Cost-effectiveness analysis of an antimicrobial stewardship team on bloodstream infections: a probabilistic analysis

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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
This study investigated the cost-effectiveness of an antimicrobial stewardship team in the management of bloodstream infections compared with standard care (no team). The authors concluded that these teams were cost-effective and more so than other funded health care services. There was uncertainty around the utility estimates, but the methods appear to have been appropriate and the authors’ conclusions appear to be reasonable.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to evaluate the cost and health outcomes of an antimicrobial stewardship team in the management of patients with bloodstream infections.

Interventions
Two strategies were assessed: an antimicrobial stewardship team versus no team (standard care) in the treatment of patients with bloodstream infections that were either Gram-negative or Staphylococcus aureus. The stewardship team aimed to hasten the timely and appropriate treatment of infections, leading to improved health outcomes.

Location/setting
USA/secondary care.

Methods
Analytical approach:
A decision tree was used to synthesise the published data from the scientific literature and additional sources. The hypothetical population was stratified by intensive care status. The analysis covered the duration of hospital stay and the authors stated that it was carried out from an institutional perspective.

Effectiveness data:
The clinical data were identified by a systematic review of the literature. The point estimates were from studies, published between 1978 and 2006, which were a mixture of experimental and observational studies and one clinical guideline report (O'Grady, et al. 2002, see ‘Other Publications of Related Interest’ below for bibliographic details). The outcomes included deaths and intensive care stays.

Monetary benefit and utility valuations:
The utility weights associated with having bloodstream infections were based on authors’ assumptions.

Measure of benefit:
The measure of benefit was quality-adjusted life-years (QALYs).

Cost data:
The medical costs for an antimicrobial stewardship team were fixed and they were averaged over 1,200 occurrences of bloodstream infections found at a large academic medical hospital. The other costs included hospitalisations and a computerised decision support aid. They were obtained from published literature, hospital administrative records and
some authors’ assumptions. All costs were in US dollars ($).

Analysis of uncertainty:

One-way sensitivity analyses assessed whether the model was robust to variations in key model parameters, such as event probabilities and team costs. Joint parameter uncertainty was evaluated using probabilistic sensitivity analysis, with 10,000 Monte Carlo simulations, to generate 95% confidence intervals and the results were presented in a cost-effectiveness acceptability curve. A scenario analysis was performed to compare the presence of a team using the clinical decision support aid against no team and no decision support.

Results

For the antimicrobial stewardship team, the total costs were $40,144 per patient compared with $39,776 for no team. The team produced a total of 8.01 QALYs compared with 7.92 QALYs for no team. The incremental cost-utility ratio for the team compared with no team was $4,089 per QALY gained.

One-way sensitivity analyses found that the base-case results were robust to variations in the probability of receiving active antibiotics in the intensive care unit, but were less so to variations in receiving treatment on general wards ($2,014 to $22,696 per QALY gained).

In the probabilistic sensitivity analyses, the 95% confidence interval for the incremental cost-effectiveness ratio ranged from dominant (cheaper and more effective) to $24,379 per QALY. The team was found to be cost-effective in 90% of the Monte Carlo simulations at a willingness-to-pay of $10,000 per QALY.

Authors’ conclusions

The authors concluded that an antimicrobial stewardship team was cost-effective in the management of bloodstream infections.

CRD commentary

Interventions:
The authors’ description of the antimicrobial stewardship team was limited and more details on the staff and other components would have been useful. The reader should decide whether this intervention is relevant in their own setting, particularly in the proportion of patients who receive timely active treatment without this team.

Effectiveness/benefits:
The clinical effectiveness parameters were derived from relevant published research that was identified by a systematic review. The authors did not report the quality of these studies, but their references were clearly reported as were all assumptions used in the model. The utility scores appeared to rely solely on the authors’ subjective assessments, raising uncertainty around the quality of these estimates.

Costs:
An institutional perspective was taken and the relevant direct medical resources were included. The average costs for each resource type were provided along with the ranges tested and distributions used for the sensitivity analyses. It was not clear which resources were part of the intervention as a detailed description of the team was not given. The price year was not reported, nor were any necessary inflationary adjustments.

Analysis and results:
The authors acknowledged and discussed a number of limitations of their study, including the fact that they did not explicitly take into account the time to receiving treatment and a lack of evidence for the utility scores. These were overcome by simplifying the model and using wide ranges in the sensitivity analyses. The separate cost and QALY differences were very small and therefore similar for the two strategies.

Concluding remarks:

There was uncertainty around the utility estimates, but the methods appear to have been appropriate and the authors’ conclusions appear to be reasonable.
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