Economic effects of beta-blocker therapy in patients with heart failure

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
The use of beta-blockers (BB) for the treatment of patients with heart failure (HF). The BBs studied included carvedilol and metoprolol.

Type of intervention
Secondary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of patients with HF.

Setting
The setting was secondary care (outpatient). The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were derived from studies published between 1987 and 1999. The resource use data were derived from studies published from 1992 to 2001. The price year was 2001.

Source of effectiveness data
The effectiveness evidence was derived from a synthesis of completed studies.

Modelling
A Markov model was constructed to simulate the natural history of HF and the impact of BB therapy on clinical and economic outcomes. The time horizon of the model was 5 years and 6-month cycles were considered. The model included five health states, comprising four New York Heart Association (NYHA) classes (from I to IV), and death. The model considered the probabilities of hospitalisation, survival and death, and patients could move to worse or better health states. The disease progression model was validated with actual data from a published trial.

Outcomes assessed in the review
The outcomes assessed were the initial state distribution of patients according to NYHA classes, and the transition probabilities across model health states (including NYHA classes and death).

Study designs and other criteria for inclusion in the review
It was unclear whether a systematic review was undertaken to identify relevant studies. Most of the primary studies were randomised clinical trials.

**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**
Six primary studies provided the model inputs.

**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 initial distribution of patients consisted of 38% in NYHA class I, 34% in NYHA class II, 23% in NYHA class III, and 5% in NYHA class IV.

The transition probabilities to NYHA classes I, II, III and IV, and death were:

- from NYHA class I, 94% to class I, 4% to class II, 0% to class III, 0% to class IV, and 3% to death;
- from NYHA class II, 3% to class I, 60% to class II, 27% to class III, 2% to class IV, and 4% to death;
- from NYHA class III, less than 1% to class I, 13% to class II, 66% to class III, 6% to class IV, and 7% to death;
- from NYHA class IV, 0% to class I, 3% to class II, 20% to class III, 39% to class IV, and 28% to death.

**Measure of benefits used in the economic analysis**
The summary benefit used was expected survival. This was derived from the decision model. An annual discount rate of 3% was applied.

**Direct costs**
Discounting was relevant since the costs were incurred during a long timeframe. An annual discount rate of 3% was applied. Some categories of costs were presented as macro-categories. The resources used were presented separately from the unit costs for some items only. The health services included in the economic evaluation were hospitalisations, outpatient hospital services, physician services and medications. The cost/resources boundaries of society, the third-party payer, the hospital, the physician and the patient were adopted. The societal perspective included total inpatient, outpatient and medication costs. The Medicare perspective was restricted to payments for inpatient and outpatient
services. The hospital perspective focused on revenue above variable costs. The physician perspective was limited to inpatient and outpatient fees. The patient perspective included out-of-pocket expenses (e.g. medication costs, coinsurance, deductibles and copayments). Medication prescriptions were based on typical prescribing patterns in the Duke Heart Failure Program. All patients in the treatment arm of the model were assumed to be using BBs. Resource use data were derived from published studies. Some of the costs were derived from the Duke Cost Accounting System. Other costs were estimated from typical Medicare sources. All of the costs were presented in 2001 values.

**Statistical analysis of costs**
The costs were treated deterministically in the base-case.

**Indirect Costs**
Indirect costs were included so that all relevant categories of costs could be considered. Patient time was estimated using the average annual pay of workers. Patient travel, waiting and visit time was based on published estimates. The unit costs were not presented separately from the quantities of resources used. As in the analysis of the direct costs, an annual discount rate of 3% was applied and the price year was 2001.

**Currency**
US dollars ($).

**Sensitivity analysis**
One-way and multivariate sensitivity analyses were performed to examine the impact of variations in model inputs on the estimated cost-effectiveness ratios. The impact of incorporating additional factors not included in the base-case (e.g. patient opportunity costs and additional visits for medical titration) was also investigated. The ranges of values used were generally derived from the literature.

**Estimated benefits used in the economic analysis**
Over the 5-year period, the expected survival was 3.6 years with no BB use and 3.9 years with BB use.

