Antibiotic prophylaxis for haematogenous bacterial arthritis in patients with joint disease: a cost effectiveness analysis

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
Antibiotic prophylaxis for haematogenous bacterial arthritis in patients with joint disease.

Type of intervention
Primary prevention.

Economic study type
Cost-utility analysis.

Study population
A 60-year-old man with joint disease, confronted with an event posing a risk of haematogenous bacterial arthritis.

Setting
The study setting was hospital. The economic study was carried out in The Netherlands.

Dates to which data relate
Effectiveness and resource use data were collected from studies published between 1960 and 1997. Cost data were taken from a survey of patients and a 1994 source. The price year was 1994.

Source of effectiveness data
Effectiveness data were derived from a review of the literature.

Modelling
A one-year decision tree was used to model the cost-effectiveness of antibiotic prophylaxis. A logistic regression analysis was also used to relate bacterial arthritis to patient characteristics.

Outcomes assessed in the review
The review assessed the risk of bacterial arthritis, efficacy of prophylaxis, risk of reaction to prophylaxis, and health state utilities.

Study designs and other criteria for inclusion in the review
Most effectiveness estimates were taken from a prospective Dutch study.
Sources searched to identify primary studies
Not stated.

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

Methods used to judge relevance and validity, and for extracting data
Summary statistics from individual studies were used.

Number of primary studies included
At least 23 studies were included in the review.

Methods of combining primary studies
The narrative method was used to combine primary studies.

Investigation of differences between primary studies
Not stated.

Results of the review
The results of the review were as follows:

The efficacy of prophylaxis was taken to be 90%.

The risk of a severe, non-fatal reaction to prophylaxis was 0.01%.

The risk of a fatal reaction to prophylaxis was 0.002%.

Life expectancy was 17.84 years for a 60-year-old man.

The risk of bacterial arthritis related mortality was 20% (95% CI: 10 - 30) and the risk of major loss of joint function was 40% (95% CI: 25 - 55).

An 'impaired' state carried a utility of 0.75.

Severe non-fatal side effects of antibiotics caused a loss of 4 quality adjusted life days (QALDs).

The data formed the principal input parameters for the decision tree.

Measure of benefits used in the economic analysis
QALDs were used as the measure of benefit. Utility values were derived using the EuroQol questionnaire. Patients’ values were used to value health states.

Direct costs
Direct costs were, appropriately, not discounted (time horizon = 1 year). Quantities and costs were reported separately. Direct costs reflected all medical costs for the first year after diagnosis of bacterial arthritis (costs of hospital stay and medical treatment, cost of physiotherapy, and cost of stay in a rehabilitation clinic or nursing home). The quantity/cost boundary adopted was that of the health service. The estimation of quantities and costs was based on actual data. Costs and quantities were taken from a survey of 37 patients with bacterial arthritis and a published source. The price year
was 1994.

**Statistical analysis of costs**

No statistical analysis was carried out.

**Indirect Costs**

Indirect costs were not included.

**Currency**

Dutch guilders (Dfl) with Dfl 1 = $ 0.60.

**Sensitivity analysis**

Sensitivity analyses to assess the impact of assumptions were conducted on all model parameters. The sensitivity analyses addressed three questions:

- for which risk situation is there certainty about the relative effectiveness of prophylaxis?
- which factors in the model have a relevant effect on the cost-effectiveness estimates; and
- what is the effect of age and sex on the cost-effectiveness estimates?

**Estimated benefits used in the economic analysis**

The risk of bacterial arthritis was 0.13% after a dermal infection (95% CI: 0.05 - 0.21), 0.02% after a low risk infection (95% CI: 0.0004 - 0.04), and 0.005% after an invasive medical procedure (95% CI: 0 - 0.03).

The patient's susceptibility to bacterial arthritis was related to the presence of a knee or hip prosthesis (coefficient = 1.9; 95% CI: 1.2 - 2.6), a diagnosis of rheumatoid arthritis (coefficient = 1.4; 95% CI: 0.6 - 2.1), comorbidity (coefficient = 1.3; 95% CI: 0.4 - 2.2), and age of 80 and over (coefficient = 1.1; 95% CI: 0.3 - 2.0).

Prophylaxis was more effective for dermal infections, infections of the urinary tract or respiratory tract if the patient's susceptibility was increased, and invasive medical procedures only if the patient's susceptibility was moderate or high.

The benefits of prophylaxis ranged from 0.4 to 35 QALDs for dermal infections, from -0.07 to 3.39 QALDs for infections of the urinary tract or respiratory tract, and from -0.11 to 0.91 for an invasive medical procedure.

**Cost results**

The difference in costs (prophylaxis minus no prophylaxis) ranged from $56 to $-237 for dermal infections, from $59 to $-31 for infections of the urinary tract or respiratory tract, and from $12.10 to $3.20 for an invasive medical procedure.

**Synthesis of costs and benefits**

The marginal cost-effectiveness ranged from $52,000 to $3,300 per quality adjusted life year (QALY) for dermal infections. For patients with high susceptibility, prophylaxis dominated (more effective and less costly).

The marginal cost-effectiveness ranged from $550,000 to $3,300 per QALY for infections of the urinary tract or respiratory tract. For patients with low susceptibility, no prophylaxis dominated.

The marginal cost-effectiveness ranged from $1,000,000 to $1,300 per QALY for an invasive medical procedure. For patients with low susceptibility, no prophylaxis dominated.
The sensitivity analyses showed that the risk of bacterial arthritis, the efficacy and cost of prophylaxis influenced these results.

Authors' conclusions
Prophylaxis seems to be indicated only for dermal infections, and for infections of the urinary and respiratory tract in patients with increased susceptibility to bacterial arthritis. Prophylaxis for invasive medical procedures may only be indicated for patients with joint diseases who are highly susceptible.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparators used, namely no antibiotic prophylaxis. You, as a user of the database, should decide if these health technologies are relevant to your setting.

Validity of estimate of measure of effectiveness
The authors noted the paucity of data on effectiveness in the literature and therefore the data source appears to be limited. It was not clear, however, whether a systematic review of the literature had been undertaken. More information about the design of the review and the method of pooling primary effectiveness estimates could have been reported. However, the authors undertook good sensitivity analyses to address these limitations. The authors justified their method approach, modelling, because of the unfeasibility of randomised controlled trials (RCTs) (due to the low prevalence of bacterial arthritis).

Validity of estimate of measure of benefit
The estimation of benefits was, appropriately, modelled. The instrument used to derive a measure of health benefit, the EuroQol questionnaire, was appropriate.

Validity of estimate of costs
Good features of the cost analysis were that all relevant direct cost categories were included, quantities and costs were reported separately and the price year was reported. The methods used to derive resource use and cost data (actual patients plus literature sources) appear to be valid.

Other issues
The authors did make appropriate comparisons of their findings with those from other studies but did not address the issue of generalisability to other settings. The authors did not present their results selectively. The study considered 60-year-old men with joint disease and this was reflected in the authors' conclusions. Considering the age and chronic disease of patients, indirect costs due to bacterial arthritis were not included, which seems to be appropriate for those already in retirement. The time perspective of the study was limited to only one year.

Implications of the study
Prophylaxis seems to be indicated only for dermal infections, and for infections of the urinary and respiratory tract in patients with increased susceptibility to bacterial arthritis. Prophylaxis for invasive medical procedures may only be indicated for patients with joint diseases who are highly susceptible. Modelling this question appears to be the most appropriate approach due to the unfeasibility of conducting RCTs in rare diseases.

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