Cost-effectiveness of vaccination against pneumococcal bacteremia among elderly people


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.

Health technology
Administration of pneumococcal vaccination in the prevention of pneumococcal bacteremia in elderly individuals.

Type of intervention
Primary prevention.

Economic study type
Cost-utility analysis.

Study population
Hypothetical cohorts of elderly individuals aged 65 years and older.

Setting
Community and hospital. The economic study was carried out in the USA.

Dates to which data relate
Effectiveness data were based on published studies and unpublished data from the period 1984 to 1997. Resource use data and their corresponding collection dates were not reported. The price year was 1993 (some of the cost data were adjusted from 1992 prices to 1993 base year).

Source of effectiveness data
Effectiveness data were derived from a review of the literature (published and unpublished data).

Modelling
A Markov decision-tree model was developed to estimate costs and effects associated with each health strategy.

Outcomes assessed in the review
The review assessed the following outcomes: the incidence of pneumococcal bacteremia per 100,000, mortality and proportion of mortality caused by vaccine serotypes, effectiveness and duration of protection of pneumococcal vaccine against vaccine serotypes, anaphylaxis cases per million doses, mortality rates for all causes, quality-adjusted life-year weights for different age groups and for bacteremia cases.

Study designs and other criteria for inclusion in the review
Inclusion criteria for the review were not given. Age-specific estimates of the effectiveness and duration of protection among immunocompetent patients were reported to be based on a case-control study. The sources of some other clinical
probabilities seemed to be unpublished data from epidemiologic cohort studies.

**Sources searched to identify primary studies**
Not reported.

**Criteria used to ensure the validity of primary studies**
Not reported.

**Methods used to judge relevance and validity, and for extracting data**
Not reported.

**Number of primary studies included**
A total of 7 studies were included in the review.

**Methods of combining primary studies**
Some of the studies provided separate inputs for the model. Details were provided for the methods of estimation of the remaining inputs based on the identified evidence.

**Investigation of differences between primary studies**
Not reported.

**Results of the review**
The results were are shown below.

1. Incidence of pneumococcal bacteremia per 100,000: 55.2 (best case-worst case, 55.4 - 42.9) for the age group 65-74 years; 88.5 (95.4 - 60.9) for 75-84 years; and 184.6 (235.6 - 120.2) for 85 years and over.

2. Mortality, 30 (43 - 15) for the age group 65-74 years; 26 (43 - 15) for 75-84 years, and 35 (43 - 29) for 85 years and over.

3. Proportion of mortality caused by vaccine serotypes, 88 (93 - 84).

4. Anaphylaxis cases per million doses, 5.

5. Quality-adjusted life-year weights for different age groups: 0.76 for the age group 65-69 years; 0.74 for 70-74 years; 0.70 for 75-79 years; 0.63 for 80-84 years; and 0.51 for 85 years and over.

6. Quality-adjusted life-year weights for bacteremia cases, 0.21.

The effectiveness and duration of protection of pneumococcal vaccine against vaccine serotypes was plotted for the age categories of 65-74, 75-84, and 85 years and older. Mortality rates for all causes were projected from the 1992 data.

**Measure of benefits used in the economic analysis**
Quality-adjusted life-years based on the 1990 US National Health Interview Survey were the benefit measures used.

**Direct costs**
Costs were discounted. Quantities were not reported separately from the costs. Cost items were reported separately.
Cost analysis covered the costs of pneumococcal vaccine and its administration, inpatient care-pneumococcal bacteremia, inpatient care-anaphylaxis, and future medical costs of survivors (in supplementary analyses). The perspective adopted in the cost analysis was that of society. The costing was based on Medicare payments for services. The date to which the price data referred was 1993 (the consumer price index was used to inflate some cost figures from 1992). The cost of treating pneumococcal bacteremia was conservatively limited to hospitalisation expenses.

**Indirect Costs**
Not considered.

**Currency**
US dollars ($).

**Sensitivity analysis**
A set of one-way sensitivity analyses was performed on reasonable ranges of values for uncertain variables. Analyses of extremes were performed based on worst-case and best-case values of the parameters of the model. Threshold values were computed for some sensitive parameters of the model. A probabilistic sensitivity analysis of cost-utility ratio was performed incorporating the likely distribution of each uncertain parameter in a Monte Carlo simulation approach. In addition, cost-utility analyses were separately performed for three geographic areas of the USA.:

**Estimated benefits used in the economic analysis**
The vaccination strategy was associated with 6.22478 quality-adjusted life-years for the general population aged 65 years or older versus 6.22811 years for the no vaccination strategy. This yields an incremental quality-adjusted days gained of 1.21 per person vaccinated. The discount rate applied in the base case was 3%. The benefit results were separately reported for different age categories and for three geographic areas of the USA as well and ranged between 0.82 and 1.48 quality-adjusted days gained.

**Cost results**
The discount rate was 3% in the base case. The vaccination strategy was associated with an average total cost of $88.42 for the general population aged 65 years or older versus $96.69 for the no vaccination strategy, yielding a saving of $8.27 per person vaccinated. The cost results were separately reported for different age categories and also for three geographic areas of the USA and ranged between $-10.91 and $-2.43.

**Synthesis of costs and benefits**
Since the vaccination strategy was the dominant strategy, cost per quality-adjusted life-years gained was not calculated in the base case analysis. The one-way sensitivity analyses established the relative robustness of the results except for doubling vaccination costs. In worst-case analyses of extremes, the cost-utility values had a range from $35,822 for the age category of 65-74 years to $598,487 for age category of 85 years and older. In probabilistic sensitivity analyses there was a less than 5% probability associated with the cost-utility ratio exceeding $100,000 for the age category of 85 years and older.

**Authors' conclusions**
Pneumococcal vaccination saves medical costs and improves health. However, it is still greatly underused among the elderly population.

**CRD COMMENTARY - Selection of comparators**
The reason for the choice of 'no vaccination' as the comparator is clear. You, the database user, should consider whether this is widely used in your own setting.
Validity of estimate of measure of benefit
The internal validity of the estimates of the benefit measure cannot be assessed because insufficient details of the methods of the literature review were provided. Therefore, results should be interpreted carefully as they may be subject to bias.

Validity of estimate of costs
Quantities were not reported separately from costs. Adequate details of the methods of cost estimation were given. Payment data were used in the cost analysis rather than true costs. Cost results might not be generalisable to other settings or countries.

Other issues
Extensive sensitivity analyses were performed to address uncertainties surrounding the parameters of the model. The issue of generalisability to other settings or countries was also addressed in the sensitivity analyses. Appropriate comparisons were made with other studies.

Implications of the study
These results support recent recommendation of the Advisory Committee on Immunization Practices and public and private efforts under way to improve vaccination coverage.

Source of funding
None stated.

Bibliographic details

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Subject indexing assigned by NLM

MeSH
Adult; Age Factors; Aged; Antiviral Agents /administration & dosage /economics; Cost-Benefit Analysis; Disease Progression; Drug Administration Schedule; Hepatitis C, Chronic /economics /drug therapy; Humans; Interferon-alpha /administration & dosage /economics; Markov Chains; Middle Aged; Quality-Adjusted Life Years; Research Support, U.S. Gov't, P.H.S.; Sensitivity and Specificity; Treatment Outcome

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