Pharmacoeconomic evaluation of alternative antibiotic regimens in hospitalized patients with community-acquired pneumonia

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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
Intravenous antibiotic monotherapy for hospitalised patients with community acquired pneumonia (CAP).

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Hypothetical patients requiring treatment for CAP

Setting
Hospital. The economic analysis was conducted in Hartford, Connecticut, USA.

Dates to which data relate
Data for the effectiveness analysis were taken from the literature, of which only one study, from 1997, was specifically cited, and also from product package inserts from 1997. Information on resources used was taken from hospital practice, although the dates were not stated. In addition, further resource information on the consequences of adverse drug events was taken from a study published in 1997. Prices used do not appear to be reported.

Source of effectiveness data
Effectiveness data were taken from a review of the literature and information on package inserts.

Modelling
A decision tree model was used by the authors to combine effectiveness probabilities and costs in order to determine the cost effectiveness of the three interventions.

Outcomes assessed in the review
The rates of adverse drug events, probability of discontinuation due to adverse drug events and success rates were identified from published literature and also from package inserts.

Study designs and other criteria for inclusion in the review
Not specified.
Sources searched to identify primary studies
Not specified.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
Only one primary study, a multi-centre randomised clinical trial of levofloxacin was identified by the authors, although information on effectiveness and adverse events associated with azithromycin was taken from package inserts. It is not clear where the probability of adverse events and rate of discontinuation for the combination therapy group were taken from.

Results of the review
The results for the azithromycin, cefuroxime/erythromycin and levofloxacin groups were:

probability of adverse drug events, 0.065-0.169, 0.085-0.170 and 0.058-0.062;
probabilities of discontinuation due to adverse events, 0.014-0.024, 0.134 and 0.47;
probability of successful treatment, 0.770-0.890, 0.740-0.900 and 0.930-0.970.

Measure of benefits used in the economic analysis
The benefit measure was pneumonia cures obtained.

Direct costs
Costs were determined from the perspective of the study hospital and specifically costs associated with drug acquisition and medical supplies and preparation for intravenous therapy were estimated. The cost of adverse events was taken from a 1997 study published in the literature. Costs following patients switching to an alternative therapy were also estimated. Costs were not discounted in the analysis, and the duration of treatment was 6 days for successful treatment. The price years used in the analysis were not stated.

Indirect Costs
Not included.

Currency
US dollars ($).

Sensitivity analysis
A Monte Carlo analysis was conducted on all variables where estimates were made or specific data were not available. Specifically 2,000 iterations were run varying adverse drug event treatment costs, and the probability of clinical events.
Estimated benefits used in the economic analysis
Cure rates were not reported by the authors and only success rate ranges obtained from the medical literature were given (see Results of Review section).

Cost results
Drug costs for the three regimens were as follows:

- azithromycin (500mg IV q24h x 4 days followed by 500 mg PO qd x 2 days) $70.76;
- cefuroxime (750 mg IV q8h) & erythromycin (500 mg IV q6h x 4 days) followed by clarithromycin (500 mg PO bid x 2 days) $72.48; and
- levofloxacin (500 mg IV q24h x 4 days followed by 500 mg PO qd x 2 days) $116.

Supply costs for the three interventions were $9.36 (azithromycin), $65.52 (cefuroxime/erythromycin) and $9.36 (levofloxacin) and similarly the costs of discontinuation were $101, $101 and $159 respectively. The costs of failure after adverse drug events were estimated to be $141, $141 and $159 and costs of failure after initial therapy were $121, $121 and $159 respectively. Costs of adverse events were varied between 0 and $2,013, which represented the mean cost in the published study.

Synthesis of costs and benefits
The cost per pneumonia cure were $228 (95% CI: $224 - $232) for the azithromycin group, $323 (95% CI: $320 - $326) for the erythromycin/cefuroxime group and $208 (95% CI: $206 - $210) for the levofloxacin group. Using sensitivity analysis the most sensitive parameter was found to be the estimate of the cost of treatment adverse events: when this fell below $650, azithromycin therapy became the most cost-effective option. In all cases the two newer treatment options, azithromycin and levofloxacin, were favourable compared with the combination therapy intervention.

Authors' conclusions
The authors, whilst recognising the limitations of their analysis due to the lack of data and the difficulty in generalising the results, concluded that, under all scenarios, the two newer interventions were more effective than the existing combination treatment option and would have reduced the costs of treatment for 200 patients treated for CAP within their institution in 1996 by $19,102 to $22,956. The authors also noted the importance of including adverse events in any analysis, as this had an impact on the determination of the most cost-effective intervention.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparator used. Combination therapy for CAP using cefuroxime/erythromycin was a common treatment protocol within the study institution.

Validity of estimate of measure of benefit
The estimate of clinical effectiveness and likelihood of adverse events were taken from a single randomised controlled trial identified from the literature, together with information taken from product package inserts. The authors do not state the methods used to search the literature for relevant studies in the analysis which may have limited the number of studies identified.

Validity of estimate of costs
Estimates of costs were based on data acquired from the study institution. However, it is unclear as to how, specifically, these data were determined. The authors also do not appear to have included a price year for costs used. Direct costs were estimated from the perspective of the institution and did not include costs to others in society which may also be
Other issues
As noted by the authors, it is difficult to generalise the results of this study to other scenarios because of the limited nature of the effectiveness information and the reliance upon costs estimates within the study hospital. This analysis was based on the use of a decision tree model and there is also a need for well designed randomised controlled trials and economic evaluations to be conducted to examine further the use of different interventions for the treatment of CAP.

Implications of the study
There is a need for well designed economic evaluations of interventions of CAP to be conducted in different settings to examine further the conclusions reached by this analysis.

Source of funding
None stated.

Bibliographic details

Indexing Status
Subject indexing assigned by CRD

MeSH
Anti-Bacterial Agents /adverse effects /therapeutic use; Azithromycin /drug therapy /economics; Cefuroxime /drug therapy /economics; Community-Acquired Infections /drug therapy /economics; Cost-Benefit Analysis; Decision trees; Erythromycin /drug therapy /economics; Hospitalization; Ofloxacin /drug therapy /economics; Pneumonia /economics; Pneumonia, Bacterial /drug therapy; Treatment Outcome

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