Modelling the economic and health consequences of cardiac resynchronization therapy in the UK

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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 objective was to examine the cost-effectiveness of cardiac resynchronisation therapy (CRT) versus optimal pharmacologic therapy alone for the treatment of advanced heart failure. The authors concluded that CRT produced improved health benefits at a reasonable cost. Most of the modelling was appropriate, but it is not clear if the trial data were the best clinical evidence available, which means that it is not clear if the authors' conclusions are appropriate.

Type of economic evaluation
Cost-utility analysis

Study objective
This study compared the cost-effectiveness of two strategies for the treatment of patients with advanced heart failure, defined as New York Heart Association (NYHA) class III or IV.

Interventions
The interventions were cardiac resynchronisation therapy (CRT) combined with optimum pharmacologic treatment (OPT), and OPT alone. CRT was a newly developed therapy which involved the implantation of a special pacemaker with three leads to the right atrium and both ventricles. OPT comprised digitalis, diuretics, angiotensin-converting enzyme inhibitors, or beta-blockers.

Location/setting
UK/secondary care.

Methods
Analytical approach:
A discrete event simulation model with a five-year time horizon was used. This type of model was chosen to allow the risk of events to depend on individual patient history. The authors stated that the third-party payer perspective of the UK National Health Service (NHS) was adopted.

Effectiveness data:
The effectiveness data were mainly derived from a published study, the Cardiac Resynchronisation in Heart Failure (CARE-HF) trial, the details of which were reported elsewhere (Cleland, et al. 2001, see 'Other Publications of Related Interest' below for bibliographic details). The risk of preoperative complications was based on data obtained from a local hospital in which 171 consecutive patients received CRT. The key clinical outcomes were the number of deaths, hospitalisations, hospital days, and complications due to unsuccessful implant, revision, or re-implant.

Monetary benefit and utility valuations:
The utility values were originally obtained from the CARE-HF trial, in which the Minnesota Living with Heart Failure (MLWHF) questionnaire was used. These MLWHF scores were converted into European Quality of life (EQ-5D) scores and the method used was reported.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the measure of benefit and an annual discount rate of 3.5% was used.
Cost data:
The economic analysis included the cost of medications, implantation, revision, re-implantation, and hospitalisation. The medication costs were from the World Standard Drug Database, while other costs reflected NHS reference costs. All costs were discounted at an annual rate of 3.5% and were reported in UK pounds sterling (£) for the price year 2004.

Analysis of uncertainty:
The parameter uncertainty was investigated using one-way sensitivity analyses on the following model parameters: time horizon, implant cost, length of stay, risk of death on implantation, hospital cost, revision hazard, discount rate, risk of failed implant, unsuccessful implant cost, revision cost, re-implant hazard, initial NYHA class, age, and gender. Multivariate sensitivity analysis was also conducted and cost-effectiveness acceptability curves were generated.

Results
Over five years OPT alone resulted in 2.39 expected QALYs while CRT resulted in 2.82 QALYs. The total cost per patient was £4,900 with OPT and £11,423 with CRT. Compared with OPT, CRT resulted in an incremental cost of £15,247 per QALY gained.

One-way sensitivity analyses demonstrated that the results were most sensitive to variation in the time horizon and cost of implantation, and slightly sensitive to length of stay, mortality at implantation, risk of implantation revision, cost of hospitalisation, and the discount rate.

The multivariate analysis demonstrated that the incremental cost-effectiveness ratio ranged from £12,531 to £23,184 per QALY and 95% of replications were below £19,122 per QALY.

Authors' conclusions
The authors concluded that, over a five-year horizon, CRT was expected to result in improved health benefits at a reasonable cost.

CRD commentary
Interventions:
The authors used the current practice in their setting as the comparator. Although the doses of the medications were not explicitly reported, the World Standard pharmacological treatment was assumed.

Effectiveness/benefits:
The effectiveness data were mainly derived from a published study, the details of which were not reported. Other trials were mentioned by the authors, but there was no indication that a systematic review was performed and no justification was given for the use of these trials. All assumptions were explicitly reported. The derivation of the benefit measure was based on a validated instrument and the methods used to derive the QALYs were reported. The source of these methods was also reported, so their validity can be assessed. The results were sensitive to the time horizon and the reader should consider whether five years was appropriate.

Costs:
The NHS perspective was adopted and it appears that the categories of costs were appropriately selected for this. Apart from for the medications, the unit costs and quantities were presented separately, enhancing the transparency of the analysis. The sources of costs, the price year and discounting were reported. In general, the economic analysis was carried out in a transparent manner.

Analysis and results:
The model structure and all the modelling assumptions were clearly reported with diagrams. The model was validated by an expert panel in the UK and the synthesis of costs and benefits was appropriately performed. The issue of uncertainty was adequately addressed, but the results of the sensitivity analyses could have been reported in more detail. The authors compared their results with those of other studies and highlighted both the similarities and differences. The authors provided a balanced discussion on the limitations of their study and highlighted the need for further research with a longer time horizon as well as the need for a budget impact analysis.
Concluding remarks:
Most of the modelling was appropriate, but it is not clear if the trial data were the best clinical evidence available, which means that it is not clear if the authors’ conclusions are appropriate.

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