A cost-effectiveness analysis of stress ulcer prophylaxis

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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.

Health technology
The use of two histamine2-receptor antagonists, cimetidine (CIM) and famotidine (FAM), and the proton-pump inhibitor lansoprazole (LAN) as stress ulcer prophylaxis.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The population comprised patients at risk for stress ulcers. These included patients who were in an ICU and had a coagulopathy, who were on a ventilator for more than 48 hours, or who had had a gastrointestinal (GI) bleed or ulcer within the past year. Patients were thought to be at risk if they met two or more of the following conditions: sepsis, ICU stay longer than one week, occult bleeding for more than 6 days, or use of high-dose steroids. Other risk factors included a Glasgow Coma Score of less than 10 or burns over more than 35% of the body surface. The patients included in the study were aged 18 years or older, and were admitted to the medical, surgical, or cardiovascular ICU. Several exclusion criteria were reported. For example, having an active GI bleed prior to the start of therapy, having risk factors for longer than 24 hours before the start of therapy, or receiving less than 48 hours of therapy.

Setting
The setting was secondary care. The economic analysis was conducted at the University of Iowa Hospitals and Clinics, Iowa City (IA), USA.

Dates to which data relate
The effectiveness and cost data were gathered from an observational study with an inclusion period that was initiated in October 2000 and ended in December 2000. The price year was unclear, but it is likely to have been 2000.

Source of effectiveness data
The effectiveness data were gathered from a single prospective study.

Link between effectiveness and cost data
The costing was undertaken prospectively on the same group of patients as that used in the effectiveness study.

Study sample
No power calculations to determine the sample size were reported. Eighty-eight patients were included in the analysis.
Of these, 32 patients started and continued on CIM, 31 patients were initiated on LAN, and the remaining 25 patients received CIM initially and were switched to LAN for either unjustified or undocumented reasons (CIM-LAN). The latter group of patients (CIM-LAN) was evaluated in a separate arm of the decision tree. Thus, in total, three groups were considered in the effectiveness analysis. The mean age was 56.1 (+/- 14.8) years in the CIM group, 59.8 (+/- 15.8) years in the LAN group, and 58.1 (+/- 20) years in the CIM-LAN group. The proportions of male patients in the three groups were 59% (CIM), 52% (LAN) and 48% (CIM-LAN), respectively.

Study design
This was a prospective cohort study that was carried out in a single centre. The duration of follow-up was unclear, but it appears that the patients were followed for 2-week periods. Neither the patients nor the physicians were blinded to the treatment.

Analysis of effectiveness
It appears that all the patients included in the initial study sample have been considered in the effectiveness analysis. The primary health outcome was treatment success. This was defined as the patient not experiencing a GI bleed and not requiring discontinuation of therapy due to either therapeutic failure (insufficient increase in gastric pH as determined by the physician) or a significant adverse event. The demographic and clinical characteristics of the patients in the three groups were similar at entry.

Effectiveness results
In the CIM group, 27 (84%) patients had successful treatment. Five patients (16%) failed therapy and were switched to either intravenous FAM or LAN. Two patients developed an adverse reaction and 3 patients experienced therapeutic failure due to low nasogastric pHs.

There were no therapeutic failures associated with CIM-LAN and the LAN only arm.

Clinical conclusions
The results showed that, compared with CIM, LAN was the drug associated with the best clinical efficacy.

Modelling
A decision analysis model (Data 3.5, TreeAge Software) was used to compare the clinical and financial outcomes associated with each agent. The decision tree used in the analysis was depicted graphically.

Measure of benefits used in the economic analysis
The authors did not develop a specific summary benefit measure. The primary health outcome, the number of failures avoided, was expressed as benefits.

Direct costs
The cost data were analysed from the perspective of the Pharmacy & Therapeutics Subcommittee. The economic outcomes were measured by drug acquisition costs only, directly related to stress ulcer prophylaxis. The prices were University of Iowa Hospital and Clinics' acquisition prices from Novation contracts in the authors' setting. The quantities were not reported whereas the unit costs for standard doses were. The duration of follow-up was not stated, but it was likely to have been less than one year. Hence, discounting was unnecessary. The price year was not reported.

