The potential cost-effectiveness of infant pneumococcal vaccines in Australia
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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
This study assessed the cost-effectiveness of 10-valent or 13-valent pneumococcal conjugate vaccine (PCV) compared with the usual 7-valent vaccine. The authors concluded that either new vaccine could be cost-effective, when assuming no additional vaccination costs. Any difference in otitis media protection between the two vaccines, and the prevalence of serotype 19A, might determine the best vaccine. The analysis framework was valid and this should ensure the validity of the authors’ conclusions.

Type of economic evaluation
Cost-utility analysis

Study objective
This study assessed the cost-effectiveness of 10-valent or 13-valent pneumococcal conjugate vaccine (PCV), compared with the recommended 7-valent PCV, considering rapid serotype replacement.

Interventions
The three immunisation schedules were three infant doses of PCV7, three infant doses and a toddler booster dose of 10-valent pneumococcal non-typeable Haemophilus influenzae protein D conjugate vaccine (PHiD-CV), and three infant doses of PCV13. No vaccination was considered in a secondary analysis.

Location/setting
Australia/primary care.

Methods
Analytical approach:
The analysis was based on a static deterministic state-transition model, with a lifetime horizon. The authors stated that it was carried out from the perspective of the health care system.

Effectiveness data:
The clinical data were from a selection of relevant studies. Most of the epidemiological inputs were from official national databases of cases of and fatalities from invasive pneumococcal disease, otitis media, and community-acquired pneumonia. Vaccine efficacy was a key input for the model and some of the data for PCV7 were from clinical trials. The long-term risk of disability with invasive pneumococcal disease or otitis media was from observational studies.

Monetary benefit and utility valuations:
The utility values were from published sources, including a study conducted in the UK.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at an annual rate of 5%.

Cost data:
The economic analysis included the costs of vaccination (vaccine acquisition and administration), the hospital treatment for pneumococcal disease, and the treatment of long-term disease consequences. Vaccination costs were assumed to be equal for the three schedules, and were from an Australian analysis. Hospital costs were Australian Refined Diagnosis-Related Group (AR-DRG) data, supplemented by data from an Australian study. The costs of long-term sequelae were from published studies generally conducted in Australia. All costs were in Australian dollars (AUD) and a 5% annual discount was applied.
discount rate was applied.

**Analysis of uncertainty:**
One-way sensitivity analyses were carried out on each input, which was varied between 75% and 125% of its base-case value. Alternative scenarios were considered, such as including the effect of herd protection with the PHiD-CV and the PCV13. A probabilistic sensitivity analysis was performed with probability distributions assigned to the model inputs.

**Results**
In the base case, both the PHiD-CV and PCV13 were dominant over the PCV7, as they were more effective and cost saving, regardless of the assumptions on herd immunity.

When the new vaccines cost slightly more than the PCV7 (up to AUD 10), they remained dominant, but when the incremental cost per infant was AUD 100, the incremental cost per QALY gained for either vaccine was greater than AUD 142,000 (AUD 62,000 when considering herd immunity).

Compared with no vaccination, the incremental cost per QALY gained was AUD 64,860 with the PCV7, AUD 50,188 with the PHiD-CV, and AUD 55,311 with the PCV13. At an additional cost of AUD 100 for the two new vaccines, the incremental cost per QALY gained rose to AUD 77,699 with the PHiD-CV, and AUD 85,038 with the PCV13.

The sensitivity analysis confirmed that the cost of the vaccine was a key driver of the model. Invasive pneumococcal disease inputs were more influential for the PCV13, and otitis media inputs were more influential for the PHiD-CV. The probabilistic sensitivity analysis found some overlap in the predicted benefits of the new vaccines.

**Authors’ conclusions**
The authors concluded that both PHiD-CV and PCV13 could save costs and prevent disease compared with the usual PCV7, when assuming no additional vaccination costs. Any difference in otitis media protection between the two new vaccines, and the prevalence of serotype 19A, in Australia, might determine the best vaccine.

**CRD commentary**
**Interventions:**
The two newer PCVs were compared against the usual vaccine, which was the PCV7. All three vaccines were compared with no vaccination to represent the pre-vaccination Australian disease rates.

**Effectiveness/benefits:**
The clinical inputs were from studies selected for their relevance to Australia. Most of the epidemiological estimates were the most recent values from local databases. Vaccine efficacy seems to have been from clinical trials, which are valid sources, but these were not described. An extensive sensitivity analysis was conducted on all the clinical parameters and alternative scenarios were presented, such as one including herd immunity. QALYs were a valid and appropriate benefit measure. They capture the impact of the disease on the patients’ health. The derivation of the utility values was not reported. Most of the data were from a UK study, and the transferability of these values to Australia was not discussed.

**Costs:**
The economic analysis was appropriately carried out. The cost categories were relevant to the health care payer. The data sources were appropriate; most of the data were official estimates for Australia. Various assumptions for the vaccination costs were considered in the sensitivity analysis. Most of the costs were category totals and were not broken down into individual items. Some resource quantities were reported. Conventional discounting was applied, but the price year was not reported, making reflation exercises for other time periods impossible.

**Analysis and results:**
Some of the results were not presented in the text, but graphs of the projected costs and benefits were displayed. Incremental cost-utility ratios were clearly presented for all strategies, for the various scenarios. Appropriate tests were used to assess uncertainty and the results were clearly discussed. The state-transition model was partly described and was based on a static rather than a dynamic approach. The results appear to be specific to Australia, with its specific serotype prevalence, but the authors stated that the prevalence of otitis media and serotype 19A should be the key
drivers for the choice between 10-valent and 13-valent pneumococcal conjugate vaccines in other countries.

Concluding remarks:
The analysis framework was valid and this should ensure the validity of the authors’ conclusions.

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