Cost-effectiveness of pneumococcal polysaccharide vaccine among healthcare workers during an influenza pandemic

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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 investigated the cost-utility of pneumococcal polysaccharide vaccination of a hypothetical cohort of previously unvaccinated health care workers, during an influenza pandemic. The authors concluded that vaccination was cost-effective from a societal perspective, but expensive from a hospital perspective. The methods were not reported in detail, particularly for the costs, which makes it difficult to assess the authors’ conclusions.

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

Study objective
The aim was to assess the cost-effectiveness of pneumococcal polysaccharide vaccination for health care workers during an influenza pandemic. The population was a hypothetical cohort of previously unvaccinated health care workers, with a mean age of 45 years and twice the usual risk of invasive pneumococcal disease and death from the disease.

Interventions
This study assessed the administration of pneumococcal polysaccharide vaccine to health care workers, compared with no vaccination, during an influenza pandemic. The vaccine was designed to prevent secondary pneumococcal infections in a high-risk population.

Location/setting
USA/primary prevention.

Methods
Analytical approach:
A Markov model was used to synthesise data from relevant available published studies, epidemiological data, and some authors' assumptions. The time horizon was 15 years. The authors stated that the study took both a societal and a hospital perspective.

Effectiveness data:
The clinical outcomes were the vaccine efficacy, the invasive pneumococcal disease incidence, the disease relative risk, and disease-related disability. The vaccine efficacy and annual mortality were estimated by a panel of clinical experts, using data from a published economic evaluation. The disease incidence during a pandemic was assumed to be twice the non-pandemic disease incidence, which was from US surveillance data.

Monetary benefit and utility valuations:
The utility data from two studies (Gold, et al. 1998, and Sisk, et al. 2003, see ‘Other Publications of Related Interest’ below for bibliographic details) were used to adjust survival to the health states. These were healthy, invasive pneumococcal disease, disabled, and vaccine adverse effects.

Measure of benefit:
The measure of benefit for the cost-utility analysis, from the societal perspective, was quality-adjusted life-years (QALYs) and these were discounted annually at 3%. For the cost-effectiveness analysis, from the hospital perspective,
the measure of benefit was the absence days per worker.

Cost data:
The direct medical costs included vaccination, vaccination adverse events, and age-specific invasive pneumococcal disease resource use. Published sources were used to measure and value these resources, including MIMS for the vaccine and the 2006 National Inpatient Sample for the age-specific disease costs. For the hospital perspective, it was assumed that health workers with the disease were absent for 10 days and it took two months to replace those who were disabled or died. The costs were reported in 2006 US dollars ($), which were discounted annually at 3%.

Analysis of uncertainty:
The model parameters were examined with one- and two-way sensitivity analyses, using ranges of values set by the authors or from the literature. Probabilistic sensitivity analyses were performed, using triangular distributions for the costs and vaccine efficacy, and uniform distributions for the utility data. Two graphs illustrated some of the results of these sensitivity analyses.

Results
From a societal perspective, over 15 years, the total costs were $63.16 for vaccination and $60.01 for no vaccination. The QALYs were 10.70178 for vaccination, and 10.70071 for no vaccination. Compared with no vaccination, the incremental cost per QALY was $2,935 for vaccination. For the hospital perspective, the incremental cost per employee absence day avoided was $1,676.

An estimated 284 cases and 32 deaths per 100,000 health care workers were estimated to occur without vaccination, compared with 171 cases and 19 deaths with vaccination. Approximately 40% of invasive pneumococcal disease cases and deaths were averted with vaccination.

The results were sensitive to the health care worker's age, with those under 30 years old producing an incremental cost-effectiveness ratio that exceeded $100,000 per QALY gained, and with cost savings for workers aged 49 years or older. The relative risk of invasive pneumococcal disease with pandemic influenza had to be greater than one, for those aged 29 years or older, or 3.4 or more for all ages, for vaccination to be favoured.

Vaccination was cost-effective in 91% of probabilistic simulations, at the acceptability threshold of $20,000 per QALY, and in 99% of simulations, at $100,000 per QALY.

Authors’ conclusions
The authors concluded that vaccinating all health care workers against pneumococcal disease, during an influenza pandemic, was economical from a societal viewpoint; but it was expensive from a hospital perspective, without external funding.

CRD commentary
Interventions:
The two strategies were briefly described, but the vaccination schedule was not provided. This vaccination might be available and feasible in other settings.

Effectiveness/benefits:
The utility values were from two published studies. The measurement and valuation methods for the utilities were not reported and these sources should be consulted to assess their internal validity. The increased disease risk in health care workers was assumed by the authors as they found no evidence for this, but it was tested over a wide range (one to six, with a baseline value of two) in the sensitivity analysis. There was no indication that a systematic review of the literature was performed for the clinical data. No details were given on the panel of clinical experts that estimated the vaccine efficacy. The authors acknowledged that the analysis was exploratory until further clinical trial data were available.

Costs:
The costs for vaccination were not itemised and administration costs might have been omitted. Disease costs were from...
publicly available sources for 2006. It was not clear how the costs of disability, death, and recruitment of a replacement were derived. In general, the costs were not well described. The authors stated that the perspective was societal, but only the direct medical costs were analysed, excluding costs, such as lost productivity while receiving the vaccine. It was not clear if these costs were opportunity costs or if a cost-to-charge ratio should have been applied for hospital costs.

Analysis and results:
The authors acknowledged their reliance on some assumptions, in the absence of evidence. The analysis did not account for varying levels of vaccine uptake and compliance among health workers, but these issues were discussed. The model was long-term, but the authors stated that it did not include effects from possible new vaccines or changes in epidemiology. The results of the sensitivity analyses were selectively reported. The distributions selected for the probabilistic sensitivity analysis (triangular and uniform) might not have been ideal, since they would not have produced adequate variation in the estimates.

Concluding remarks:
Given the lack of detail about the methods, particularly for the costs, it's difficult to assess the authors' conclusions.

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