Cost-effectiveness analysis of treatment options for acute otitis media
Coco A S

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 study compared four strategies for the treatment of acute otitis media (AOM). The strategies were:

- watchful waiting, involving 72 hours of observation of possible symptom recession before administering amoxicillin;
- delayed prescription (DP), patients return to the office for a prescription of amoxicillin in the case that symptoms continue for 48 to 72 hours;
- routine antibiotic treatment with 5 days of amoxicillin; and
- routine antibiotic treatment with 7 to 10 days of amoxicillin.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised children aged between 6 months and 12 years with uncomplicated sporadic AOM who had not been administered antibiotics during the previous month, or for whom it was documented that a previous episode of AOM treated with antibiotics during the last month had recessed.

Setting
The setting was primary care. The economic analysis was carried out in the USA.

Dates to which data relate
The effectiveness data were obtained from studies published between 1979 and 2005. The resource use and cost data were derived from sources published between 1997 and 2003. The price year was 2001.

Source of effectiveness data
The clinical parameters associated with the various treatments included:

- the probability of mastoiditis,
- non-attendance,
- clinical failure with and without attendance, and
Modelling
A decision analytic model was constructed to compare the short-term outcomes and cost-utilities of the four treatment strategies. Health states, model parameters and their sources, as well as a number of modelling assumptions, were presented in full. A graphical representation of the model structure was provided.

Sources searched to identify primary studies
The data on the effectiveness of the antibiotic strategies were derived from a published meta-analysis. The probabilities of adverse events were mainly derived from a pragmatic randomised controlled trial, a randomised double-blind trial and a clinical trial. However, the design of the study reported in Ruben et al. 1999 was not clear. The probabilities of developing mastoiditis were based on national statistics, while non-attendance rates were based on official national data augmented with data from a cross-national study and a clinical trial. Clinical failure data were mainly obtained from randomised controlled trials and a cross-national study.

Methods used to judge relevance and validity, and for extracting data
The search methods used to identify the primary studies were not reported. No inclusion criteria for any parameters were specified. The methods used to select the estimates for the model were not presented.

Measure of benefits used in the economic analysis
The author used quality-adjusted life-years (QALYs) as the measure of benefit in the economic analysis. Quality of life weights were derived from the published cost-utility analysis (Oh et al. 1996, see 'Other Publications of Related Interest' below for bibliographic details). The utility values and calculations used to generate QALYs were reported in full.

Direct costs
The health service costs were included in the analysis. These covered antibiotics, the treatment of mastoiditis (including hospitalisation, medication, outpatient costs) and outpatient consultations. The study accounted for non health-care costs such as babysitting, day care, travelling expenses, parking and further costs (not described in detail) related to an episode of simple AOM. The unit costs and the resource quantities were not reported separately, although the unit costs were presented. The costs reported appear to have been the average costs per patient. The costs were derived from official published sources. In line with the societal perspective adopted in the analysis, the author used a cost-to-charge ratio for adjusting hospitalisation charges in order to reflect true costs. Discounting was not relevant and all costs were appropriately adjusted using the medical component of the US Consumer Price Index. The costs were reported for the price year 2001.

Statistical analysis of costs
The author calculated the 95% confidence interval (CI) for all model parameters.

Indirect Costs
Productivity losses due to work loss were included in the analysis. The costs were derived from official published sources, whereas the author made relevant assumptions about resource use. The costs were appropriately adjusted for inflation and reported for the year 2001.

Currency
US dollars ($).
Sensitivity analysis
Parameter uncertainty was investigated through one-way sensitivity analyses on all model parameters. All parameters were varied over their 95% CIs, while cost data were varied from -50% to +200%. Parameter uncertainty was further investigated through a probabilistic sensitivity analysis. All parameters in the model were assigned prior probability distributions, which were reported. The author conducted 100,000 iterations and computed 95% likelihood comparisons of the strategies.

Estimated benefits used in the economic analysis
The mean QALYs were 0.99460 for DP, 0.99472 for watchful waiting, 0.99501 for routine antibiotic treatment (7 to 10 days) and 0.99487 for routine antibiotic treatment (5 days).

Cost results
The mean cost per patient was $132.40 for DP, $146.0 for watchful waiting, $155.30 for routine antibiotic treatment (7 to 10 days) and $156.90 for routine antibiotic treatment (5 days).

Synthesis of costs and benefits
An incremental cost-effectiveness analysis was performed.

Routine antibiotic treatment resulted in an incremental cost-utility ratio (ICUR) of $55,853 per QALY gained compared with DP. Watchful waiting and a 5-day course of antibiotic treatment were dominated.

One-way sensitivity analyses demonstrated that the ICUR of 7 to 10 days' antibiotic treatment, compared with DP, was sensitive to variations in the costs of amoxicillin, non-health care, office consultation and work loss. Variation in the costs of office consultation resulted in an ICUR of between $43,300 and $85,600 per QALY gained. The results were also sensitive to variation in the probabilities of clinical failure and non-attendance of routine amoxicillin, GI adverse event, non-attendance and prescription redemption in DP, and the utility value of one day of treatment failure.

