Cost-effectiveness of introducing the 10-valent pneumococcal conjugate vaccine into the universal immunisation of infants in Brazil

Sartori AM, Coelho de Souza P, Dutilh Novaes HM

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
This study evaluated the cost-effectiveness of adding the 10-valent pneumococcal conjugate vaccine to the routine childhood immunisation programme, in Brazil. The authors concluded that adding the vaccine was cost-effective. On the whole, the methods seem to have been appropriate and were adequately reported. The conclusions reached by the authors appear to be appropriate, but there were some limitations to the study and the overall uncertainty in the results is unclear.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to evaluate the cost-effectiveness of adding the 10-valent pneumococcal conjugate vaccine (PCV10) to the routine childhood immunisation programme, in Brazil.

Interventions
The normal national strategy, of vaccinating high-risk children only, was compared with a universal immunisation programme, using the PCV10, for all children, during their first year of life.

Location/setting
Brazil/primary and community care.

Methods
Analytical approach:
A decision-tree model, based on the ProVac Initiative model (see Other Publications of Related Interest), was used to combine data from published studies and databases. The time horizon was 25 years. The authors reported that they took both a health care system and a societal perspective.

Effectiveness data:
The effectiveness data were from published studies, hospitalisation information databases, a national household survey, national mortality databases, and the Network Surveillance System for the Bacterial Agents Responsible for Pneumonia and Meningitis (SIREVA) II database. The SIREVA II database provided data on the distribution of pneumococcal serotypes in Brazil. The main clinical estimate was the vaccine efficacy, which was based on clinical trials of the PCV10.

Monetary benefit and utility valuations:
The utility estimates were based on the 2004 Global Burden of Disease report, published by the World Health Organization (WHO).

Measure of benefit:
Benefit was measured by the number of deaths avoided, life-years gained, and disability-adjusted life-years (DALYs) avoided. The benefits were discounted at an annual rate of 3%.

Cost data:
The main cost categories were hospital treatment, ambulatory treatment, and productivity lost. A top-down costing approach was used, with the costs based on aggregate national average values, paid by the Brazilian Ministry of Health and health care organisations. The productivity losses for care givers were estimated, using the human capital approach and the daily average income for a Brazilian woman. The costs were presented in 2004 Brazilian reais (BRL) and were discounted at an annual rate of 3%.

Analysis of uncertainty:
Univariate sensitivity analyses were undertaken on the key parameters, such as disease incidence, serotype coverage by the vaccine, the case death rate, vaccine efficacy, hospitalisation costs, discount rate, number of vaccine doses, and the price per dose. Best- and worst-case scenarios were analysed, by varying the parameters that were identified as important by the univariate analyses. The results were presented in a table and a line graph.

Results
With no discounting, the programme avoided 10,226 deaths, 433,808 hospitalisations, and 5,117,109 out-patient visits, or 360,657 DALYs. The additional cost was BRL 10,674,478,765 and the expected savings were BRL 1,036,958,639 on direct medical costs and BRL 209,919,404 on family costs.

From a societal perspective, this resulted in an incremental cost-effectiveness ratio of BRL 753,688 per death avoided, or BRL 21,369 per DALY avoided. With a discount rate of 3% per year, for both health benefits and costs, the ratios were BRL 778,145 per death avoided, or BRL 22,066 per DALY avoided. From a health care perspective, the discounted ratios were BRL 879,142 per death avoided, or BRL 24,930 per DALY avoided.

The sensitivity analysis indicated that the results were most sensitive to the disease incidence, the case fatality rate, and the price of the vaccine. There were large variations between the best- and worst-case scenarios.

Authors' conclusions
The authors concluded that adding the PCV10 to the universal infant immunisation programme was cost-effective.

CRD commentary
Interventions:
The interventions were described and were appropriate comparators. Other pneumococcal vaccines were not included, as comparators, and this might reduce the generalisability to other settings.

Effectiveness/benefits:
The effectiveness data were described and appear to have been of sufficient quality. There was no mention that a systematic review was undertaken, so it is unclear if the best available evidence was used. The main clinical effectiveness estimate was from a randomised controlled trial, which should have supplied a good quality estimate. To estimate the effectiveness of vaccination, several parameters and assumptions were considered, and these were described, but possible adverse events were not considered. Very little information was provided on the utility estimates, so their quality and suitability is unclear.

Costs:
The perspectives were clearly stated, and it appears that the appropriate cost categories, for each perspective, were included. The data sources were satisfactory. The resource use estimates were briefly described and seem to have been adequate. The costs were appropriately discounted and adjusted for inflation.

Analysis and results:
The model structure was described in detail, with a diagram. The results were adequately reported. The uncertainty in the model parameters was investigated in deterministic sensitivity analyses. This provided some indication of the uncertainty in the results, but probabilistic sensitivity analysis could have fully explored the overall uncertainty in the model. The authors discussed some limitations to their study, which included the omission of the benefits of the herd effects from the vaccination, and some underestimations of the costs.

Concluding remarks:
On the whole, the methods seem to have been appropriate and were adequately reported. The conclusions reached by
the authors appear to be appropriate, but there were some limitations to the study and the overall uncertainty in the results is unclear.

**Funding**
Funded by the Ministry of Health of Brazil, and the Conselho Nacional de Desenvolvimento Científico e Tecnologico (CNPq).

**Bibliographic details**

**PubMedID**
20884668

**DOI**
10.1136/jech.2010.111880

**Original Paper URL**
http://jech.bmj.com/content/66/3/210.abstract

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Brazil; Child, Preschool; Cost-Benefit Analysis; Decision Trees; Humans; Immunization Programs /statistics & numerical data; Infant; Infant, Newborn; Pneumococcal Vaccines /administration & dosage /economics /supply & distribution; Vaccines, Conjugate

**AccessionNumber**
22012012915

**Date bibliographic record published**
08/05/2012

**Date abstract record published**
02/05/2013