Cost effectiveness of gene expression profiling for early stage breast cancer: a decision-analytic model

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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
The study examined the cost-effectiveness of two commercially available gene expression profiling tests for risk stratification to identify women with early stage breast cancer who were most likely to benefit from adjuvant chemotherapy. The authors concluded that the MammaPrint test was a cost-effective alternative to Oncotype DX test to guide decision about adjuvant chemotherapy. The study used a conventional cost-effectiveness framework, although data sources were not satisfactorily reported. However, the authors’ conclusions appear robust.

Type of economic evaluation
Cost-utility analysis

Study objective
The study examined the cost-effectiveness of two commercially available gene profiling tests for risk stratification to identify women with lymph node-negative oestrogen receptor-positive early stage breast cancer who are most likely to benefit from adjuvant chemotherapy.

Interventions
The two gene expression profiling tests assessed were Oncotype DX (Genomic Health, California) and MammaPrint (Agendia Inc., California).

Location/setting
USA/hospital.

Methods
Analytical approach:
The analysis was based on a Markov model with a ten-year time horizon. The authors stated that the analysis took the perspective of the third-party payer.

Effectiveness data:
Clinical inputs came from the literature but the methods used to identify them were not reported. No information on the types of sources used was given. Most data presumably came from observational studies given the lack of published clinical trials. Data for the probability of classification in low risk, intermediate risk and high-risk group for the two gene expression profiling were key inputs of the model.

Monetary benefit and utility valuations:
Utility valuations associated with toxicity from chemotherapy, recurrence-free states, and recurrence states were taken from the literature, including a published systematic review of cost-utility assessment in oncology and a review of health-related quality-of-life estimates.

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure and were discounted at an annual rate of 3%.

Cost data:
The costs included those of the gene tests, adjuvant chemotherapy and other chemotherapy (including pre-medication, oncology visits, and monitoring of adverse events), treating cancer recurrence, costs associated with the management of adverse events, and end-of-life care. Economic data were taken from various published studies. Costs were in US dollars ($). A 3% annual discount rate was applied. The price year was 2009.

Analysis of uncertainty:
One-way sensitivity analyses were carried out on several inputs of the model. A probabilistic analysis was performed using a Monte Carlo simulation with 1,000 replications.

Results
For the Oncotype DX test, the expected cost was $27,882 and QALYs were 7.364.

For the MammaPrint test, the expected cost was $21,598 and QALYs were 7.461.

Thus, the MammaPrint test was the dominant strategy as it was both more effective and less expensive than the Oncotype DX test. This conclusion held in 82% of the simulations, as well as in all deterministic sensitivity analyses. Differences in costs and benefits were statistically significant. MammaPrint remained dominant or cost-effective in all one-way sensitivity analyses.

Authors' conclusions
The authors concluded that the MammaPrint gene profiling test was a cost-effective alternative to the Oncotype DX test to guide treatment decisions about adjuvant chemotherapy in early stage breast cancer.

CRD commentary
Interventions:
The selection of the comparators was appropriate. The authors stated that the Oncotype DX test was the most commonly used gene profiling test in the USA, while the MammaPrint test was more often used in European countries.

Effectiveness/benefits:
The authors stated that clinical data came from the literature, but no information on the methods or conduct of a literature review was provided. The authors stated that there were two on-going clinical trials on the two gene expression profiling tests compared, but results were not available at the time of the study. The methodological features of the studies used to derive these inputs were not described. This limited the possibility of judging the validity of these data. Breast cancer impacts on both survival and quality of life, which could also be affected by adjuvant treatments; QALYs were appropriately used to capture both these dimensions of health in this specific patient population. Utility weights were taken from published studies (partially described).

Costs:
The costs included in the analysis appeared to be representative of the third-payer perspective. Costs were generally presented as totals; a breakdown of cost items was not given. Unit costs for gene expression profiling tests were provided, but the quantities of resource use were not reported. Little information on sources of costs was given, although it was likely that US publications were used. The price year was reported, which would allow reflation exercises.

Analysis and results:
An incremental analysis was performed to identify the optimal strategy. Both deterministic and probabilistic sensitivity analyses were carried out to deal with uncertainty, whose methods and results were explicitly reported. The benefits and costs of the two testing strategies were clearly reported. The authors acknowledged some limitations of their analysis in the assumption that only one recurrence was possible for cancer patients and the lack of good clinical sources. They stated that future studies should corroborate these findings when clinical trials results would be available. Study findings were specific to the US and could not be directly transferred to other countries.

Concluding remarks:
The study used a conventional cost-effectiveness framework, although data sources were not satisfactorily reported. However, the authors’ conclusions appear robust.
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