The probabilistic sensitivity analysis demonstrated that, with 95% certainty, 7 to 10 days' antibiotic treatment had a 39% chance of producing an ICUR below $50,000 per QALY gained compared with DP, watchful waiting had a 23% chance, and 5 days' amoxicillin a 17% chance. Watchful waiting had a 17% chance of being dominated by DP.

Authors' conclusions
From an economic point of view, both the delayed prescription (DP) strategy and the routine amoxicillin strategy (7- to 10-day course) could be considered as rational alternatives. Antibiotic treatment resulted in higher benefits but at a significant cost, while DP was shown to be the least costly strategy.

CRD COMMENTARY - Selection of comparators
The choice of the comparators was justified with reference to the medical literature and clinical guidelines in the USA. Antibiotic treatment would appear to represent the most commonly used strategy in the author's setting. You should decide if the technologies compared represent valid health technologies in your own setting.

Validity of estimate of measure of effectiveness
The parameters of the model were derived from published literature. The author did not report a systematic search of the literature. It was clear from the model inputs that some synthesis of the study results had taken place, but no details of the methods used were provided. However, the author calculated 95% CIs for all input parameters. The author did not report any search methods or inclusion criteria, nor did he provide any justification for the selection of the estimates. However, antibiotic treatment effect parameters were obtained from a published meta-analysis, which potentially has the greatest level of internal validity. Further input parameters were derived from randomised controlled trials, but it is not possible to judge the validity of the data given the level of information reported in the current paper.
Validity of estimate of measure of benefit
The author used QALYs as the measure of benefit in the economic analysis. Quality of life weights were derived from the published cost-utility analysis. The utility values and calculations used to generate QALYs were reported in full.

Validity of estimate of costs
The analysis of the costs was conducted from a societal perspective. As such, it appears that all the relevant categories of costs have been included in the analysis. The unit costs were adequately described and dated. The costs and the quantities were calculated separately but were not reported separately in the paper. Since the author only reported summary aggregated costs for the treatment of mastoiditis, it is not possible to know which aspects of the costs were included in this category (professional costs, overheads etc.); this may limit the replication of the analysis in other settings. The author appropriately used a cost-to-charge ratio for adjusting hospitalisation charges in order to reflect true costs. Uncertainty surrounding the cost estimates was investigated in a sensitivity analysis, which enhances the generalisability of the results to other settings. The costs were appropriately adjusted for inflation and the price year was reported.

Other issues
The author compared his study with previous studies, providing a balanced discussion on the methodological differences between them. The issue of the generalisability of the results to other settings was not directly addressed, although extensive sensitivity analyses were conducted to assess the robustness of the results. Although the author did not present their sensitivity analysis in full detail, the results do not appear to have been presented. However, the interpretation of the results could have been further enhanced by plotting cost-effectiveness acceptability curves.

The author discussed a number of limitations to the study. First, the parameter to which results were most sensitive (i.e. the non-attendance rate in the DP option), was derived from the only study available. Second, the utility values were based on expert opinion as it was difficult to derive children's preferences for various health states. Third, one of the most important implications of antibiotic treatment, increase of antibiotic resistance, cannot be quantified. The author strongly suggested that expanded use of DP would significantly restrict antibiotic resistance, owing to the high incidence of AOM among children.

Implications of the study
The author did not make explicit recommendations for changes in policy or practice. Although routine amoxicillin treatment for 7 to 10 days proved to be most beneficial, the authors strongly endorsed the use of the DP strategy due to the fact that AOM is basically a self-limiting acute upper respiratory infection and due to the possible impact of DP in deteriorating antibiotic resistance in the population. The author made no recommendations for further research.

Source of funding
Funding received from the Lancaster General Hospital and the American Academy of Family Practice.

Bibliographic details

PubMedID
17261862

DOI
10.1370/afm.626

Other publications of related interest
Because readers are likely to encounter and assess individual publications, NHS EED abstracts reflect the original
publication as it is written, as a stand-alone paper. Where NHS EED abstractors are able to identify positively that a
publication is significantly linked to or informed by other publications, these will be referenced in the text of the
abstract and their bibliographic details recorded here for information.


**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Acute Disease; Amoxicillin /economics /therapeutic use; Anti-Bacterial Agents /economics /therapeutic use; Child;
Child, Preschool; Cost of Illness; Cost-Benefit Analysis; Decision Support Techniques; Humans; Infant; Netherlands;
Otitis Media /drug therapy /economics; Quality-Adjusted Life Years; United States

**AccessionNumber**
22007000464

**Date bibliographic record published**
31/10/2007

**Date abstract record published**
31/10/2007