Enhanced decision support for policy makers using a web interface to health-economic models: illustrated with a cost-effectiveness analysis of nation-wide infant vaccination with the 7-valent pneumococcal conjugate vaccine in the Netherlands


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 study evaluated the cost-effectiveness of a national infant vaccination programme with the 7-valent pneumococcal conjugate vaccine in comparison with no vaccination in the Netherlands, in order to show a web-based user-interface of a health economic model. The study demonstrated that the vaccination strategy was potentially cost-effective and the web interface led to a transparent and clear analysis. The study was well conducted, with an extensive assessment of uncertainty and clear description of the model results. However, some aspects of the analysis were only partially reported as they had already been published.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective of the study was to determine the cost-effectiveness of a nationwide infant vaccination programme (NVP) with the 7-valent pneumococcal conjugate vaccine (PCV7) in comparison with no vaccination. This analysis was used as an example to show the usefulness of a web-based user-interface for a health economic model intended to support decision-making.

Interventions
The study examined an infant NVP with the PCV7. This was compared with a scenario of no vaccination. A vaccination schedule of four doses of PCV7 administered at the age of 2, 3, 4 and 12 months was used.

Location/setting
Netherlands/primary care.

Methods
Analytical approach:
A published decision analysis model (Bos et al. 2003, see ‘Other Publications of Related Interest’ below for bibliographic details) was updated with recently published epidemiological data and health care unit costs in order to project the costs and benefits of the two strategies. The time horizon of the analysis was 10 years. The authors stated that a societal perspective was adopted.

Effectiveness data:
Most of the clinical data were based on estimates used in the published model. More recent information on epidemiological inputs was derived from selectively identified primary studies. Some assumptions were also made. National surveillance databases and professionals’ records were often used to derive epidemiological estimates such as the number of cases of invasive pneumococcal disease or the number of cases of pneumonia. The key model input was vaccine effectiveness. This was obtained from a small number of published studies, the designs of which were not reported. The most important assumption was the inclusion of herd immunity.

Monetary benefit and utility valuations:
Utility estimates were based on EuroQol assessment, of which no details were reported.
Measure of benefit:
The summary benefit measures that were combined with costs were the life-years gained (LYG) and quality-adjusted life-years (QALYs) gained with vaccination in comparison with no vaccination. Both were estimated through the decision model. Cases averted were also reported. The benefits were discounted at an annual rate of 4%.

Cost data:
The categories of costs included in the analysis were those of the vaccination programme and the health services associated with the treatment of specific conditions such as meningitis, pneumonia, otitis media and invasive infection. Both direct and indirect costs were considered. The costs were generally presented as macro-categories, but the unit costs and the quantities of resources used were presented separately. The costs were derived from the most recent version of the Dutch guidelines on costing. The quantities of resources used were obtained from published databases. The costs were measured in euros (EUR) and the price year was 2004. Discounting was relevant and an annual rate of 4% was applied to future costs.

Analysis of uncertainty:
The issue of uncertainty was addressed by means of univariate/bivariate deterministic and multivariate probabilistic sensitivity analyses. The key model inputs under examination and stochastic distributions were reported. Seven alternative scenarios were considered; these were described in detail.

Results
In the Dutch population, the expected LYG and QALYs gained with vaccination over no vaccination were 1,397 and 1,253, respectively.

The net costs of vaccination over no vaccination were EUR 19,527,900.

The incremental cost per QALY gained with vaccination was EUR 14,000, while the incremental cost per LYG was EUR 15,600.

At a cost-effectiveness threshold EUR 20,000 per LYG or QALY gained, the vaccine cost per dose was EUR 60.85.

The sensitivity analysis showed that assumptions on herd immunity and vaccine cost had a strong impact on the cost-effectiveness results.

Variations in other model inputs did not substantially alter the base-case findings. Furthermore, the probabilistic sensitivity analysis suggested that vaccination has a high probability of being cost-effective, with the 95% uncertainty interval being EUR 9,800 to EUR 20,200 for QALYs and EUR 11,100 to EUR 23,900 for LYG.

Authors' conclusions
The authors concluded that a vaccination policy with PCV7 was a cost-effective alternative to no vaccination in the Netherlands. It was also pointed out that one of the main advantages of the web interface was the transparency of the analysis.

CRD commentary
Interventions:
The rationale for the choice of the interventions under examination was clear and the selection of the two strategies was appropriate. No vaccination should represent a valid comparator in several settings, including those of the authors.

Effectiveness/benefits:
Given that the effectiveness data were derived from a published decision modelling analysis, little information on the sources of clinical estimates was provided. More details were given of more recent data used in the current analysis. Often national databases were used, but the sources used to derive other data were not described. Similarly, little information on the derivation of the benefit measures was provided. This limits the possibility of judging the validity of these estimates. However, given the uncertain nature of some parameters and the use of some assumptions, extensive sensitivity analyses were performed around the clinical estimates.
Costs:
The analysis of the costs reported the main cost categories but a breakdown of cost items was not presented. In effect, the costs were related to health conditions. However, the unit costs and the resource quantities were reported separately for most items and this may help in replicating the analysis in other settings. The source of the costs was reported and reflects the authors’ setting. The approach used to derive the indirect costs was described, along with the assumptions made in the analysis. Other details such as the price year and discounting were given. Statistical analyses of both costs and resources were undertaken in the sensitivity analysis.

Analysis and results:
The costs and benefits were appropriately combined. The results of both the base-case analysis and the sensitivity analyses were extensively reported. The impact of the uncertainty was satisfactorily addressed in the sensitivity analysis. The model interface was available on the web, which enables simulations to be run in which some model parameters are varied. The authors did not explicitly discuss the issue of transferability and caution will be required if extrapolating the study results to other settings as model inputs, especially economic data, were derived from local sources. However, the authors noted that the web interface made the model very flexible, except for large changes. An interactive version of the authors’ model is publicly accessible and can be used for scenario analysis in the reader's own setting. The url for the web-interface can be found in the 'Other url' field.

Concluding remarks:
The study was well conducted in terms of the presentation of the results and the description of the model. However, as the model was derived from a previous analysis, there was little information regarding some estimates. In general, the authors’ conclusions appear robust and appropriate.

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None stated.

Bibliographic details

Other publications of related interest


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MeSH
Bacteremia /epidemiology /prevention & control; Cost-Benefit Analysis; Decision Trees: Health Policy; Humans; Immunity, Herd; Immunization Programs /economics /standards; Infant; Internet; Meningitis, Pneumococcal /epidemiology /prevention & control; Meningococcal Vaccines /administration & dosage; Models, Economic; Netherlands /epidemiology; Pneumococcal Infections /epidemiology /prevention & control; Pneumococcal Vaccines
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