Cost-effectiveness analysis: stress ulcer bleeding prophylaxis with proton pump inhibitors, H2 receptor antagonists

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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 assess the cost-effectiveness of two types of drug to prevent stress ulcer bleeding in patients in the intensive care unit. The authors concluded that a proton pump inhibitor was more efficient than a histamine 2-receptor antagonist in preventing bleeding from a stress ulcer in patients at a high risk. The conclusions seem reasonable, but due to omissions in reporting, the opportunity for bias in the clinical and cost estimates was unclear.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to assess the cost-effectiveness of two types of drug to prevent stress ulcer bleeding in patients in the intensive care unit.

Interventions
Proton pump inhibitors (PPIs) and histamine 2 (H2)-receptor antagonists were compared. The PPI was either bolus intravenous or oral omeprazole 40mg daily. The H2-receptor antagonist was intravenous famotidine 40mg twice daily.

Location/setting
USA/hospital intensive care unit.

Methods
Analytical approach:
A decision tree was constructed to combine data from a systematic review and costs from a US national database. The time horizon was 60 days, and the authors stated that they took a third-party payer perspective.

Effectiveness data:
A systematic review was undertaken to identify the relevant evidence. MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Knowledge were searched, along with clinical trial databases and abstracts from Digestive Disease Week and United European Gastroenterology Week. The main clinical effectiveness estimates were the rates of bleeding from stress ulcer and ventilator-associated pneumonia. These rates were estimated from a published meta-analysis, by some of the authors of this study (see Other Publications of Related Interest).

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
The benefit measure was the probability of no complication (bleeding or pneumonia).

Cost data:
The hospital costs were included, and these were assumed to include the drugs. The length of stay and per day costs were from the National Inpatient Sample for 2008. They were estimated by combining the average charges with a cost-to-charge ratio. They were presented in 2010 US $.
Analysis of uncertainty:
One-way sensitivity analyses were undertaken, by varying each parameter within its 95% confidence interval. The results were presented in a tornado diagram. A two-way sensitivity analysis was undertaken to assess the pneumonia incidence for the two treatment pathways, and threshold analysis was undertaken on the probabilities of ventilator-associated pneumonia and bleeding from stress ulcer, and the costs. Probabilistic sensitivity analysis was undertaken, using 10,000 Monte Carlo simulations; the results were presented in a scatterplot and cost-acceptability curves.

Results
The probability of no complication was 0.8833 with the PPI, and 0.8307 with the H$_2$-receptor antagonist. The average cost per patient without a complication was $58,700 for PPIs, and $63,921 for H$_2$-receptor antagonists.

PPIs dominated H$_2$-receptor antagonists, as they were less costly and more effective at averting bleeding from stress ulcer and ventilator-associated pneumonia.

The one-way sensitivity analysis showed that the probability of developing ventilator-associated pneumonia was the most influential parameter. Even in extreme cases, the PPI remained more effective. Its cost-effectiveness was robust in the threshold and the two-way sensitivity analyses.

The probabilistic sensitivity analysis found that the PPI was dominant in 49% of simulations and remained cost-effective in an additional 9% of simulations, at a willingness-to-pay threshold of $50,000 per patient who did not have a complication.

Authors’ conclusions
The authors concluded that a PPI was more efficient than an H$_2$-receptor antagonist in preventing bleeding from a stress ulcer in patients at a high risk.

CRD commentary
Interventions:
The interventions were described. An additional intervention was discussed, and justifications for its exclusion from the main study were presented; these justifications were plausible.

Effectiveness/benefits:
Adequate details of the systematic review were provided and it seems likely that all of the best available evidence was identified. Only the publication details for the meta-analysis were stated, making a full assessment of its quality unfeasible. A discussion on the choice of benefit measure was presented, and a justification was provided for not using quality-adjusted life-years.

Costs:
The study’s perspective was clearly stated and it appears that the relevant costs were included. The units costs and resource use estimates were not reported, due to the sources used. This limits the ability to reproduce this study for other settings. Due to the short time horizon, discounting of the costs was not necessary. They were appropriately adjusted for inflation.

Analysis and results:
The analytic approach was described, and a diagram of the model was provided. The time horizon was short, but it was likely to have been appropriate for the short duration of the medical problem. The results were clearly presented, and the sensitivity analysis was comprehensive.

Concluding remarks:
The conclusions seem reasonable, but given the omissions in reporting, the opportunity for bias in the clinical and cost estimates was unclear.

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**Other publications of related interest**

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