Benefits and costs of interventions to improve breast cancer outcomes in African American women


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
Interventions for breast cancer control, such as screening (patient reminders or lay health workers) and optimal treatment (consistent with current recommendations), were examined.

Type of intervention
Screening and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of 40-year-old African American women.

Setting
The setting was primary and secondary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were derived from studies published between 1982 and 2002. Some resource use data were obtained from studies published between 1992 and 1999. The price year was 2000.

Source of effectiveness data
The effectiveness evidence was derived from a synthesis of completed studies and authors' assumptions.

Modelling
An event-driven, continuous-time, Monte Carlo simulation was constructed to determine the clinical and economic impact of adding new cancer control interventions to current US patterns of care in a hypothetical cohort of 1.25 million simulated African American women. Each woman was simulated twice, once with screening and once without. Women were randomly assigned dates of death, symptomatic breast cancer incidence, and dates of first and subsequent biennial screening mammograms. The model took diagnostic accuracy and different patterns of care into consideration, as well as recurrence and survival. A simplified structure of the model was depicted. The time horizon of the model appears to have been lifetime. The cycle length was not reported.

Outcomes assessed in the review
The outcomes estimated from the literature were:
stage distribution for screen-detected and non-screen-detected breast cancer cases for African American women;

ER positivity for African American women;

the transition probabilities across stages;

the dwell time (time in one stage until progression to the next stage);

the sensitivity and specificity of mammography;

the use of mammography after patient reminders or lay health worker interventions;

the distribution of local treatment for African American women diagnosed with breast cancer (breast conservation, breast conservation plus radiation, mastectomy);

systemic treatment distribution (chemotherapy, tamoxifen, both, neither); and

survival.

Study designs and other criteria for inclusion in the review

It was not stated whether a systematic review of the literature was undertaken. Limited information on the designs of the primary studies was provided. Some data were derived from population-level studies and US statistics and databases. In particular, SEER data from 1975 to 1979 were used to approximate the stage distributions of events for unscreened women, while data from the Breast Cancer Surveillance Consortium were used to represent the stage distribution for screen-detected African American women.

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
Thirty-five primary studies provided the published evidence.

Methods of combining primary studies
The primary studies appear to have been combined using a narrative method.

Investigation of differences between primary studies
Not stated.

Results of the review
The rate of ER positivity for African American women was 48% (range: 42.8 - 53.2) in the age class 35 - 49 years, 66% (range: 61.1 - 70.9) in the age class 50 - 64 years, and 76% (range: 71.5 - 81.5) in the age class 65 - 79 years.
The transition probabilities were 0.714 from ductal carcinoma in-situ (DCIS) to DCIS, 0.286 from DCIS to local cancer (Loc), 0.828 from Loc to Loc, 0.172 from Loc to regional cancer (Reg), 0.916 from Reg to Reg, 0.084 from Reg to distant cancer (Dist), and 0.99 from Dist to Dist.

The dwell time was 2.1 years for women of 59 years or younger, 3 years for women aged 60 to 69 years, and 4.7 years in women of 70 years and older.

During the first screen, the sensitivity of mammography was 93.6% for women aged 50 to 59 years, 94.1% for women aged 60 to 69 years, and 91.2% for women of 70 years and older. The specificity of mammography was 92.9% (age 50 - 59 years), 92.6% (age 60 - 69 years) and 93.4% (age 70 years and older), respectively.

During subsequent screens, the sensitivity of mammography was 76.5% for women younger than 50 years of age, and 73.8% for women older than 50 years of age. The specificity of mammography was 98.1% (women younger than 50 years) and 98.2% (women older than 50 years), respectively.

The median rate of African American women reporting mammograms in the past 2 years was 76.1% (range: 44.3 - 85.5). The relative risk of being unscreened was 0.73 (range: 0.68 - 0.92) after patient remainder interventions and 0.82 (range: 0.75 - 0.89) after exposure to lay health worker interventions.

