Outcomes of improved anaerobic techniques in clinical microbiology
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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
A programme for the improvement of anaerobic techniques in clinical microbiology was examined. The characteristics of the programme were:

- an anaerobic chamber;
- the use of anaerobic transport media and pre-reduced Brucella blood agar, phenylethyl alcohol agar, Bacteroides bile esculin agar biplate, and thioglycollate broth;
- education for technologists;
- intensive education on anaerobic cultures for practitioners; and
- strict adherence to improved guidelines from the literature for the work-up of anaerobes.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients providing acceptable samples, which consisted of aspirations and biopsies from sites with no anaerobic normal flora. Patients with anaerobes isolated from blood cultures were not included.

Setting
The setting was the clinical laboratory. The economic study was carried out at the Memorial Medical Center at Springfield (IL), USA.

Dates to which data relate
The effectiveness and resource use data were gathered from July to December 1998 in the control group and from January to June 1999 in the intervention group. The price year was not reported.

Source of effectiveness data
The effectiveness evidence was 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
Power calculations to determine the sample size were not performed. The two samples of patients were selected at the study centre over two different time periods, and were matched by diagnosis-related groups (DRG) after excluding those patients with a negative anaerobic culture. Initially, there were 86 DRG-matched patients in each study group. However, 12 length-of-stay outliers were further excluded from the control group and 10 were excluded from the intervention group. Therefore, the final sample comprised 150 patients. There were 74 patients in the control group and their mean age was 57.5 (+/- 16.7) years. There were 76 patients in the intervention group and their mean age was 47.1 (+/- 20.4) years.

Study design
This was a retrospective comparative study with a historical control, which was conducted in a single centre. The length of follow-up was not reported and no patient appears to have been lost to the final assessment. An open evaluation of the outcome was performed.

Analysis of effectiveness
It appears that all the patients included in the initial study sample (after excluding outliers) were accounted for in the effectiveness analysis. However, a secondary analysis, which also included outlier observations, was performed. The outcomes used in the study were the turnaround time, crude mortality rate and length of stay (LOS). In terms of baseline comparability, the control patients were significantly older than the intervention patients. A regression analysis was therefore performed to control for potential confounding factors (i.e. age and severity of disease). Disease severity was estimated using the Health Care Financial Authority (HCFA) weight, although this was not significantly different between the groups.

Effectiveness results
The average turnaround time was 124 (+/- 25) hours in the control patients and 107 (+/- 34) hours in the intervention patients, (p=0.001).

The crude mortality rate was 10.8% in the control group and 1.3% in the intervention group, (p=0.06).

The mean LOS was 10.2 (+/- 10) days in the control group and 8.8 (+/- 7.2) days in the intervention group, (p=0.91).

These trends favouring the intervention groups were even more apparent in the secondary analysis where outliers were considered. When calculations were performed to adjust for possible confounding such as age and HCFA weight, the crude mortality rate was 10.5% higher in the control group and the mean LOS was 0.5 days lower in the intervention group.

Clinical conclusions
The effectiveness evidence showed that the use of a programme for improved anaerobic techniques led to a significant reduction in turnaround time. It also suggested a (non significant) trend towards a reduction in the crude mortality rate in comparison with specimens that were analysed using the standard approach. No differences in hospital stay were observed.

Measure of benefits used in the economic analysis
The health outcomes were left disaggregated and no summary benefit measure was used in the economic analysis. Therefore, the study was classified as a cost-consequences analysis.

Direct costs
Discounting was not relevant since the costs were incurred during a short time. The unit costs and the quantities of
resources used were not presented separately. The health services in the economic evaluation were fixed and variable costs. Fixed costs were those such as overheads and administration. Variable costs related to supplies, radiological tests and laboratory tests (including anaerobe chamber and institution of bio-bags). The cost/resource boundary adopted in the study was not provided, but it was likely to have been that of the hospital. The authors stated that costs (not charges) were used. The costs were derived from the clinical data management team. Resource use was estimated using actual data coming from the sample of patients involved in the effectiveness analysis. The price year was not reported.

