Cost-effectiveness of treatment options for prevention of rheumatic heart disease from group A streptococcal pharyngitis in a pediatric population

Ehrlich J E, Demopoulos B P, Daniel K R, Ricarte M C, Glied 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
Five strategies to prevent rheumatic heart disease (RHD) in paediatric patients with suspected group A streptococcal (GAS) pharyngitis were examined. The strategies were:

"treat all" of the patients presenting with pharyngitis;

"treat none" of the patients presenting with pharyngitis;

perform an antigen test to all patients presenting with pharyngitis and treat only those patients with positive antigen test results ("rapid test");

perform a throat culture on all patients presenting with pharyngitis and treat only those patients with positive culture results by telephone ("culture");

perform a "rapid test" on all patients presenting with pharyngitis and treat those patients with positive "rapid test" results at the office visit, and perform a throat culture on those patients with negative "rapid tests" and treat those with positive culture results by telephone ("rapid test with culture").

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised children aged between 5 and 17 years in the USA.

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

Dates to which data relate
The effectiveness data were derived from studies published between 1951 and 1999. The resource use date and price year were not reported.

Source of effectiveness data
The effectiveness data were derived from a synthesis of completed studies.
Modelling
A decision tree model was used to determine the cost-effectiveness of treatment options for RHD in a paediatric population. The model compared five strategies:

"treat all" of the patients presenting with pharyngitis;
"treat none";
perform an antigen test on all patients presenting with pharyngitis and treat those with a positive result ("rapid test");
perform a throat culture on all patients presenting with pharyngitis and treat only those patients with positive results by telephone ("culture"); and
perform a "rapid test" on all patients presenting with pharyngitis and treat those patients with positive results at the office, and perform a throat culture on those patients with negative rapid tests and treat those with positive culture results by telephone ("rapid test with culture").

Outcomes assessed in the review
The following outcomes were assessed in the review and used as inputs in the economic evaluation:

the proportion of children with GAS as a cause of sore throat;
the incidence of GAS in children aged from 5 to 17 years old;
the sensitivity and specificity of culture in detecting GAS;
the sensitivity and specificity of antigen tests;
the rate of suppurative complications;
the rate of rheumatic fever;
serious rheumatic sequelae;
the probability of penicillin failure; and
the provider's resource cost for culture, rapid test, treatment and complications.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Not reported.

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

Methods used to judge relevance and validity, and for extracting data
Not reported.
Number of primary studies included
Approximately 14 studies were included in the review.

Methods of combining primary studies
The method of combining the primary studies was not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
The proportion of children with GAS as a cause of sore throat ranged from 20 to 30%;
the incidence of GAS in children aged from 5 to 17 years old was 0.20;
the sensitivity of culture in detecting GAS was 0.90 and the specificity was 0.99;
the sensitivity of antigen tests was 0.80 and the specificity was 0.99;
the rate of suppurative complications was 0.005;
the rate of rheumatic fever was 0.004;
serious rheumatic sequelae was 0.038; and
the probability of penicillin failure was 0.30.

Measure of benefits used in the economic analysis
The measure of effectiveness used in the economic analysis was the number of cases of RHD prevented in 5 million children presenting with pharyngitis annually.

Direct costs
The costs were not discounted. However, the relevance of this was unclear, as it was not stated when the costs of treating complications were incurred. The quantities and the costs were not analysed separately, and it was unclear which resources were included when calculating the costs. The costs were estimated using actual data from the New York City hospital microbiology laboratories (throat culture) and the Children's Hospital of Philadelphia (treatment of complications). The price and cost dates were not reported. The costs of the different strategies in the economic analysis were calculated per 5 million children presenting with pharyngitis annually.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
No indirect costs were reported.

Currency
US dollars ($).
Sensitivity analysis
A sensitivity analysis was carried out on the sensitivity and specificity of the "rapid test", and the effectiveness of oral antibiotic therapy. Parameter uncertainty was investigated. The type of analysis used was not explicitly reported, but it can be inferred to have been either a one-way or two-way sensitivity analysis.

