Cost effectiveness of influenza vaccination for healthy persons between ages 65 and 74 years
Nichol K L, Goodman M

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
The vaccination of healthy persons aged between 65 and 74 years for influenza was studied.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised healthy persons aged between 65 and 74 years. Patients were considered to be eligible if they had no diagnosis in the preceding year of heart disease, lung disease, diabetes, renal disease, dementia/stroke, cancer or rheumatologic disease.

Setting
The study was conducted at the VA Medical Center in Minneapolis, USA.

Dates to which data relate
The effectiveness data were collected from the administrative databases of a health maintenance organisation (Group Health). The data related to six consecutive influenza seasons, 1990 - 1991 to 1995 - 1996. The cost data were estimated from published literature and all the costs were adjusted to 1996 dollars.

Source of effectiveness data
The effectiveness data were gathered from a single retrospective study. Previously, the authors reported on the initial results of an analysis to assess the costs and effectiveness of influenza vaccination. The present analysis was updated and expanded for healthy adults between 65 and 74 years of age. Data from the Minnesota Department of Health Influenza Surveillance System were used to help define the dates of influenza seasons for each season study year.

Link between effectiveness and cost data
The costing was undertaken on the same sample as that used in the effectiveness study.

Study sample
There were 66,435 person-periods of observation over the six seasons for healthy people aged between 65 and 74 years. A total of 36,081 were vaccinated (54.3%) and 30,354 (45.7%) not vaccinated. Power calculations to determine the sample size were not relevant.
Study design
The study was a cohort study. The patients were selected from Group Health, which has 300,000 members at 21 clinics. The duration of follow-up was not reported. The duration of the influenza season was not reported.

Analysis of effectiveness
The analysis of effectiveness was conducted on the basis of vaccination completers. The primary health outcomes were reductions in the numbers of hospitalisations for pneumonia and influenza (HPI) and for all acute and chronic respiratory conditions (HACRC), and in the risk of death. Multivariate models were used to assess the association of vaccination with reductions in the number of HPI and HACRC (Poisson regression) and in the risk of death (logistic regression). In terms of baseline comparisons, vaccinated persons were older than non vaccinated, 69.2 (+/- 2.7) years versus 68.7 (+/- 2.8) years, (p>0.0001). Vaccinated persons were also more likely to have been hospitalised during the prior 12 months (5.3% versus 3.0%; p<0.0001), and to have been hospitalised for pneumonia or influenza in the past (1.9% versus 0.9%; p<0.0001). Confounding factors included in the models were age, gender, vaccination status and prior resource use.

Effectiveness results
Vaccination was associated with a 36% reduction in HPI (risk ratio, RR=0.64, 95% confidence interval, CI: 0.41 - 0.98), an 18% reduction in HACRC (RR 0.82, 95% CI: 0.63 - 1.06), and a 40% reduction in death (odds ratio 0.60, 95% CI: 0.42 - 0.86). For HACRC, the reduction was not statistically significant.

The number of deaths averted (or lives saved) was not reported.

Clinical conclusions
Vaccination for healthy persons between 65 and 74 years of age was associated with substantial reductions in the risk of hospitalisation and death.

Modelling
Multivariate models were used to estimate reductions in hospitalisation and death associated with vaccination. A Monte Carlo simulation was used to conduct probabilistic sensitivity analyses.

Measure of benefits used in the economic analysis
The primary health outcome, the reduction in death, was expressed as benefits and used in the economic analysis.

Direct costs
The direct costs included the cost of the influenza vaccine (based on 1996 Medicare reimbursement rate) and its administration (from Rita Hobot, personal communication, 5/99). The direct costs for hospitalisations averted were also assessed and calculated (equation provided). The cost estimates represented the median costs per hospitalisation episode adjusted by the 1995 Medicare cost-to-charge ratio, to best reflect actual costs. An additional 20% was added to the hospitalisation cost to account for the cost of physicians’ service. The resource quantities and the costs were not reported separately. 1996 prices were used. Discounting was not applied.

