Cost-effectiveness of ceftriaxone in the treatment of community-acquired pneumonia in adult hospital patients: a pharmaco-economic study based on a meta-analysis

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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 cephalosporin and amoxicillin/clavulanic acid regimens in the treatment of community acquired pneumonia (CAP).

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Adult patients with community acquired pneumonia.

Setting
Hospital. The economic analysis was conducted in Pretoria, Johannesburg and Gauteng, South Africa.

Dates to which data relate
Effectiveness and resource data were collected from literature published between 1984 and 1996. The price years used in the analysis were not stated.

Source of effectiveness data
Effectiveness data were derived from a review of previously published studies.

Outcomes assessed in the review
The outcomes assessed were clinical cure or improvement in patients with CAP.

Study designs and other criteria for inclusion in the review
Randomised controlled trials were included in the meta-analysis. Other inclusion criteria included a requirement for a clear diagnosis of CAP and more than one trial identified for each of the interventions in the analysis. In the case of amoxicillin/clavulanic acid, only one study was identified. However, the sample size was considered to be large enough (256 patients in each group) to warrant inclusion. Studies were excluded if they dealt with nosocomial pneumonia, bronchitis, immunosuppressed patients, paediatric patients only, or ambulatory treatment settings. Studies set in intensive care units were also excluded from the analysis.
Sources searched to identify primary studies
Medline and Internet databases were searched. Primarily English papers were assessed, although one German paper was also assessed.

Criteria used to ensure the validity of primary studies
Blinding was not considered to be necessary. No other criteria were stated.

Methods used to judge relevance and validity, and for extracting data
The number of reviewers used to assess the validity of primary studies was not stated. Summary statistics from individual studies were used in the meta-analysis.

Number of primary studies included
21 randomised controlled trials were identified in the literature review of which five passed the homogeneity test and were included in the meta-analysis.

Methods of combining primary studies
Meta-analysis. Success rates and number of treatment days were reported as the weighted aggregates of results from individual studies for each of the interventions.

Investigation of differences between primary studies
A chi-squared test for homogeneity with a significance level (alpha) of 5% was used with all data from each trial identified in the review to ensure that results were not trial dependent and could be combined in the meta-analysis.

Results of the review
Aggregate success rates for the four interventions were identified: ceftriaxone 92.9%; cefotaxime 85.7%; cefuroxime 87.3% and amoxicillin/clavulanic acid 85.9%. Odds ratios (ORs) were also calculated for every two way comparison and all of the ORs, including ceftriaxone, were approximately two indicating that the drug was twice as likely as the other interventions to have a favourable outcome.

Measure of benefits used in the economic analysis
The benefit measure was successfully treated patients.

Direct costs
Scenarios identified in the clinical trials were costed from the perspective of the patient/payer for healthcare services in South Africa. Costs estimated included drug costs, administration costs and hospital ward costs. The number of treatment days for different interventions were taken from the literature review. Costs were determined using South African private hospital prices and medical schemes rates of benefit. Discounting was not conducted as costs occurred over a short period of time. The price years used were not stated. Costs of adverse events were not included in the analysis.

Indirect Costs
Not estimated.

Currency
South African Rands (R).
**Sensitivity analysis**
Success rates, ward costs and number of treatment days for comparator interventions were varied in a sensitivity analysis using best possible estimates. Oral treatment was assumed not to require hospitalisation and estimates for ceftriaxone were not varied in the sensitivity analysis.

**Estimated benefits used in the economic analysis**
Success rates were as follows: ceftriaxone 92.9%; cefotaxime 85.7%; cefuroxime 87.3% and amoxicillin/clavulanic acid 85.9%.

**Cost results**
Costs per course of treatment for the four interventions were ceftriaxone R3,290.67, cefotaxime R5,403.90, cefuroxime R4,244.33 and amoxicillin/clavulanic acid R4,003.02.

**Synthesis of costs and benefits**
The average costs per successfully treated patient in the four groups respectively were ceftriaxone R3,543.80, cefotaxime R6,305.60, cefuroxime R4,861.78 and amoxicillin/clavulanic acid R4,658.06 respectively. Ceftriaxone remained dominant over the other interventions in sensitivity analysis except when it was assumed that oral therapy would not require hospitalisation. In that case both cefuroxime and amoxicillin/clavulanic acid regimens were more cost-effective.

**Authors' conclusions**
The authors concluded that ceftriaxone was the most cost-effective of the four interventions for the treatment of CAP in adult patients within a hospital setting, in spite of the fact that the drug acquisition costs were much higher than for the older interventions, cefuroxime and amoxicillin/clavulanic acid. These interventions would, however, be the most cost-effective if oral therapy could be administered outside the hospital, although the validity of this assumption was thought to be debatable. The authors also concluded that it is important, when making comparisons of drugs, to include all hidden costs before making decisions about which intervention to adopt.

**CRD COMMENTARY - Selection of comparators**
A justification was given for the comparators used. All interventions were included within guidelines for the treatment of CAP in South Africa.

**Validity of estimate of measure of benefit**
The estimates of benefits were based on a systematic literature review and meta-analysis, reducing the possibility of bias. The authors themselves noted that the review was predominantly of English language papers and it is not clear whether papers published in languages other than English and German were excluded from the analysis. It would also be useful to know which Internet search engines were used to supplement the publications found from searching MEDLINE.

**Validity of estimate of costs**
Although the authors stated that costs were estimated for different scenarios appearing in the meta-analysis, it would have been helpful to have more information on how these costs were estimated. In addition, the base price year used does not appear to be stated. The authors noted that the study was limited as costs of treatment failure, drug preparation and nursing time were not included. In addition it would also be useful, in further analysis, to include costs to others in society such as patients and caregivers.
Other issues
The results of this study may not be generalisable to settings outside South Africa and further studies are required to
determine if oral regimens for older therapies can be administered outside the hospital setting.

Implications of the study
Further prospective economic evaluations and trials are required to identify all costs and benefits associated with these
antibiotic therapies.

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pneumonia in adult hospital patients: a pharmaco-economic study based on a meta-analysis. South African Medical
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Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Amoxicillin-Potassium Clavulanate Combination /economics /therapeutic use; Cefotaxime /economics
/therapeutic use; Ceftriaxone /economics /therapeutic use; Cefuroxime /economics /therapeutic use; Cephalosporins
/economics /therapeutic use; Community-Acquired Infections /drug therapy; Cost-Benefit Analysis; Drug
Administration Schedule; Drug Therapy, Combination /economics /therapeutic use; Hospital Costs; Humans; Infant;
Length of Stay; Odds Ratio; Pneumonia, Bacterial /drug therapy; Retrospective Studies; South Africa; Treatment
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