Dynamic modelling of infectious diseases: an application to the economic evaluation of influenza vaccination

Pradas-Velasco R, Antonanzas-Villar F, Martinez-Zarate M P

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 examined the clinical and economic impact of influenza vaccination, using both a dynamic and a static model. It was concluded that the vaccination strategy was efficient in the dynamic model, which provided a more comprehensive picture of the burden of influenza, because it considered the effect of herd immunity. The sources were not reported in detail, but the decision modelling approaches, which were the focus of the analysis, were extensively described. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
This study examined the clinical and economic impact of influenza vaccination, using two different simulation models; a dynamic and a static model.

Interventions
Influenza vaccination was compared against a strategy of no vaccination.

Location/setting
Spain/primary care.

Methods
Analytical approach:
This economic evaluation was based on two modelling approaches (a dynamic and a static model). The time horizon of the analysis was one year. The authors stated that the perspective of the Spanish National Health System (NHS) was adopted.

Effectiveness data:
The clinical data came from a review of the literature, the methods and results of which were not reported. No information on the sources of data was provided, but epidemiological values were based on Spanish sources. The key clinical endpoint was the vaccine efficacy.

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
Health outcomes were not combined and no summary benefit measure was used. The key model output was the number of cases avoided with vaccination.

Cost data:
The economic analysis included the costs of vaccination (acquisition and administration), treatment of influenza, Spanish NHS treatment co-payment, primary care consultation, and emergency care visit. The unit costs and resource quantities were presented separately for most items. These were derived from published sources; most of the costs were obtained from official Spanish sources. The price year was 2005 and costs were in Euros (EUR).
Analysis of uncertainty:
Multivariate sensitivity analyses were carried in order to analyse both a favourable and an unfavourable scenario for the cost-effectiveness of vaccination. The results were presented separately for the static and the dynamic model.

Results
In a hypothetical cohort of 100,000 eligible individuals, the cases avoided with vaccination over no vaccination were 11,527 in the dynamic model and 2,680 in the static model.

The total health care savings were EUR 343,735 in the dynamic and EUR 79,918 in the static model. The total vaccination costs were EUR 282,400 with both models. The return rate per one EUR invested in vaccination was 1.22 in the dynamic and 0.28 in the static model. A return rate over one indicates an efficient cost-saving strategy. In the dynamic model, the vaccination strategy was more effective and less costly, or dominant.

The cases avoided ranged from 3,637 in the unfavourable scenario to 15,597 in the favourable scenario for the dynamic model, and from 560 (unfavourable) to 10,080 (favourable) for the static model. The return rate ranged from 0.15 (unfavourable) to 1.88 (favourable) for the dynamic model, and from 0.023 (unfavourable) to 1.21 (favourable) for the static model.

Authors’ conclusions
The authors concluded that the indirect effect of the influenza vaccination on non-vaccinated individuals (herd immunity) was greater than its direct effect on vaccinated individuals. Thus, the vaccination strategy was efficient in the dynamic model, which provided a more comprehensive picture of the burden of influenza.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear in that the vaccination strategy was compared against a background strategy of no vaccination, which might have reflected the current pattern of care in the authors’ setting. However, the authors did not report the details of the vaccination strategy, such as the type of vaccine and the target population.

Effectiveness/benefits:
The clinical data were derived from a literature review, the methods and conduct of which were not reported. Thus, it is not possible to judge the validity of the clinical inputs. Most of these reflected the country-specific setting, but no details were given on their sources or the methods of selection and combination of the data. The benefit measure was disease-specific and will be difficult to compare with benefit measures for other disease analyses.

Costs:
The categories of costs reflected the perspective. The unit costs and quantities of resources were presented for most items, making the economic analysis transparent. However, the sources of data were not described in detail; only the references revealed the use of official data. The price year was reported and the use of discounting was not required given the short time horizon.

Analysis and results:
The costs and benefits were not synthesised as a cost-consequences analysis was performed. The expected costs and benefits were appropriately reported. The issue of uncertainty was investigated by means of a multivariate analysis, which depicted a favourable and an unfavourable scenario. The study focused on the methodological differences between the two models that included (dynamic) or did not include (static) herd immunity, which turned out to be the key driver for the cost-effectiveness results.

Concluding remarks:
The sources were not reported in detail, but the decision modelling approaches, which were the focus of the analysis, were extensively described. The authors’ conclusions appear to be robust.
Funding
Supported by a grant from the Riojan Regional Government.

Bibliographic details

PubMedID
18088158

Original Paper URL
http://www.ingentaconnect.com/content/adis/pec/2008/00000026/00000001/art00005

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Cost Savings; Cost-Benefit Analysis; Humans; Immunity, Herd /immunology; Influenza Vaccines /economics; Influenza, Human /economics /epidemiology /prevention & control; Mass Vaccination /economics; Models, Immunological; Models, Statistical; Spain /epidemiology

AccessionNumber
22008000351

Date bibliographic record published
03/06/2009

Date abstract record published
23/09/2009