Improved antimicrobial interventions have benefits

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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 Thera Trac 2, a computer software program that electronically links antimicrobial susceptibility testing results to the pharmacy and alerts pharmacists of potential interventions. This was combined with additional education of the pharmacists.

Type of intervention
Other: organisation (data processing system).

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised:

patients infected with a bacterial isolate without an order for antimicrobial therapy;

patients infected with bacteria resistant to their current antimicrobial therapy;

patients on therapy which was not tested; and

patients who were on antimicrobial therapy but from whom no sample for culture had been taken.

Setting
The setting was a teaching hospital (secondary care). The study was carried out at the Memorial Medical Centre, Springfield (IL), USA.

Dates to which data relate
The effectiveness and resource use data related to the period October 1998 to February 1999. The price year was not reported, but seems to have related to the same period.

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

Link between effectiveness and cost data
The costing was carried out prospectively on the same patient sample as that used in the effectiveness analysis.

Study sample
Power calculations to determine the sample size were not reported. All eligible patients in the study period whose surnames began with the letters A to K were included in the study group. Those patients whose surnames began with the letters L to Z were included in the control group. The number of patients or interventions included in the analysis depended on the type of analysis performed. Three types of analysis of effectiveness were performed. Analysis A included only inpatients with interventions. There were 24 patients or interventions in the control group and 52 patients or interventions in the study group. Analysis B included all patients with matching diagnosis-related group (DRG), independently of whether they had had an intervention. There were 190 patients in the control group and 188 in the study group. Analysis C included DRG-matched patients, as in analysis B, but adjusted for severity. Consequently, the sample was the same as in analysis B.

Study design
Initially, the design of this single-centre study was quasi-randomised, since the patients were allocated to the control and study groups on the basis of the first letters of their surname. The length of follow-up was not reported, but it appears that the patients were followed for at least 4 days.

Analysis of effectiveness
The basis of the clinical analysis (intention to treat or treatment completers only) was not stated. The primary health outcomes used in the analysis were the number of interventions performed, the mortality rate and the mean length of stay in hospital.

In analysis A, there was a non significant difference in the average age of the study group (64.7 years) and control group (67.3 years). There was also a non significant difference in the Health Care Financing Administration (HCFA) weights for the DRG categories, which were 2.4 in the study group and 5.4 in the control group.

In analysis B, the average age was 66.1 years in the study group and 65.6 years in the control group. The HCFA weights were 2.2 in the study group and 2.5 in the control group. The different numbers of patients in the different DRGs in the study and control groups were adjusted to improve the comparability of the two groups.

Effectiveness results
The number of interventions was 52 (79% were accepted) in the study group and 24 (71% were accepted) in the control group. In analyses A and B, the mortality rate did not differ significantly between the study and control groups. In analysis A, the mortality rate was 7.7% in the study group and 12.5% in the control group, (p=0.68). In analysis B, the mortality rate was 11.2% in the study group and 10.0% in the control group, (p=0.741). In analysis C, the severity-adjusted mortality rate was 12.6% in the control group and 11.2% in the study group. This represented a decrease in the mortality rate of 1.4% in the study group.

In analysis A, the average length of stay in the hospital was 16.5 days per patient in the study group and 33 days per patient in the control group. The difference was 16.5 days, (p=0.37). In analysis B, the average length of stay in the hospital was 11 days per patient in the study group and 13.7 days per patient in the control group. The difference was 2.7 days (p=0.035). In analysis C, the control group had a severity-adjusted length of stay of 12.2 days in the hospital. This represented a decrease of 1.2 days per patient in the average length of stay for the study group.

Clinical conclusions
The difference in mortality rates between the study and control groups was insignificant in all of the analyses. Only analysis B showed an unfavourable mortality rate for the study group. However, this difference was small and insignificant, and was likely to be due to chance alone.

Measure of benefits used in the economic analysis
No summary measure of benefits was used in the economic analysis. Therefore, the benefits are associated with the effectiveness results. The costs were analysed separately for the study and the control groups. The cost-effectiveness
analysis was, therefore, of a cost-consequences design.

