Impact of a hospital-based antimicrobial management program on clinical and economic outcomes


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
Following the introduction of a restricted formulary, the effectiveness of prescriptions given by an Antimicrobial Management Team (AMT) and an Infectious Disease (ID) team was assessed. The AMT comprised a clinical pharmacist and an ID physician. The ID team comprised ID fellows.

Type of intervention
Other: Effectiveness of prescribing decisions.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients in the study hospital. The inclusion criteria specified patients older than 18 years who had a request on their chart, made during the study period, for a restricted antimicrobial agent. The exclusion criteria included dying within 72 hours of the request, or dying of causes unrelated to infection (this was assessed by a blinded reviewer) during the antimicrobial course. If more than one call for antimicrobial agents were made for a single patient, only the first call was included in the study.

Setting
The setting was tertiary care. The economic study was carried out in Pennsylvania, USA.

Dates to which data relate
The effectiveness data were collected during November 1993. The cost data were collected retrospectively from charts and related to the same time. The price year was 1993.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was carried out retrospectively on the same sample of patients as that used in the effectiveness study.

Study sample
The authors reported that, during the study period, 265 calls for restricted agents were made. Of these, 19 were excluded due to death of the patient and 30 due to the patients’ charts not being available. Of the remaining 216, 36 calls were multiple calls, leaving 180 patients for inclusion in the study. The authors did not report whether power
calculations, to estimate the influence of chance on the results, were carried out. The initial sample was appropriate for the clinical study question since it comprised patients for whom restricted agents were requested. Eighty-seven patients (43% male) received their prescription from the AMT and 93 (47% male) from ID fellows. The median age was 60 years in the AAMT group and 50 years in the ID fellow group. The authors reported that patients whose charts were available were more likely to be female, and that ID fellows were more likely to have made the calls for these patients. Ten patients who received antimicrobial agents in the absence of infection were later excluded from the calculation of patients who were cured.

**Study design**

The authors reported that this was a "quasi-experimental" study. However, the nature of how the patients were allocated to the groups suggests that this was, in fact, a prospective cohort study with groups defined by exposure to either prescription by the AMT or ID fellows. The patients were allocated to the AMT or ID fellows group according to the time at which the prescription was requested. Antibiotic approval was given by the AMT between 08:00 and 17:00 on weekdays, and by ID fellows between 17:00 and 23:00 on weekdays and 08:00 and 23:00 on weekends. Patients receiving a prescription outside of these hours were evaluated in the morning. The study was set in a single centre, the Hospital of the University of Pennsylvania, a tertiary care medical centre. The duration of follow-up was unclear. There was no reported loss to follow-up. The AMT director later evaluated all the prescription recommendations in a blinded manner.

**Analysis of effectiveness**

The basis of the analysis was intention to treat, which also equates to the actual prescription received. The primary health outcomes were:

- the appropriateness of the prescription (based on adhering to guidelines, adjusted doses, and allowance for known allergies), as decided by the AMT director (the 'gold' standard);
- cure; and
- failure.

The authors reported that patient characteristics were similar among the two groups (calls to ID fellows and calls to the AMT). Although the ID fellows received more calls about intensive care patients than the AMT, the AMT received more calls about older patients. These factors represent potential confounding factors which the authors explored using multiple logistic regression.

**Effectiveness results**

An appropriate cure was given for 76 of the AMT patients and 44 of the ID fellow patients, giving an unadjusted odds ratio (OR) of 7.7 (95% confidence interval, CI: 3.7 - 16.2; p<0.001).

Treatment cured 49 of the AMT patients and 35 of the ID fellow patients, giving an unadjusted OR of 2.4 (95% CI: 1.3 - 4.5; p<0.007).

Treatment failed for 13 of the AMT patients and 26 of the ID fellow patients, giving an unadjusted OR of 0.5 (95% CI: 0.2 - 0.9; p<0.03).

AMT was strongly associated with appropriate antimicrobial use (OR 11.0, 95% CI: 4.6 - 25; p<0.001).

**Clinical conclusions**

The authors concluded "cases managed by AMT had better outcomes than those managed by the ID fellows" in terms of appropriate treatment, cure and failure. Their study therefore demonstrated that AMT comprising a pharmacist with ID specialist backup was "better able to manage antimicrobial recommendations in a hospital with a restricted formulary".
Measure of benefits used in the economic analysis
The authors did not produce a summary measure of health benefit. Therefore, the study was effectively a cost-consequences analysis.

