The economic value of a quadrivalent versus trivalent influenza vaccine
Lee BY, Bartsch SM, Willig AM

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 objective was to assess the economic impact of a quadrivalent vaccine, compared with the traditional trivalent vaccine, against seasonal influenza. The authors concluded that the quadrivalent vaccine could produce substantial cost savings, even when the quadrivalent vaccine cost significantly more than the trivalent vaccine. The reporting was limited, in some areas, making it hard to assess the appropriateness of the authors' conclusions.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to assess the economic impact of a quadrivalent vaccine, compared with the traditional trivalent vaccine, against seasonal influenza.

Interventions
The trivalent vaccine contained the A/H1N1 and A/H3N2 strains, and one of two influenza B strains – Yamagata or Victoria – depending on the prediction of which B strain might be prevalent in each influenza season. The quadrivalent vaccine contained the A/H1N1 and A/H3N2 strains, and both B strains.

Location/setting
USA/out-patient care.

Methods
Analytical approach:
A Monte Carlo simulation was developed to estimate the potential cost savings from the quadrivalent vaccine, compared with the trivalent vaccine, over 10 influenza seasons (1999 to 2009). The authors stated that the analysis was conducted from a third-party payer perspective and from a societal perspective.

Effectiveness data:
The estimates for the number of influenza cases, hospitalisations, and deaths averted, each year, with each vaccine, were from one study (see Other Publications of Related Interest). Several key assumptions were based on this study. These were that the quadrivalent vaccine was as effective against each strain as the trivalent vaccine (47% to 68%); that the quadrivalent vaccine was introduced in stages, rather than wholly replacing the trivalent vaccine; and that vaccination coverage was 18% to 30%, based on prior recommendations, for each year.

Monetary benefit and utility valuations:
Not applicable.

Measure of benefit:
The measures of benefit, influenza cases, hospitalisations, and deaths averted, were presented separately.

Cost data:
For the third-party payer perspective, the direct costs of illness (out-patient visits and hospitalisation) were included. For the societal perspective, the indirect costs of illness (productivity lost due to missed work or death) were included as well as the direct costs. The costs were from a range of sources. Lost productivity was valued using wage data from the US Bureau of Labor Statistics. Clinical in-patient and out-patient visits were assessed using a research database.
Medicare and Medicaid Services data, and national statistics. All costs were assessed by age, where applicable, for each influenza season, based on data from the US Census Bureau. The costs were reported in 2012 US $, and an annual discount rate of 3% was applied to future costs.

Analysis of uncertainty:
Probabilistic sensitivity analysis was conducted to assess the effects on the model results of simultaneously varying the model parameters, within given ranges, using 5,000 simulations. Scenario analyses were conducted by varying the price premium of the quadrivalent vaccine, over the trivalent vaccine, from zero to $120.

Results
Assuming that the quadrivalent vaccine cost the same as the trivalent vaccine, over a decade, compared with the trivalent vaccine, the quadrivalent vaccine resulted in a median of $3.1 billion societal cost savings (mean 3.1 billion, 95% CI 2.8 to 3.5 billion), and a median of $292 million third-party payer cost savings (mean 294 million, 95% CI 251 to 342 million), across the entire USA.

Over the decade, 2,684,145 cases were averted by using the quadrivalent vaccine, rather than the trivalent vaccine. No cases were averted for the 1999 to 2000, and 2000 to 2001 seasons, as the influenza B strain for the trivalent vaccine matched the circulating strain.

From the third-party payer perspective, the 2007 to 2008 season yielded the highest median cost savings per case and per death averted. At the highest premium of $120, the cost per case averted was $2 and the cost per death averted was $3,831. The highest cost savings per hospitalisation averted were found for the 2001 to 2002 season, for all premiums up to $105 (from both perspectives).

At a premium of $105, it cost third-party payers $23 to avert one case, $4,450 to avert one hospitalisation, and $45,865 to avert one death. At a premium of $120, it cost third-party payers $38 to avert one case, $7,332 to avert one hospitalisation, and $75,570 to avert one death.

Authors’ conclusions
The authors concluded that using the quadrivalent vaccine, instead of the trivalent vaccine, could produce substantial cost savings, even when the quadrivalent vaccine cost significantly more than the trivalent vaccine.

CRD commentary
Interventions:
The interventions appear to have been appropriate, and included the usual practice. The authors discussed alternative quadrivalent vaccines, that were being developed at the time of the study, and were expected to reach the market for the 2013 to 2014 influenza season.

Effectiveness/benefits:
No justification was given for the selection of the study that supplied the effectiveness data. The study design, sample size, and patient characteristics were not given. The authors discussed the key assumptions made for the effectiveness data, but they did not report any justifications to support these assumptions. They stated that their analysis was subject to any limitations in the source study, but did not discuss these. The effectiveness data did not include any adverse events, but the authors stated that the evidence suggested the same rate of adverse events with the quadrivalent vaccine as with the trivalent vaccine. The main focus of the analysis was the costs; the effectiveness evidence was required to estimate the costs, but it was not the focus of the analysis.

Costs:
The costs were appropriate for the perspectives adopted. The sources that supplied them were clearly reported and they were US specific. The authors did not report the costs of the quadrivalent and trivalent vaccines, but conducted scenario analyses over a range of potential premiums for the quadrivalent vaccine. The authors did not justify this range of values, and they did not discuss the expected costs of the quadrivalent and trivalent vaccines. Generally, the reporting of the costs was good.

Analysis and results:
The model was not described in detail, and no diagram was supplied. The focus of the study was on the economic impact of the quadrivalent vaccine, so the authors reported only limited details of the health outcomes. It would have been useful if these outcomes were reported in a table for each of the influenza seasons, as for the costs. For the probabilistic sensitivity analysis, the authors stated that the initial values were varied over given ranges, but these ranges were not justified, and the distributions used were not reported. Only a selection of parameters was varied and uncertainty in effectiveness data was not explored. Confidence intervals for each of the cost outcomes were reported, but no diagrams for the probabilistic sensitivity analysis results were reported, and the impact of uncertainty was not discussed in the text.

Concluding remarks:
The reporting was limited, in some areas, making it hard to assess the appropriateness of the authors’ conclusions.

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