The other rates used in the model will not be reported here.

**Methods used to derive estimates of effectiveness**

The authors made some assumptions that were used in the decision model.

**Estimates of effectiveness and key assumptions**

The differences in distribution of ER status by race represented a proxy for general race-specific differences in tumour makers. Lobular and ductal in-situ cancers had the same natural history and survival. The interventions had an effect that persisted over the long term. Women diagnosed with DCIS were destined to progress to local stage-invasive disease, while those diagnosed with local stage who survived for 15 years without recurrence would have similar survival after that time as their age- and race-matched non-breast cancer cohort. Survival was the same for women with screen-detected and clinically-detected cancers.

**Measure of benefits used in the economic analysis**

The summary benefit measure used was the life expectancy associated with status quo screening and treatment (versus no screening), with lay health worker or patient remainder interventions (versus status quo), and enhanced treatment (versus status quo). The estimated benefits were discounted at an annual rate of 3%. Other model outputs, such as the number of mammograms and the number of false positives, were also reported.

**Direct costs**

An annual discount rate of 3% was used because of the long time period considered in the model. The unit costs were not presented separately from the quantities of resources used for all items. The health services included in the economic evaluation were mammography, treatment, patient time, tamoxifen, adjuvant chemotherapy, and interventions to enhance screening (reminder letter and lay health worker). Patient time covered the time for receiving screening, the diagnostic evaluation and treatment, and the travel and waiting time for receiving care. The cost/resource boundary of the health care system and the patient appears to have been adopted. The costs were estimated from multiple sources, such as Medicare reimbursement rates, prior studies, wholesale average prices, and the median US wage rates for African American women (for patient time). The source of the resource use was generally unclear. The exception being patient time data, which were based on published evidence. All of the costs were inflated to 2000 values using the medical care component of the Consumer Price Index.
Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not considered in the economic evaluation.

Currency
US dollars ($).

Sensitivity analysis
Univariate and multivariate sensitivity analyses were carried out to examine the robustness of the estimated cost-effectiveness ratios to variations in several model inputs. Some ranges of values were derived from published studies. Utility weights were also added to the estimated survival to determine quality-adjusted life-years (QALYs). The values used were 1.0 for healthy, 0.85 for local cancer, 0.7 for regional cancer and 0.5 for distant cancer.

Estimated benefits used in the economic analysis
The discounted life expectancy was 21.299179 years with no screening, 21.30649 years with status quo screening and treatment, 21.307290 years with lay health worker intervention, 21.30736 years with patient reminder intervention, and 21.32556 years with enhanced treatment. The incremental life expectancy was 0.007312 years with status quo over no screening, 0.000800 years with lay health worker over status quo, 0.000870 years with patient reminder over status quo, and 0.019070 years with enhanced treatment over status quo.

The number of mammograms was 9.97 with status quo screening and treatment, 10.53 with lay health worker intervention, 10.82 with patient reminder intervention, and 9.97 years with enhanced treatment.

The number of false positives was 0.66 with status quo screening and treatment, 0.70 with lay health worker intervention, 0.71 with patient reminder intervention, and 0.66 years with enhanced treatment.

Cost results
The discounted costs were $3,511.93 with no screening, $4,138.93 with status quo screening and treatment, $4,238.18 with lay health worker intervention, $4,247 with patient reminder intervention, and $5,143.50 with enhanced treatment.

The incremental costs were $627 with status quo over no screening, $99.24 with lay health worker over status quo, $108.07 with patient reminder over status quo, and $1,004.67 with enhanced treatment over status quo.

Synthesis of costs and benefits
An incremental cost-effectiveness ratio was calculated to combine the costs and benefits of the screening and treatment strategies.

The incremental cost per life-year saved was $85,755 with status quo over no screening, $124,053 with lay health worker over status quo, $124,217 with patient reminder over status quo, and $52,678 with enhanced treatment over status quo.