**Direct costs**
No discounting was carried out due to the short time horizon of the analysis. The cost/resource boundary adopted appears to have been that of the hospital. The unit costs and the quantities of resources were not reported separately. The health care costs included were for variable costs and fixed costs. The variable costs included supplies used by the patient, pharmaceuticals, and laboratory or radiological tests performed on a particular patient. The fixed costs included overheads and administration costs. The source of the cost and resource use data was the data management team. No price year was reported. The quantities of resources used were measured from October 1998 to February 1999.

**Statistical analysis of costs**
Statistical analyses of the total costs were only carried out to test the statistical significance of the results. The cost differences between the study and the control groups were analysed using the Wilcoxon rank sum test in analysis A, as this is generally considered to be more appropriate for disparate groups, and t-tests for independent groups in analysis B. The costs were not treated stochastically in analysis C due to the severity adjustment made at the group level.

**Indirect Costs**
No indirect costs were evaluated.

**Currency**
US dollars ($).

**Sensitivity analysis**
No sensitivity analysis was performed.

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

**Cost results**
The radiology costs, pharmacy costs, total variable cost, and total costs were reported.

In analysis A, the average total cost was $21,189 for the study group and $51,790 for the control group.

The average variable costs were $14,033 for the study group and $34,919 for the control group.

The variable pharmacy costs were $2,331 for the study group and $5,931 for the control group.

The variable radiology costs were $580 for the study group and $1,105 for the control group.

All of the average costs were lower for the study group, but no difference was statistically significant.

In analysis B, the average total cost was $13,294 for the study group and $18,601 for the control group. The difference was $5,308, (p=0.008).

The average variable costs were $5,889 for the study group and $8,515 for the control group. The difference was $2,626, (p=0.008).

The variable pharmacy costs were $1,227 for the study group and $1,702 for the control group. (p=0.104).
The variable radiology costs were statistically significantly lower in the study group ($233) than in the control group ($328). The difference was $95, (p=0.043).

In analysis C, the total costs were $16,106 in the study group and $13,294 in the control group.

The control group had a severity-adjusted variable cost of $7,355, compared with $5,889 in the study group. This represented a difference of $1,466 per patient over that for the study group.

The severity-adjusted variable pharmacy costs were $1,466 for the control group and $1,227 for the study group. This represented an increase of $239 per patient over that for the study group.

The variable radiology costs were $222 in the study group and $274 in the control group.

**Synthesis of costs and benefits**
No synthesis of the costs and the benefits was performed.

**Authors' conclusions**
The study demonstrated the financial benefits of an electronic system aimed at improving interventions involving antimicrobial agents, in terms of the reduced length of hospital stay, and the total costs, variable costs, and radiology costs.

**CRD COMMENTARY - Selection of comparators**
The usual practice of the manual processing of patients' microbiologic data was compared with the use of Thera Trac 2 software, to alert pharmacists of potential interventions, combined with additional education of the pharmacists. The authors justified their choice of the comparator on the grounds it was common practice. You should consider if this is the usual practice in your own setting.

**Validity of estimate of measure of effectiveness**
The analysis used a quasi-randomised design and the data were analysed in three different ways. However, the patients were randomised to the study or control group on the basis of the first letter of their surname. In all of the analyses, only the proportion of patients considered for intervention was analysed. This corresponded to only those patients who had interventions in analysis A, and only those with matching DRGs in analyses B and C. No power calculations were reported. The study and control groups in analysis A were shown not to be comparable in terms of age and HCFA weight, although these differences did not reach statistical significance. In analysis B, the number of patients in different DRG groups differed between the study and the control groups.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefit. The analysis was therefore categorised as a cost-consequences study.

**Validity of estimate of costs**
The costs of implementing the programme and necessary support were not considered in the analysis. All other relevant cost categories from the perspective of the hospital were analysed. Since all the costs were incurred over a five-month period, discounting was irrelevant and was not performed. The costs were reported in categories but no quantities of resource use were reported. The dates to which the costs related were not explicitly stated, thus making reflation exercises to other settings problematic. Statistical analyses were only conducted for the total costs.

**Other issues**
The authors made appropriate comparisons of their findings with those from other studies. They did not, however, address the issue of generalisability to other settings. No sensitivity analysis was carried out. The authors did not present their results selectively and their conclusions reflect the scope of the analysis.

**Implications of the study**
The authors state that, due to the encouraging results, the study was stopped in their hospital in order to provide the new intervention to all patients. "More studies involving more patients or a multicentre trial to confirm these findings would be ideal."

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