Cost-effectiveness of adult pertussis vaccination in Germany

Lee GM, Riffelmann M, Wirsing von König CH

**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 aim was to assess the cost-effectiveness of three pertussis vaccination strategies for adults aged between 20 and 64 years. The authors concluded that the adult vaccination was cost-effective and resulted in cost savings if the disease incidence was higher than 200 cases per 100,000 people. Overall, the methods were appropriate and explicitly reported. There were some limitations in the reporting of the clinical evidence, but the authors’ conclusions appear to be appropriate.

**Type of economic evaluation**
Cost-effectiveness analysis, cost-utility analysis

**Study objective**
The aim was to assess the health benefits, risks and cost-effectiveness of routine pertussis (whooping cough) vaccination for adults aged between 20 and 64 years.

**Interventions**
Three strategies were examined: one-time vaccination with a single dose of acellular pertussis vaccine (Tdap); vaccination with Tdap boosters every ten years; and no adult pertussis vaccination.

**Location/setting**
Germany/primary prevention.

**Methods**

- **Analytical approach:**
The economic evaluation was based on a Markov model with a lifetime horizon. The authors stated that a societal perspective was adopted.

- **Effectiveness data:**
The clinical data came from a selection of known studies, which were considered by the authors to be relevant. A number of assumptions were made around unreliable estimates. The main clinical parameters were vaccine efficacy, vaccine adverse events, and disease incidence and outcomes.

- **Monetary benefit and utility:**
  - **valuations:**
The utility weights were obtained from a published study, which used the time trade-off approach to assess preferences in adults with pertussis.

- **Measure of benefit:**
The summary benefit measures were pertussis cases prevented and quality-adjusted life-years (QALYs). Both measures were estimated using a modelling approach and they were discounted at an annual rate of 3%.

- **Cost data:**
The direct costs were medical costs, which included laboratory tests, out-patient visits, hospitalisation, use of chest radiography, antibiotics, and vaccine acquisition, and non-medical costs, which included time lost from work and over-the-counter medications. All costs were reported at the macro-level. They were derived from published studies and official sources. The sources for resource use data were not explicitly reported. All costs were in Euros (EUR) and were discounted at an annual rate of 3%.
discounted at an annual rate of 3%. The price year was 2006.

Analysis of uncertainty:
One-way sensitivity analysis was conducted on the key model inputs, using ranges of values based on either published data or assumptions.

Results
The results were reported in full over a range of incidence rates. Those for the rate of 165 cases per 100,000 people are reported here.

For the cohort of 50 million adults, there were 4,425,000 cases of pertussis with no vaccination. The one-time adult vaccination prevented 498,000 cases and generated 13,400 QALYs saved. The booster vaccinations every 10 years prevented 1,046,000 cases and generated 28,700 QALYs saved. The cost of pertussis cases was EUR 2,576 million. The incremental cost was EUR 78 million with one-time vaccination and EUR 207 million with vaccination every 10 years.

In comparison with no vaccination, the incremental cost per discounted pertussis case prevented was EUR 160 with one-time adult vaccination and 200 with vaccination every 10 years. The incremental cost per QALY saved was EUR 5,800 with one-time vaccination and EUR 7,200 with vaccination every 10 years.

The sensitivity analysis indicated that these cost-effectiveness ratios were sensitive to model inputs such as disease incidence, vaccine cost, and initial vaccine efficacy.

Authors’ conclusions
The authors concluded that adult vaccination was cost-effective and resulted in cost savings if the disease incidence was higher than 200 cases per 100,000 people.

CRD commentary
Interventions:
The selection of the vaccination strategies was appropriate, as they appear to have represented both the existing and the possible vaccination strategies in the authors’ settings.

Effectiveness/benefits:
The effectiveness data were derived from published studies and authors’ assumptions. It was unclear if a systematic search of literature was conducted as no details were presented on how the source studies were identified. This makes it difficult to ascertain if the best available evidence was used. Limited detail on these source studies was given, which makes it difficult to assess their quality. The epidemiological data were taken from German sources to reflect the authors’ setting. The authors used a disease-specific measure (cases prevented) and a broader measure (QALYs) for the benefits. Both are commonly used outcomes for vaccination programmes.

Costs:
The cost categories were consistent with the stated perspective. Macro-categories were reported and no detailed breakdown of the unit costs was provided. Limited information was provided on the sources used to derive the unit costs and resource quantities. These facts limit the transferability of the study. The price year and discount rate were presented, which simplifies reflation exercises for other time periods.

Analysis and results:
The costs and benefits were appropriately synthesised and were well reported. The one-way sensitivity analyses were comprehensive and tested the key inputs over sufficiently large variations. The findings were clearly reported in a Tornado diagram. Whilst this assessed some uncertainty, a probabilistic sensitivity analysis would have assessed the overall uncertainty in the model. The authors acknowledged some limitations of their study.

Concluding remarks:
Overall, the methods were appropriate and explicitly reported. There were some limitations in the reporting of the clinical evidence, but the authors’ conclusions appear to be appropriate.
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