The most interesting result of the sensitivity analysis was that enhanced screening could be cost-effective only in areas with pockets of unscreened or very underscreened women (e.g. the incremental cost-effectiveness ratio for patient reminder was $51,537).

The use of QALYs did not change the conclusion that enhanced screening was not cost-effective. The incremental cost per QALY was even higher than the incremental cost per life-year saved.
Authors' conclusions
Enhanced screening and treatment for African American women should be restricted to situations in which there are pockets of unscreened women, or to ensure that all high-risk women are screened.

CRD COMMENTARY - Selection of comparators
The selection of the comparators was appropriate because they reflected current patterns of care in the USA. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness evidence was based on data derived from published studies. However, it was not stated whether a systematic review of the literature had been undertaken, and the primary studies appear to have been identified selectively. The methods used to extract and combine the primary estimates were not explicitly reported. However, in most cases, a single source was used for most estimates. No information on the design of the primary studies was provided, but most of the sources were US statistics. Some key assumptions were also made. The issue of uncertainty around the estimates was not extensively addressed. Only a few results of the sensitivity analysis were reported.

Validity of estimate of measure of benefit
The use of life-years saved as the summary benefit measure was appropriate because it captured the most relevant aspect of the impact of the interventions on patient health, namely survival. The effect of enhanced screening or treatment on quality of life was investigated in the sensitivity analysis, and the results of the base-case scenario were not changed substantially. However, the sources and values of the utility weights were not reported. Discounting was applied, as recommended in US guidelines. The use of life-years saved allows comparisons to be made with the benefits of other health care interventions.

Validity of estimate of costs
The perspective of the study was not explicitly stated, but it appears that costs relevant to the health care system and the patients have been considered. The indirect costs (i.e. productivity losses) were not considered, the authors stating that such costs would have been accounted for by decrements in utility values. However, a formal cost-utility analysis was not carried out and the issue was only briefly addressed in the sensitivity analyses. Although the authors stated that a micro-costing approach was used to calculate the total costs, details of the unit costs and the quantities of resources used were not presented separately, which limits the possibility of replicating the results of the analysis. The source of the cost data was provided, but little information on the source of the resource use was given. The price year was reported, which aids reflation exercises in other settings. The costs were treated deterministically and it was unclear whether the cost estimates were varied in the sensitivity analysis.

Other issues
The authors stated that their findings were consistent with those from published studies. The authors highlighted some strengths of their analysis, such as the use of reliable data, a robust model, and the comparison of different cancer control strategies. However, the issue of the uncertainty was not satisfactorily addressed since few results of the sensitivity analysis were reported. Some limitations of the study were also noted, most of which related to the lack of published evidence on some model inputs. The authors stressed that caution should be used when generalising the results of the analysis to other settings, as a limited sub-group of women with breast cancer was considered for the analysis. Thus, the study results should not be extrapolated to black patients from other countries.

Implications of the study
The study results suggested that, except in pockets of unscreened or high-risk women, enhanced screening and treatment for breast cancer was not cost-effective and should not be recommended. It was highlighted that substantial investments in educational or other interventions should made to overcome the barriers to care, and also to improve referral for the uptake of systemic adjuvant therapy for breast cancer among African American women. The authors...
noted that differences in access to cancer treatment services, including chemotherapy and referral to a medical oncologist by race, income, education, or insurance and setting of care, could limit the efficacy of enhanced screening and testing. It was also noted that African American were still less likely to be offered trial participation than white patients.

Source of funding
Supported by grants from the National Cancer Institute, Bethesda (MD), USA.

Bibliographic details

PubMedID
15173213

DOI
10.1200/JCO.2004.05.009

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; African Americans; Aged; Aged, 80 and over; Breast Neoplasms /diagnosis /economics /therapy; Cost-Benefit Analysis; Female; Humans; Mammography; Mass Screening /economics; Middle Aged; Models, Theoretical; Survival Analysis

AccessionNumber
22004000945

Date bibliographic record published
31/08/2005

Date abstract record published
31/08/2005