The cost analyses were conducted for each level of vaccination costs. The three levels were the health plan cost for vaccination, the Medicare reimbursement rate for the vaccine and its administration, and an upper level of cost representing twice the Medicare reimbursement rate.

Statistical analysis of costs
No statistical analysis was carried out.
Indirect Costs
The indirect costs included the value of 1 hour of work-loss time for vaccination, as well as the productivity losses averted for each life saved. These values were weighted by the age distribution and by the estimated proportion of sample population in the labour and housekeeping force. The present value of future earnings per person for each life saved was discounted at a rate of 5%. The resource quantities and the costs were not reported separately. 1996 prices were used.

Currency
US dollars ($).

Sensitivity analysis
A Monte Carlo simulation was used to conduct probabilistic sensitivity analyses for plausible range of values for each parameter in the cost model, in order to derive 95% probability intervals (95% PI) for each estimate of the net costs.

Estimated benefits used in the economic analysis
The number of lives saved was the benefit measure used, but details were not provided except in the synthesis of the costs and benefits.

Cost results
At each of the three levels of vaccination costs studied, vaccination resulted in net cost-savings. At the base-case analysis (vaccination cost of US$4.50), the net saving per 10,000 persons vaccinated was US$429,008 (95% PI: 781,734 - 148,383). The total direct costs or total costs averted were not reported.

Synthesis of costs and benefits
The net benefits (number of life saved) were not reported separately. The net saving per life saved was US$53,652 (95% PI: 92,438 - 30,248).

When confining the analyses only to direct costs, vaccination was also cost-saving per life saved for the two lower vaccination costs (US$4.50 and US$7.93). The net savings were not shown.

For a vaccination cost twice the Medicare reimbursement (US$15.86), vaccination was highly cost-effective with a net cost of US$5,000 per life saved or about US$380 per year of life saved (no details were given to calculate the number of years of life saved).

Authors' conclusions
The authors concluded that their findings provided evidence that, for the elderly, an age-based strategy beginning at the age of 65 is clearly associated with health benefits and cost-savings, even for healthy persons in the 65 - 74 age group.

CRD COMMENTARY - Selection of comparators
The rational for the choice of the comparator (no vaccination in the same specific targeted population) was clear.

Validity of estimate of measure of effectiveness
The analysis used a cohort study. The patient groups, however, were not shown to be comparable at analysis, which is a common feature of cohort studies. A randomised controlled trial would have been more appropriate, in terms of minimising the impact of bias and confounding, to compare the benefits and costs between vaccinated and unvaccinated groups. The study sample was representative of the study population. The measures of primary health outcomes are likely to be valid. However, the quantities of health outcomes were not reported. It is likely that more details were given...
in the previous study.

**Validity of estimate of measure of benefit**
The incremental benefits were not reported and the duration of follow-up was not clearly stated. The authors indicated that six consecutive influenza seasons were observed. An assessment of the quality of life or satisfaction of vaccinated and unvaccinated persons would have been a relevant additional measure of benefits.

**Validity of estimate of costs**
The societal perspective was adopted, and all the categories of cost relevant to this appear to have been included in the analysis. The costs and the quantities were not reported separately. The total direct and indirect costs were not reported. Sensitivity analyses of the prices, but not resource quantities, were conducted. The period during which the costs were estimated was not reported (3 months, 6 months or one year?). Discounting at 5% was undertaken for loss of future earnings. A sensitivity analysis on the discount rate value would have been relevant and informative for other settings.

**Other issues**
The authors made appropriate comparisons of their findings with those of published studies, but did not report any limitations of their study. The authors recognised that the issue of generalisability to other settings will depend on several factors. For example, the rates of hospitalisation for respiratory conditions, the costs of hospitalisation and vaccination, the proportion of persons in the labour and housekeeping force, and the economic value placed on productivity.

**Implications of the study**
The authors concluded that the findings of this study affirm the value of an age-based strategy for routine influenza vaccination of all elderly persons, including healthy elderly persons between 65 and 74 years.

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**Other publications of related interest**


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