Economic Analysis of the Breast Cancer Screening Programme used by the NHS: Should it be maintained? 

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Introduction

The financial burden of cancer is increasing at a constant rate, with an aging population and ever-increasing treatment costs. Consequently, economic evaluations have become an intrinsic component of the clinical decision-making process. Breast cancer is one of the most common cancers in the UK. The mean cost to the NHS for treatment of breast cancer, 15 months following diagnosis is £12,595 per patient. This is currently costing the NHS over £700million a year and is predicted to rise, with each late stage diagnosis costing significantly more than if the cancer could be detected earlier. One of the key tools thought to combat and prevent the spiraling costs of late stage breast cancer diagnosis is the use of breast cancer screening. However, over recent years, with more effective treatments being available and questions being raised over safety and risk - implications of using mammography as part of the screening programme, the cost-effectiveness of breast cancer screening has been highlighted as an important issue to investigate.

Aim: to evaluate the current cost-effectiveness of the best cancer screening programme, and its place in the NHS.

Materials and Method

A cost-utility analysis was conducted to appraise the breast cancer-screening programme. The analysis considered the breast cancer screening programme and its utility over a 20 year period, accounting for the typical breast cancer screening period taking place between the ages of 50 and 70.

Analysis was conducted from the perspective of the NHS. This accepted NHS threshold was utilised for analysis of £20,000/QALY - £30,000/QALY gain.

Compared against the alternative of not having a screening programme.

A systematic literature review was conducted to obtain relevant financial, health and probability outcomes relevant to the Breast cancer screening programme. PubMed/Medline, NHS Economic Evaluation Database and the Cochrane Database of Systematic Reviews were utilised using relevant search terms and strings.

Five key papers were identified. Data was extracted from these papers and weighted means (based on sample size) used to conduct the economic analysis. Probability data, cost data and QALY data were obtained from these papers.

A discount rate of 3.5% per annum was applied for costs incurred beyond 2016, as per UK government guidance.

Cost/QALY Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean present value of cost screening/patient</td>
<td>£1,092.84</td>
<td>0.23</td>
</tr>
<tr>
<td>Mean present cost of screening/patient</td>
<td>£1,149.64</td>
<td>0.29</td>
</tr>
<tr>
<td>Mean present value quadrupled</td>
<td>£2,601.68</td>
<td>0.04</td>
</tr>
<tr>
<td>Average present cost of unscreened patient</td>
<td>£2,230.24</td>
<td>1.00</td>
</tr>
<tr>
<td>Mean present value of cost of follow-up testing</td>
<td>£2,601.68</td>
<td>0.04</td>
</tr>
<tr>
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<td>£2,601.68</td>
<td>0.04</td>
</tr>
<tr>
<td>QALYs gained/patient treated in a screened population</td>
<td>0.03</td>
<td>0.96</td>
</tr>
<tr>
<td>QALYs gained/patient treated in an unscreened population</td>
<td>0.03</td>
<td>0.96</td>
</tr>
<tr>
<td>QALYs lost due to harm from breast screening</td>
<td>0.03</td>
<td>0.94</td>
</tr>
</tbody>
</table>

Monetary Net Benefit and Health net Benefit

Effects are expressed in monetary units by taking into account the ceiling ratio (R), which can be used to convert costs and effects to the same units. If the net monetary benefit and health net benefit are greater than zero, then the activity is cost-effective.

<table>
<thead>
<tr>
<th>Base Case MNB and HNB</th>
<th>HNB</th>
<th>MNB</th>
</tr>
</thead>
<tbody>
<tr>
<td>HNB</td>
<td>633</td>
<td></td>
</tr>
<tr>
<td>MNB</td>
<td>0.05Rc - 633</td>
<td></td>
</tr>
<tr>
<td>Worst Case MNB and HNB</td>
<td>HNB</td>
<td>MNB</td>
</tr>
<tr>
<td>HNB</td>
<td>1142</td>
<td></td>
</tr>
<tr>
<td>MNB</td>
<td>0.05Rc - 1142</td>
<td></td>
</tr>
</tbody>
</table>

R = 30,000
Worst Case HNB = 0.012
Worst Case MNB = £358

Utility Analysis

To summarise the effectiveness of breast cancer screening, an Incremental cost-effectiveness ratio (ICER) was calculated. The mean ICER calculated was at a value of £11,546.11 with subsequent sensitivity analysis conducted around this value.

Three sensitivity analyses were undertaken to evaluate ICERs of a range of scenarios which could occur:

1. Maximum costs at each node - £17,254/QALY
2. All costs are fixed costs: screening centre costs, and staff are paid for regardless of use - £14,172/QALY
3. Combination of (1) and (2) to produce a worse case scenario - £20,823/QALY

Discussion

The majority of calculations suggested that breast cancer screening is cost effective. However, in our worst case scenario the, the MNB and HNB suggest that screening is cost effecting, while the ICER fell near the bottom ceiling ratio. This makes it unclear whether or not the programme should be part of the screening programme, the cost-effectiveness of breast cancer screening has been highlighted as an important issue to investigate.

Limitations

1. CUA's do not take into account the full social costs or benefits to the population as a whole (externalities).
2. We were unable to consider equity of care, with some evidence suggesting that those in the most deprived areas were less likely to attend screening.
3. Using OALYs for a screening programme is not considered representative of the dimensions being measured. (4) The horizon of this analysis was 20 years, meaning large assumptions had to be made over future treatment changes and effectiveness.

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Utility Analysis

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