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

Cost results
The total costs of the different strategies were:

- $39 million per study population (5 million children annually) with "treat none";
- $211.8 million per study population with "treat all";
- $100.8 million per study population with "rapid test";
- $252.1 million per study population with "culture"; and
- $269.7 million per study population with "rapid test with culture".

Synthesis of costs and benefits
The estimated costs and benefits were combined as the cost per case of RHD prevented. No incremental analysis was performed. The cost per case prevented was:

- not stated for "treat none", as no case was prevented with this strategy;
- $2 million with "treat all";
- $1.9 million with "rapid test";
- $2.63 million with "culture"; and
- $2.54 million with "rapid test with culture".

The ranking of the four strategies relative to each other does not change as the effectiveness of the oral antibiotic increases. The sensitivity value stated for "rapid test" was very conservative, and, when higher values were used the "rapid test" strategies performed better.

Authors' conclusions
The authors concluded "the most cost effective method of reducing the incidence of RHD (rheumatic heart disease) in a paediatric population presenting with pharyngitis potentially caused by a GAS (group A streptococcal) infection is the rapid antigen test with concomitant antibiotic treatment without the use of any confirmatory culture".

CRD COMMENTARY - Selection of comparators
A justification was given for the comparators used. The throat culture test is recommended by the American Heart Association and Paediatric Committee on Infection Diseases to confirm negative rapid tests. No justification was given for the "treat all" or "treat none" strategies. You should decide if they represent valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature had been undertaken. There were no details of whether or how the studies were combined. The studies used were not compared. In addition, the authors appear to have used the data from the available studies selectively. Hence, there is a high probability of bias in the results. The approach adopted hinders the overall internal validity of the effectiveness.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefit. The measure of effectiveness used in the economic evaluation was the number of cases of RHD prevented. The authors stated that a societal perspective was adopted, but a wider type of benefit measure might have been more appropriate than the effectiveness measure used.

**Validity of estimate of costs**
The indirect costs were not included, even though the authors reported adopting a societal perspective. The authors affirm that productivity losses and reduced disease transmission were beyond the scope of the analysis. Moreover, the costs and the quantities were not reported separately. Therefore, it was unclear whether all the relevant categories of costs were included in the analysis. It was also unclear as to whether these could affected the authors’ conclusions. The price year was not stated and this, in conjunction with the other limitations in terms of the costs, would limit the generalisability of the cost results to other settings. Finally, no statistical analysis of the costs was performed.

**Other issues**
The authors did not make appropriate comparisons of their findings with those from other studies. The issue of generalisability to other settings was not addressed. However, the authors did report some limitations of their study. First, that patients who are GAS carriers cannot be distinguished clinically from those who are truly infected. This assumption, according to the authors, reflects current practice. Second, the analysis focused more on assessing the reduction in RHD rather than the reduction in suppurative complications of rheumatic fever. Finally, according to the authors this analysis should not be applied to those rare patients with a personal or family history of rheumatic fever, as this population is at special risk.

**Implications of the study**
The authors concluded that the most cost-effective method of reducing the incidence of RHD in a paediatric population presenting with pharyngitis potentially caused by GAS infection is the rapid antigen test with concomitant antibiotic treatment, without the use of any confirmatory culture. Moreover, over the last 20 years, with the emergence of more sensitive rapid test technology, throat cultures used in the management of endemic GAS pharyngitis have provided less useful information at an increasing expense.

**Source of funding**
None stated.

**Bibliographic details**

**PubMedID**
12202067

**Other publications of related interest**


**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Adolescent; Child; Child, Preschool; Cost-Benefit Analysis; Decision Trees; Humans; Latex Fixation Tests; Penicillins /therapeutic use; Pharyngitis /complications /drug therapy /economics; Rheumatic Heart Disease /economics /etiology /prevention & control; Streptococcal Infections /complications /drug therapy /economics; Streptococcus pyogenes /isolation & purification; United States

**AccessionNumber**
22002008280

**Date bibliographic record published**
31/03/2004

**Date abstract record published**
31/03/2004