Modeling for the decision process to implement an educational intervention: an example of a central venous catheter insertion course

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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 a hospital programme of education to reduce the rates of infection and mechanical complications with central venous catheter (CVC) placement. The authors concluded that if the education programme was effective, a small increase in costs could reduce the complication rate. The cost-effectiveness methods were conventional and various scenarios for the theoretical impact of the intervention were considered. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to examine the cost-effectiveness of a hospital programme of education to reduce the rates of infection and mechanical complications with central venous catheter (CVC) placement.

Interventions
The hypothetical education programme was offered to all postgraduate first-year residents starting specialties where CVC insertion was expected. The one-day course consisted of brief introductory lectures, followed by hands-on, station-by-station procedural simulation. Nurses encouraged residents and ensured compliance. This was compared with no educational programme.

Location/setting
USA/hospital.

Methods
Analytical approach:
The analysis was based on a decision tree. The authors stated that the perspective was that of the health care system.

Effectiveness data:
The clinical data were from published sources and intensive care staff at the authors’ institution. A key input was the rate of central-line associated bloodstream infections and these data were from the authors’ institution. Another key input was the deaths due to these infections and these data were from a review published by the Agency for Healthcare Research and Quality. The percentage reduction in the rates of infection and mechanical complications was varied.

Monetary benefit and utility valuations:
Not considered.

Measure of benefit:
Expected survival was the main benefit measure.

Cost data:
The costs included the education programme and medical events, such as infections and iatrogenic pneumothorax. The cost items were reported for the programme. Pneumothorax costs were from a study collecting administrative data, and infection costs were estimated by the Institute for Healthcare Improvement. These were reported as category totals. All
costs were in US $.

Analysis of uncertainty:
One-way sensitivity analyses were carried out on the model inputs. The ranges of values were assumed by the authors or were published confidence intervals. A probabilistic sensitivity analysis was carried out, using Monte Carlo simulation and normal distributions for the costs and mortality.

Results
Assuming the programme reduced the rate of central-line infections by 50% and the rate of pneumothorax by 25%, the costs were $546 with the programme and $392 without it. The survival rates were 0.899 with the programme and 0.898 without it.

The net monetary benefit with the programme was -$154 per patient. At a rate of 600 patients receiving CVCs per year, there was an additional cost of $92,400 to a large health care system to prevent two of the four infections.

Assuming the programme had no impact on the rate of pneumothorax, but reduced infections by 50%, the net monetary benefit was -$223. Assuming it was 100% effective at reducing the rates of infection and pneumothorax, the net monetary benefit was $108.

Changes in other parameters did not substantially affect the model results.

Authors' conclusions
The authors concluded that if the education programme was effective, a small increase in costs could reduce the complication rate.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the proposed intervention was compared against the usual care. Various scenarios were considered for the theoretical education programme.

Effectiveness/benefits:
Most of the clinical inputs were from the authors’ institution, with some from published reviews or authors’ assumptions. These sources were not well described, making it difficult to objectively assess their validity. Different percentage reductions in the rates of infections and mechanical complications were considered, and had substantial impact on the final costs and benefits. The benefit measure was appropriate for capturing the impact of the intervention on the patients’ outcomes; deaths from complications were relevant to these patients.

Costs:
The economic analysis was consistent with the perspective of the hospital. The programme costs were reported in detail, while other costs were presented as category totals, as they were from other publications. A valid justification for the selection of these estimates from the literature was given. The key information on the data sources was provided. Reflation exercises will not be possible as the price year was not stated; costs were not adjusted for inflation as this was reported to be low. The impact of variations in the programme costs was assessed in the sensitivity analyses.

Analysis and results:
The results were presented for a variety of scenarios. Net monetary benefit was used to synthesise the costs and benefits of the two strategies and to identify the best option. The analysis of uncertainty used both deterministic and probabilistic approaches, but may have been restricted to the key model inputs. The decision tree used to estimate the total costs and benefits was presented in detail. The authors acknowledged that the main limitation of their analysis was the lack of high quality published sources for some model parameters. The results appear to be specific to the authors’ setting and may be difficult to transfer to other settings.

Concluding remarks:
The cost-effectiveness methods were conventional and various scenarios for the theoretical impact of the intervention were considered. The authors’ conclusions appear to be robust.
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