Cost effectiveness of heptavalent pneumococcal conjugate vaccine in populations of high risk in Colombia

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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.

CRD summary
The objective was to determine the cost-effectiveness of the introduction of a heptavalent pneumococcal conjugate vaccine (serotypes 4, 23F, 6B, 19F, 18C, 14, and 9V) against pneumococcal disease in a high-risk infant population. The authors concluded that the introduction of a heptavalent pneumococcal conjugate vaccine in Colombia was very cost-effective. The methods were poorly reported, which makes it difficult to determine if the results are reliable and if the conclusions are appropriate.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to determine the cost-effectiveness of the introduction of a heptavalent pneumococcal conjugate vaccine (PCV7), against pneumococcal disease in a high-risk population.

Interventions
A vaccination programme for children at high risk of pneumococcal disease, defined as under two years old and with a low birth weight of less than 2.5kg, was compared with no vaccination. The vaccination programme consisted of three doses of vaccine against serotypes 4, 23F, 6B, 19F, 18C, 14, and 9V.

Location/setting
Colombia/primary and secondary care.

Methods
Analytical approach:
The authors constructed a decision-tree model of the likelihood of getting invasive pneumococcal disease, meningitis, pneumonia, or otitis media, with or without vaccination, and the likelihood of dying from each of these diseases. The time horizon was lifetime, with disease assumed to occur within one year of vaccination. The authors stated that a third-party payer perspective was adopted.

Effectiveness data:
The efficacy of the PCV7 came from two clinical trials (Black, et al. 2000 and Black, et al. 2002, see 'Other Publications of Related Interest' below for bibliographic details). The authors stated that no adjustment was made for the distribution of specific serotypes in Colombia. The incidence rates for pneumococcal diseases were from predominantly Latin American published studies in children with normal weight. They were adjusted to represent children with low birth weight by doubling them, based on a Danish population-based cohort study (Mahon, et al. 2007, see 'Other Publications of Related Interest' below for bibliographic details). The demographic data and vaccination coverage rate were assumed by the authors.

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
The measure of benefit was life-years and an annual discount rate of 3% was applied. The number of disease events
avoided (cases or deaths) was reported.

Cost data:
The categories of costs included vaccination (acquisition and administration) and the treatment of invasive pneumococcal diseases (meningitis, clinically-diagnosed pneumonia, radiologically-diagnosed pneumonia, pneumococcal pneumonia, and otitis media). The vaccination costs were based on information from the National Ministry for Social Protection and from the Fondo Rotatorio de Vacunas (Vaccine Revolving Fund) of the Pan-American Health Organization. The treatment costs were from a published Latin American and Caribbean review (Constenla, et al. 2007, see 'Other Publications of Related Interest' below for bibliographic details). The price year was 2006 and the costs were in US dollars ($).

Analysis of uncertainty:
A deterministic univariate sensitivity analysis was undertaken to explore the impact of variations in the following model parameters: the pneumococcal disease incidence, the treatment costs, the vaccine efficacy, and the vaccine costs. The lower and upper ranges for the vaccine efficacy and the treatment costs came from the literature (Black, et al. 2000, Black, et al. 2002, and Constenla, et al. 2007). Best- and worst-case epidemiologic scenarios, varying the disease incidence, were assessed.

Results
The total costs, for a cohort of 70,000 children, in the base case, were $8.1 million without vaccination and with vaccination the PCV7 costs were $7.3 million and the treatment costs were $6.0 million. Vaccination had an additional cost of $5.3 million. The number of deaths was 532 without vaccination and 355 with vaccination; a reduction of 33%. The life-years lost were 21,280 without vaccination and 14,213 with vaccination.

The incremental cost per life-year gained with vaccination was $752. Univariate sensitivity analyses showed that the incremental cost per life-year gained ranging from $590 to $762 in the base case; from $422 to $589 in the best-case scenario; and from $845 to $1,026 in the worst-case scenario.

The results were most influenced by the cumulative incidences of pneumococcal invasive disease and pneumonia. The cost-effectiveness of vaccination compared favourably with other treatments for acute respiratory diseases due to pneumonia in Latin America and the Caribbean. It had lower or better costs per life-year gained than vaccination in high-risk populations in developed countries, such as Germany.

Authors' conclusions
The authors concluded that the introduction of a heptavalent pneumococcal conjugate vaccine in high-risk populations in Colombia was very cost-effective.

CRD commentary
Interventions:
The selection of the comparators appears to have been appropriate as the proposed vaccination strategy was compared against a strategy of no vaccination. The usual care in the authors’ setting was not reported, but was likely to have been no vaccination. The timing of the administration of the three doses of vaccine was not reported.

Effectiveness/benefits:
The authors did not state how they identified the relevant sources of clinical evidence. The characteristics of these primary studies, such as their population, size, risk group, study design, and follow-up period were not reported. This makes it is difficult to judge the validity and relevance of the clinical evidence. A description of the clinical evidence was not given. The duration of vaccine protection was not reported; if the benefit of vaccination was assumed to be limited to two years, when it could last longer, then the cost-effectiveness of vaccination would be underestimated. The probabilities of death were not reported. Life-years gained might be an appropriate benefit measure, but there could be significant sequelae associated with the diseases that might affect the quality of life over a lifetime. If this is the case then the cost-effectiveness of vaccination would be underestimated. The life-years gained were appropriately discounted.
Costs:
The cost categories were consistent with the stated perspective and their sources were reported. The cost estimates were presented as category totals, with no breakdown of individual items and no separate presentation of resource use, which reduces the transparency of the analysis. The price year was reported. The costs do not appear to have been discounted, which was appropriate for the short-term costs accruing due to pneumococcal diseases. It was not clear when these various diseases were expected to occur, given the clinical evidence, and therefore whether these costs should have been discounted.

Analysis and results:
The analytic approach was satisfactorily described and a diagram of the model was presented. An incremental approach was appropriately used to calculate the cost-effectiveness of vaccination. The results could have been more clearly reported. The uncertainty was partly addressed through univariate sensitivity analysis and a series of worst-case to best-case epidemiological scenarios. Multivariate and probabilistic sensitivity analyses would have been helpful. The authors compared their findings with those of other economic evaluations and explained the potential reasons for different results. The authors noted some limitations of their analysis, such as the exclusion of herd immunity and the fact that their cost estimates were not from high-risk populations.

Concluding remarks:
The methods were poorly reported, which makes it difficult to determine if the results are reliable and if the conclusions are appropriate.

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Bibliographic details

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Other publications of related interest


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