Cost-effectiveness analysis of the 10- and 13-valent pneumococcal conjugate vaccines in Argentina


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 examined the cost-effectiveness of routine child vaccination with the 10-valent or 13-valent pneumococcal conjugate vaccine (PCV). The authors concluded that vaccination with either vaccine was cost-effective, compared with no vaccination. The PCV13 was more effective, but the PCV10 saved more costs to the health care system. The methods were valid and alternative scenarios for the key model assumptions were considered. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of routine child vaccination, with a 10-valent or 13-valent pneumococcal conjugate vaccine (PCV), compared with no vaccination.

Interventions
The interventions were the PCV10 or the PCV13 added to the routine child immunisation schedule. Three doses were given at two, four, and six months, followed by a booster at 12 to 18 months, for each vaccine. These were compared with no vaccination.

Location/setting
Argentina/primary care.

Methods
Analytical approach:
The analysis was based on the pneumococcal component of the integrated Pan American Health Organization's TRIVAC vaccine cost-effectiveness model. This was adapted for Argentina. Twenty cohorts of children younger than five years were simulated. A lifetime horizon was considered. The authors stated that the analysis was carried out from the perspective of the health care system.

Effectiveness data:
The clinical data were from a selection of relevant studies. The demographics of the birth cohorts were from the National Population Census for 1991. Official epidemiologic data were provided by the Argentinean Ministry of Health, if available. Other information was from published sources, identified by a literature review in international electronic databases. Argentinean experts confirmed the relevance and validity of these data. Key information on the selected sources was given. Vaccine efficacy was the key endpoint and was based on authors’ assumptions and the extrapolation of data for the PCV7, due to a lack of clinical trials on PCV10 and PCV13. The relative efficacy of a reduced schedule was assessed, based on evidence for the PCV7. Coverage was based on that achieved in Argentina for other vaccines.

Monetary benefit and utility valuations:
Average life expectancy and standard methods were used to calculate disability-adjusted life-years (DALYs) lost due to morbidity and premature death. Several other outcomes were reported, such as the cases of consolidated pneumonia, pneumococcal bacteraemia, sepsis or meningitis, and acute otitis media.
Measure of benefit:
DALYs were the main measure of benefit and a 3% annual discount rate was applied.

Cost data:
The economic analysis included the costs of immunisation and disease sequelae. The direct medical costs included medications, out-patient visits, diagnostic tests, hospitalisations, and other medical services. The resource quantities were from official national statistics and from questionnaires completed by paediatricians, otolaryngologists, and neurologists. The costs were based on official fees from regulated lists, agreements with self-administered hospitals, the Ministry of Health, the pharmacist workbook, and a database. The vaccine costs were their manufacturers’ prices. All costs were in US dollars ($) and were discounted at an annual rate of 3%. The price year was 2009.

Analysis of uncertainty:
A societal perspective was considered in the sensitivity analysis and this included the costs of transport, additional costs during hospitalisation, and parental productivity lost due to their child's hospitalisation. These costs were from a study conducted for the Ministry of Health. Additional scenarios considered the indirect effect of vaccination (herd immunity and serotype replacement), and variations in selected inputs, using published or assumed ranges of values.

Results
Compared with no vaccination, the DALYs averted were 64,252 with the PCV10 and 71,628 with the PCV13. The vaccination programme costs were $973,513,153.

With the PCV10, the savings to the health care system were $396,953,956 ($424,362,186 to society). The incremental cost per DALY averted was $8,973 ($8,546 from the societal perspective).

With the PCV13, the savings to the health care system were $189,344,152 ($220,683,590 to society). The incremental cost per DALY averted was $10,948 ($10,510 from the societal perspective).

The PCV13 was more expensive ($207,609,804) and more effective (7,376 DALYs averted) than the PCV10. The incremental cost per DALY averted with the PCV13, over the PCV10, was $28,147 ($27,614 from the societal perspective).

The cost-effectiveness threshold, using the criterion of the national per capita gross domestic product in Argentina, was $22,000, with a threshold of $7,366 for highly cost-effective interventions. The base-case findings were generally robust in the alternative scenarios. The most influential inputs were the discount rate, vaccine price, serotype replacement rate, herd immunity effect, and pneumonia case-fatality ratio.

Authors’ conclusions
The authors concluded that vaccination with either vaccine was cost-effective, compared with no vaccination. The PCV13 was more effective, but the PCV10 saved more costs to the health care system.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear. The two vaccines had recently become available in Argentina and a cost-effectiveness analysis was required.

Effectiveness/benefits:
Various approaches were used to identify the relevant data sources. Most of the evidence came from Argentinean databases, particularly for the epidemiological and demographic inputs. A literature search was performed to identify additional data. The vaccine efficacy was based on clinical trials of PCV7, since no trials were available for PCV10 and PCV13. The authors acknowledged that the efficacy against additional serotypes could be different to that of PCV7 and this was a limitation of the analysis, but conservative assumptions were made and the uncertainty was extensively tested in the sensitivity analysis. Local experts were contacted for further inputs and to validate estimates found in the literature. DALYs were a valid benefit measure, as they capture the health burden of disease. No information on the derivation of the disability weights was provided.
Costs:
The cost categories were appropriate for the two viewpoints adopted. The reporting of both a health care system and a societal perspective was informative; the results of the two analyses were very similar. The authors stated that this could be due to the exclusion of productivity costs for out-patient visits and recovery after release from hospital, which might have underestimated the benefits of vaccines to society. The resource use was based on a questionnaire sent to local experts, as there was a lack of published data, and this appears to have been appropriate. The unit costs were from official Argentinean sources. The unit costs and resource quantities were not presented separately and few category costs were given. The costs were treated deterministically, but they were varied in the sensitivity analysis. Details, such as the price year and discount rate, were reported.

Analysis and results:
The results were clearly presented for both the base case and the alternative scenarios. Incremental cost-utility ratios were calculated to synthesise the costs and benefits of the two strategies and the best approach was identified using the World Health Organization (WHO) criterion. A clear description of the decision-tree model was provided. The authors acknowledged limitations due to the uncertainty in some clinical parameters, but the results were generally stable. Herd immunity effects were not included, which was conservative against the vaccines. The authors compared their results with those of other published studies, which generally found that the vaccines were cost-effective. The results appear to be specific to Argentina and might not be generalisable to other settings.

Concluding remarks:
The methods were valid and alternative scenarios for the key model assumptions were considered. The authors’ conclusions appear to be robust.

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