Effectiveness and cost-effectiveness of vaccination against pandemic influenza (H1N1) 2009
Khazeni N, Hutton DW, Garber AM, Hupert N, Owens DK

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 assessed the effectiveness and cost-effectiveness of vaccination against pandemic influenza (H1N1), with coverage of 40% of the population, in October 2009 or November 2009, compared with no vaccination. The authors concluded that early vaccination in October produced superior health outcomes and was more cost-saving than November vaccination. The study methods and results were thorough, transparent, and appropriately reported. These conclusions are a good assessment of the analysis undertaken.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to evaluate the cost and health effects of vaccination against pandemic influenza (H1N1), with varying start times in 2009. The population was a hypothetical cohort of 8.3 million US metropolitan residents, representing the population of New York City. It was assumed that 10,000 people were infected at the start of the pandemic and 10% of the population were already immune.

Interventions
The vaccination was 15µg adjuvant-to-antigen concentration and was administered to 40% of the population in mid-October 2009 compared with administration in mid-November 2009 and no vaccination. Vaccination was in addition to non-pharmaceutical public health hygiene measures recommended by the Centers for Disease Control and Prevention.

Location/setting
USA/primary care.

Methods
Analytical approach:
A compartmental epidemic model and a Markov model were used to synthesise the published data from studies and official sources. The analysis had a life-time horizon and the authors stated that it was carried out from a societal perspective.

Effectiveness data:
The clinical data for the vaccine effectiveness and estimates of influenza progression were from a selection of relevant published studies, government statistics, authors' assumptions, and two preliminary reports of trials of a 2009 H1N1 influenza vaccine (Greenberg, et al. 2009, and Clark, et al. 2009, see ‘Other Publications of Related Interest’ below for bibliographic details). The clinical outcomes included symptomatic infections, influenza transmission, re-infections following recovery, vaccine side-effects, and deaths.

Monetary benefit and utility valuations:
Influenza-related health state values were abstracted from published studies, using the European Quality of life (EQ-5D) questionnaire, and from authors' assumptions.

Measure of benefit:
The measure of benefit was quality-adjusted life-years (QALYs) and discounting was applied at an annual rate of 3%.

Cost data:
The direct medical costs were included for vaccine antigen, adjuvant, and administration; health care for influenza treatment and side-effects; general health care; and hospitalisations. Patient time taken in receiving the vaccine was estimated and valued, using the US Bureau of Labor Statistics. The unit costs were based on a selection of relevant published sources, US government reports, and personal communications with experts. The costs were discounted at 3% per annum and adjusted to 2009 US dollars ($), using the Gross Domestic Product deflator.

Analysis of uncertainty:
The uncertainty was measured in one-way sensitivity analyses, on all the model parameters, and a probabilistic sensitivity analysis, with 10,000 Monte Carlo simulations. The uncertainty in the one-way sensitivity analyses was reported in appendices, summarised in the main text, and illustrated graphically. Full details of the probabilistic analysis methods and results, including the cost-effectiveness acceptability curves, were provided in appendices.

Results
In the base case, vaccinating 40% of the population in mid-October resulted in an estimated 285,566 symptomatic infections and 286 deaths compared with 541,865 symptomatic infections and 542 deaths when vaccinating in mid-November.

The discounted QALYs gained compared with no vaccination were 69,679 for mid-October vaccination and 49,422 for mid-November vaccination. Compared with no vaccination, cost-savings of $469 million were estimated for mid-October vaccination and $302 million for mid-November vaccination.

There was a 45% likelihood that vaccinating 40% of the population in November would be cost-saving compared with no vaccination. In 69% of Monte Carlo simulations, November vaccination resulted in an incremental cost per QALYs of less than $50,000.

The findings were sensitive to two-dose vaccination (less cost-effective), certain viral characteristics, the occurrence of more frequent severe side-effects (less cost-effective), and more effective non-pharmaceutical public health interventions for influenza control (more cost-effective).

Authors' conclusions
The authors concluded that early vaccination against influenza H1N1 in October, aimed at 40% of the population and added to non-pharmaceutical public health interventions for influenza control, was the most effective and cost-saving scenario. They suggested that the timing of vaccination had important implications for the urgent, but safe manufacture and distribution of the H1N1 vaccine.

CRD commentary
Interventions:
The authors' provided clear details of the dose and population coverage for the influenza vaccine. The reader should decide if these are feasible options in their own setting, especially the option to not vaccinate, which might not be possible if consumers or employers are able to purchase the vaccine.

Effectiveness/benefits:
The clinical effectiveness data were derived from the most recent published research trials, with preliminary results. The data sources were clearly reported, as were all the assumptions. The methods used to value the utilities were briefly stated and the source studies should be consulted to assess the quality of these data.

Costs:
A societal perspective was taken and the relevant medical resources appear to have been included, but patient time was the only non-health care cost included. Other costs that should have been included, for a societal perspective, were productivity losses arising from influenza illness and additional resources involved in the fast production of vaccine on a large scale. The setting for the administration of the vaccine (nurse or general practitioner) could influence the costs significantly. Details of the costing methods were available in the appendices.
The authors acknowledged a number of limitations to their study including the use of a population model that assumed a homogeneous mix of individuals and disease transmission rates, unknown implications of downstream effects on tourism, school and workplace closures, etc, and the uncertainty around influenza transmission and mortality. Suggestions were made for further research on vaccine efficacy and safety to improve the data in the model. The probabilistic sensitivity analysis methods, such as the parameter distributions and number of simulations, and the results, including 95% confidence intervals around the incremental cost-effectiveness ratio, were provided in the appendices.

Concluding remarks:
There were some limitations to the model, due to its simplifications and reliance on early clinical estimates of the vaccine efficacy, but the methods were appropriate, transparent, and comprehensive. The conclusions are a good assessment of the analysis undertaken.

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Other publications of related interest


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