Direct costs
A perspective for the costing analysis was not reported. However, the authors stated that their primary economic outcome was to estimate the cost of hospitalisation from the time of the request for antimicrobial agents to discharge. A secondary outcome was to examine the costs directly attributable to the infection being treated. The resources costs were for drug acquisition, the room during treatment, the laboratory and ID consultation. Charges were determined using financial data from the University of Pennsylvania Health System Historical Online Warehouse, the Health Care Financing Administration National Physician Fee Schedule, and the University of Pennsylvania wholesale price. The charges were converted to 1993 costs using the ratio of cost-to-charges for 1993 for the study hospital. Discounting was, appropriately, not carried out since the authors were interested in the immediate costs of treatment. The unit costs and the quantities were not reported separately.

Statistical analysis of costs
Bootstrapping was used to generate 95% CIs for the differences between the costs.

Indirect Costs
The indirect costs, such as those incurred by that patient, were not reported to have been included. They were not relevant if the hospital perspective was adopted.

Currency
US dollars ($).

Sensitivity analysis
A one-way sensitivity analysis was carried out to explore the impact of the cost of an ID consultation on the results.

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

Cost results
The median total hospital cost after the approval call was $6,468 for AMT patients and $7,864 for ID fellow patients. The difference was $1,396 (95% CI: -3,154 - 5,991; p=0.08).

The median cost attributable to infection was $3,510 for AMT patients and $4,205 for ID fellow patients. The difference was $695 (95% CI: -1,078 - 2,985; p=0.10).

The median cost of antimicrobial agents was $79 for AMT patients and $122 for ID fellow patients. The difference was $43 (95% CI: -47 - 136; p=0.09).

The authors reported that the sensitivity analysis showed no "important change" from the base-case analysis.

Synthesis of costs and benefits
The costs and benefits were not combined.
Authors' conclusions
The authors concluded "in a hospital with a restricted formulary an AMT (Antimicrobial Management Team) made more appropriate recommendations and yielded better outcomes than did ID (infectious disease) fellows" and the move to AMT "suggested a trend toward cost-saving". Therefore, the authors noted that the AMT was a dominant strategy, with better outcomes achievable at a reduced cost.

CRD COMMENTARY - Selection of comparators
The authors compared prescribing decisions made by an AMT with those made by ID fellows given a restricted formulary. The AMT was created and explored as a way to help reduce the inappropriate use of antibiotics. ID fellows seemed to represent standard practice in the authors' setting. You should decide if this represents a valid comparison in your own setting.

Validity of estimate of measure of effectiveness
The analysis used a prospective cohort study. This design was appropriate as the authors' study was reported to be "the first comparative study of antimicrobial management strategies", and was therefore structured as an exploratory study. The study sample was representative of the study population since it comprised patients who had calls for restricted antimicrobial agents. However, the study did not explore patients for whom calls for restricted agents were not made, and whether these patients may have been better treated with such restricted agents. In a sense, any false-negative prescription decisions were therefore ignored in this study. The patient characteristics between the groups were reported to have been similar at analysis. An appropriate logistic regression analysis was carried out for differences observed, to account for potential confounding factors. The authors chose to exclude patients who died within 72 hours of the request call. Death may have been related to the antimicrobial prescription, thus excluding these patients may have created a bias. The authors did not discuss this issue.

Validity of estimate of measure of benefit
The authors did not derive a summary measure of health benefit. Therefore, the analysis was effectively a cost-consequences analysis.

Validity of estimate of costs
A perspective for the costing analysis was not reported. Thus, it was not possible to assess whether all the relevant categories of cost were included. Those costs that were included were relevant to the perspective of a hospital. Given the relatively small and statistically insignificant differences in cost, the inclusion of different cost factors may have a large impact on the results and the authors' conclusion. A breakdown of the costs was not provided and the unit costs were not reported separately from the quantities. Including these two factors would have improved the ability of other authors to understand the results in the context of their own clinical setting. Discounting was not relevant due to the timeframe of the study and, appropriately, was not performed. The price year was reported, which will aid any future reflation exercises.

Other issues
Since this study was reported to be the first comparative study of antimicrobial management strategies, the authors could not compare their results. However, there was a useful discussion of the results explaining why the AMT may have been so successful in the authors' setting. This improves the generalisability of the results. The authors were also able to point out some factors that may limit the generalisability of the result. The base-case results were not reported selectively. However, the authors chose not to report all the sensitivity analysis results since they felt that no "important changes" were identified. The conclusions drawn accurately reflected the scope of the study and answered the clinical study question. A number of limitations were reported. For example, the non-randomised nature of the study and the inability to control for some potential confounding factors. However, overall, the authors were able to recognise confounding factors and took actions to control for these where possible.
Implications of the study
The authors reorganised their AMT in response to the evidence. They proposed the need for a randomised study to explore antimicrobial management strategies and recommended that, if their results were confirmed, the AMT system should be "implemented in other hospitals where antibiotics are used injudiciously".

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Other publications of related interest

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