges of values studied were based on confidence intervals (CIs) and standard errors derived from published sources. In an alternative scenario, the sensitivity of film screening was increased and the sensitivity of digital screening was decreased. Model simulations (first-order) were also conducted to generate CIs around the total costs and QALYs.

Results
The expected QALYs in the sample of women aged ≥40 years were 13.280 with all-film screening, 13.281 with age-targeted digital screening, 13.282 with age- and density-target digital screening, and 13.281 with all-digital screening.

The expected costs per woman in the sample of women aged ≥40 years were $2,749 with all-film screening, $2,773 with age-targeted digital screening, $2,915 with age- and density-target digital screening, and $3,056 with all-digital screening.

All-film screening was the reference strategy, while the incremental cost per QALY gained was $26,500 (95% CI: 21,000 to 33,000) with age-target digital screening and $84,500 (95% CI: 75,000 to 131,000) with age- and density-target digital screening.

All-digital screening was dominated (less effective and more expensive than age- and density-target digital screening).

In the Medicare population (women over 65 years of age) and in the alternative scenario, the incremental cost per QALY for density-target digital screening was high (approximately or higher than $100,000 per QALY), while all-digital screening was always dominated.

The sensitivity analysis showed that the incremental cost per QALY gained was very sensitive to variations in the cost of digital screening and prevalence of dense breasts, but all-digital screening remained a not cost-effective strategy.

Authors' conclusions
The authors concluded that screening for BC by using all-digital mammography is not cost-effective, compared with film mammography, from the perspectives of the health care payer and society in the USA. Age-targeted screening with digital mammography has the potential to be cost-effective, although the economic value of density-targeted screening is unclear, especially in older women.

CRD commentary
Interventions:
The selection of the comparators appears to have been appropriate as they represented both the current pattern of care and the proposed screening strategy in the authors' setting. The authors stated that film screening represented the status quo in the USA, although it is quickly becoming obsolete. These mammography options are also likely to be valid in other settings.

Effectiveness/benefits:
The clinical data were obtained from a selection of known sources, with most of the evidence coming from a large clinical trial, the design of which should have ensured the robustness of the clinical estimates. The main strength of the
analysis was the large sample of women involved, who were followed over time. These estimates were augmented with other published sources, including national screening patterns and secular trends of disease. These further sources enhanced the representativeness of the patient population. The use of QALYs as a benefit measure is appropriate because they are validated measures that are comparable with the benefits of other health care interventions.

Costs:
The types of costs included in the analysis and the sources used for both resource use and costs were reported. The categories of costs were consistent with the health care perspective, but not the societal prospective since no productivity costs were considered. The costs were presented as macro-categories and a detailed breakdown of the cost items was not given. This was due to the use of reimbursement rates for several cost categories. The price year was reported, which will help if replicating the analysis in other time periods.

Analysis and results:
The synthesis of the costs and benefits was appropriate and the results of both the base-case and sensitivity analyses were presented clearly. The issue of uncertainty was satisfactorily addressed using both deterministic and stochastic sensitivity analyses. Details of the decision model were presented clearly in terms of its structure, health states and main patterns of care, although the main characteristics of the model were published in a separate article.

Concluding remarks:
The quality of the study methodology was good, with satisfactory reporting of the methods and results. Clear information on the sources used and the approaches used to derive the costs and benefits of the interventions was provided. The authors' conclusions appear valid.

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Other publications of related interest


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Adult; Aged; Breast /anatomy & histology; Computer Simulation; Cost-Benefit Analysis; Early Diagnosis; Female; Humans; Mammography /economics /methods; Mass Screening /economics /methods; Medicare /economics; Middle Aged; Quality-Adjusted Life Years; Radiographic Image Enhancement; Sensitivity and Specificity; United States