**Statistical analysis of costs**
Statistical tests were performed to estimate the significance of the difference in costs between the two groups. The type of tests used was not explicitly reported.

**Indirect Costs**
The indirect costs were not included in the economic evaluation.

**Currency**
US dollars ($).

**Sensitivity analysis**
Sensitivity analyses were not performed.

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

**Cost results**
The mean total costs were $15,384 (+/- 19,453) in the control group and $10,450 (+/- 8,659) in the intervention group, (p=0.18).

The mean variable costs were $6,865 (+/- 10,043) in the control group and $4,432 (+/- 3,901) in the intervention group, (p=0.21).

The mean laboratory costs were $723 (+/- 1,221) in the control group and $380 (+/- 479) in the intervention group, (p=0.08).

When outliers were included in the analysis, the difference in total costs between the intervention and control groups increased to $14,877.

These non significant reductions in costs among the intervention patients were observed when the general trend in all hospitalised patients identified at the Memorial Medical Center during the time of the study was towards an increase in costs and LOS.

The cost to achieve anaerobic conditions was about $0.09 per plate in the intervention group and $0.96 per plate in the control group.

The authors calculated that, by adding technologist time and subtracting the savings due to reductions in variable costs, the hospital laboratory would save about $632,705 annually.

**Synthesis of costs and benefits**
Not relevant as a cost-consequences analysis was performed.
Authors' conclusions
Compared with the standard approach for anaerobic cultures, the implementation of a programme for improved anaerobic testing led to shorter turnaround times and substantial cost-savings to the hospital.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator was clear. The new intervention was compared with the standard approach used before the introduction of the new programme. The content of the routine approach was described. You should decide whether it represents a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The basis of the analysis of effectiveness was a retrospective comparative study. The use of a prospectively designed study with random allocation of patients to the study groups would have been more appropriate for the study question. The main limitation to the internal validity of a retrospective comparative study was the potential impact of confounding factors. However, the authors performed appropriate regression analyses to account for the impact of some factors (age and severity of disease) that could affect the results of the analysis. The study sample was selected using wide inclusion criteria and is likely to have been representative of the study population.

A further drawback of the analysis was that there was no evidence that the sample size was appropriate and power calculations were not performed. Consequently, the study could have been underpowered to detect statistically significant differences in some of the outcome measures, such as the death rate, which failed to reach the critical value set for significance despite an apparent difference between the two groups of patients. The effectiveness analysis was also carried out considering those observations that were excluded in the primary analysis (outliers). Finally, details of the length of follow-up were not provided.

Validity of estimate of measure of benefit
No summary benefit measure was used in the analysis because a cost-consequences analysis was conducted.

Validity of estimate of costs
The authors did not explicitly state the perspective of the study. It appears to have been that of the hospital since the costs relevant to the clinical laboratory were considered. A detailed breakdown of the costs was not provided. The source of the cost data was reported. The price year was not given and the unit costs were not presented separately from the quantities of resources. Therefore, reflation exercises and replication of the study in other settings would be difficult. Statistical tests were carried out to assess the significance of the differences in total costs, but the types of tests used were not reported. The cost estimates were specific to the study setting and sensitivity analyses were not conducted.

Other issues
The authors did not compare their findings with those from other studies. They also did not address the issue of the generalisability of the study results to other settings. Sensitivity analyses were not performed and the overall external validity of the analysis was low.

Implications of the study
The study results suggested that a programme for improved anaerobic techniques in clinical microbiology might have a positive impact on the activity of the laboratory in terms of reductions in both the costs and turnaround time. However, the authors noted that patient care did not change substantially even though shorter turnaround times led to faster antibiotic prescribing, which, in turn, led to faster recovery.

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