**Cost results**
Over the 5-year period, the total expected costs per patient were:

- from the societal perspective, $52,999 without BBs and $49,040 with BBs;
- from the third-party payer perspective, $39,739 without BBs and $33,675 with BBs; and
- from the patient perspective, $7,569 without BBs and $9,682 with BBs.

The total revenues were $14,026 without BBs and $11,409 with BBs from the hospital perspective, and $6,325 (without BBs) and $5,898 (with BBs), respectively, from the physician perspective.

**Synthesis of costs and benefits**
The incremental cost-effectiveness ratios (cost per life-year saved) were calculated to combine the costs and benefits of BB versus usual care.

Under the societal perspective, BB therapy was the dominant strategy because it was more effective and less costly than no BB therapy.

The results of the analysis were sensitive to variations in the effectiveness of BBs. However, the incremental cost-effectiveness ratio was low even when the effectiveness of BBs was substantially lower than that used in the model from
the perspectives of society and the third-party payer.

The hospitalisation costs had a negligible impact on the base-case results. However, when higher hospitalisation costs where associated with low BB effectiveness, BB therapy was no longer cost-saving.

Changes in medication costs and patient time costs affected only the perspectives of the patient and the third-party payer on the basis of the proportion of reimbursed costs (higher reimbursement rates favoured the patients).

Only substantial increases in physician reimbursements would offset the lost revenue from the physician perspective.

**Authors' conclusions**
From a societal perspective, the use of beta-blockers (BBs) to treat heart failure (HF) was a cost-effective strategy because it improved survival without increasing costs in comparison with standard therapy (no BB therapy). Financial incentives to prescribe BB therapy were achieved only for the third-party payer. There were no clear incentives for hospitals, physicians and patients, unless there were to be dramatic changes in reimbursement rates. The cost-effectiveness of BB therapy was clear, although under some scenarios cost-savings could be offset by unfavourable high cost estimates. However, the cost-effectiveness ratio remained well below the acceptable range for health care interventions.

**CRD COMMENTARY - Selection of comparators**
The selection of the comparators was appropriate because no BB therapy reflected typical patterns of care in the authors' setting. However, the category “no BB” was quite wide and included a number of different treatments. You should decide whether this is a valid comparator in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness data came from published studies. It was not stated whether a systematic review of the literature was undertaken and the search strategy was not reported. The validity of the primary estimates was ensured by using predominantly clinical trials as sources of the evidence. The methods used to extract and then combine the primary estimates were not described. To address the issue of uncertainty in some estimators, all of the model inputs were varied in the sensitivity analysis.

**Validity of estimate of measure of benefit**
The use of survival as a summary benefit measure was appropriate as it captured the most relevant impact of the interventions on patient health. Survival is also a measure that is comparable with the benefits of other health care interventions. Discounting was applied, as recommended in US guidelines. The impact of the treatments on quality of life was not investigated.

**Validity of estimate of costs**
The analysis focused on the impact of the interventions under examination from different perspectives. Thus, relevant costs depended on the perspective selected. This approach was useful in showing that the impact of using BBs differed depending on the perspective selected in the study. A detailed breakdown of the cost items was not reported and most of the costs were presented as macro-categories, which reduces the possibility of replicating the results of the analysis. The source of the data was reported. The impact of changes in the cost estimates was investigated in the sensitivity analysis. The price year was reported, which aids refraction exercises in other settings. Discounting was appropriately applied.

**Other issues**
The authors compared their findings with those from other studies and stated that their results supported prior research. However, some studies presented contrasting results, which showed that BB therapy was cost-effective but not cost-
saving. The authors highlighted the reasons for the current prescribing patterns in the USA, and stated that the lack of financial incentives for physicians and hospitals played an important role in explaining the under-use of BB therapy in an outpatient setting. Some limitations to the validity of the study were noted. First, the time horizon of the study was limited to 5 years, owing to the lack of reliable long-term information. Second, the costs were estimated from a single institution and could not be generalisable to other institutions. Finally, it was assumed that all patients were covered by Medicare.

**Implications of the study**
The study results supported the prescribing of BBs for the treatment of HF in an outpatient setting. The authors stressed that alternative approaches to encourage BB use should be investigated and implemented, so that optimal allocation of resources can be achieved.

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None stated.

**Bibliographic details**

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**Other publications of related interest**


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