Statistical analysis of costs
No statistical analysis of the costs was carried out.
Indirect Costs
The indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
A sensitivity analysis was performed. This varied the unit costs of the agents and the use of oral versus intravenous therapy. The type of analysis was not reported, but it appears to have been one-way.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The mean cost per patient was $33.80 in the CIM group ($25.01 for patients treated successfully and $79.97 for patients who experienced a failure), $26.62 in the CIM-LAN group (no failure was observed), and $22.99 in the LAN group (no failure was observed).

Synthesis of costs and benefits
An average cost-effectiveness ratio was calculated to combine the costs and benefits of the therapies under evaluation. The results of the CIM-LAN group were not evaluated because it was not possible to determine whether the clinical outcome was due to the first or the second agent.

The cost per failure avoided was $39.82 in the CIM group. Since there were no failures in the LAN arm, the cost per failure prevented was the same as the expected cost per patient ($22.99).

When it was assumed that all patients in the CIM group would receive intravenous therapy (maximal cost), the cost per failure prevented was $40.35. When it was assumed that all patients in the CIM group would receive oral therapy (minimal cost), the cost per failure prevented was $18.10.

If all patients in the LAN arm were treated instead with intravenous pantoprazole ($20.00 per 40 mg versus $2.29 per capsule for LAN), the cost per failure prevented would increase to $183.87.

When a minimal cost per LAN capsule of $0.24 was assumed, the cost per failure prevented was $2.99.

The results of the decision model were robust, as long as the oral proton-pump inhibitor formulation was used.

Authors’ conclusions
Lansoprazole (LAN) was the most cost-effective agent for stress ulcer prophylaxis at the authors' institution, as long as an oral rather than an intravenous formulation was administered. Assuming equal effectiveness, a more expensive intravenous proton-pump inhibitor, namely pantoprazole, would not be cost-effective in comparison with cimetidine (CIM) due to the far lower acquisition cost of CIM.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparator used (i.e. LAN). The comparator was chosen because it represented the only proton-pump inhibitor available on formulary at the authors' setting, while CIM represented the standard therapy prescribed at the authors’ institution. The authors stated that FAM was also routinely prescribed. You should consider whether this is a widely used technology in your own setting.
Validity of estimate of measure of effectiveness
The use of a cohort study rather than a randomised design may limit the validity of the effectiveness measure. The estimate of effectiveness was modelled and, although the decision analysis model used to derive an expected value of each therapy appears to have been valid, a double-blinded, randomised controlled trial would have been more appropriate for the study question. The sample size was very small and the lack of power calculations may represent the main drawback of the analysis. The authors acknowledged that because several factors are involved in the formation of stress ulcers, the results of the study might be due to a low chance of ulceration and not necessarily the prophylactic medication. Finally, the validity of the effectiveness measure was questioned.

Validity of estimate of measure of benefit
The authors did not derive a summary measure of health benefit. The primary health outcome was, therefore, expressed as benefits.

Validity of estimate of costs
The authors limited the estimation of the cost to the Pharmacy & Therapeutics Subcommittee perspective. The direct costs included only the drug acquisition costs directly related to stress ulcer prophylaxis. The dose quantities and unit costs were not reported separately. No statistical analysis was performed. These facts hinder the reproducibility of the results to other settings. Discounting was unnecessary. A sensitivity analysis on the unit costs of the agents was performed. The price year was not reported.

Other issues
The generalisability of the results was not discussed and the authors made few comparisons of their findings with those from other studies. The study examined patients at risk for stress ulcers and this was reflected in the authors’ conclusions. The results do not seem to have been presented selectively. The authors reported further limitations of their study.

Implications of the study
The authors noted that the results have been used at their institution to support strict criteria for the use of intravenous pantoprazole, to avoid its misuse and the associated increase in costs.

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None stated.

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Other publications of related interest

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