Influenza vaccination, hospitalizations, and costs among members of a Medicare managed care plan

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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.

Health technology
The study evaluated the vaccination of persons aged 65 years or older against influenza.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The population comprised all members of a Medicare managed care plan who were aged 65 years or older.

Setting
The setting was not specified, although it appears to have been primary care and secondary care. The economic study was carried out in Hawaii, USA.

Dates to which data relate

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was carried out retrospectively on the same patient sample as that used in the effectiveness analysis.

Study sample
Power calculations were not reported. All members of a Medicare managed care plan aged 65 years or older were eligible for the study. Members were included in the analysis for a given influenza season if they had been continuously enrolled for 12 months before November 15th of the season. Those persons with evidence of vaccination were classified as vaccinated from the date of the vaccination forward, often including more than one season. A sample of 77,951 person-periods was included in the analysis. There were 44,271 person-periods (62% females; mean age 77.4 +/- 6.9 years) in the vaccinated group and 33,680 person-periods (59.9% females; mean age 76.8 +/- 7.3 years) in the unvaccinated group.
Study design
This was a retrospective cohort study that appears to have been conducted in multiple health centres. The follow-up period included the influenza season (November 15th to March 31st) and an equal time interval afterwards (April 1st to August 15th).

Analysis of effectiveness
The outcomes evaluated were:

- the number of hospitalisations per 1,000 person-periods for influenza or pneumonia, for any respiratory conditions, and for congestive heart failure (CHF); and
- the associated odds ratios (ORs) and 95% confidence intervals (CIs) for hospitalisations in the vaccinated group versus the unvaccinated group during the influenza season and after.

Deaths that occurred in the hospital setting were also assessed, as were the ORs of dying in the hospital and those of disenrolment in the Medicare managed care plan (considered an indirect indicator of death). Sub-group analyses were performed according to different age groups (65 - 70 years versus 80 years and older), whether the participants had major diseases, influenza season and ethnicity.

Compared with unvaccinated individuals, the vaccinated individuals were older, more frequently female and had received pneumococcal vaccine more often. In addition, within the last 12 months, they had presented a higher morbidity index and had major diseases (e.g. heart disease, lung disease, diabetes, renal disease, rheumatologic disease and pneumonia) more often. Unvaccinated individuals presented dementia or stroke episodes more often than vaccinated individuals. These differences were statistically significant, (p<0.05). Adjustments for confounding factors were made in the analysis, considering age, gender, pneumococcal vaccination, and morbidity index, hospitalisations, physician visits and major diseases in the last 12 months.

Effectiveness results
The results of the analysis, which included data from all three seasons, were as follows.

During the influenza season, vaccinated individuals had 20% lower ORs for hospitalisation due to respiratory conditions (OR 0.8, 95% CI: 0.7 - 1.0) and CHF (OR 0.8, 95% CI: 0.7 - 0.9) than unvaccinated individuals after adjusting for confounding factors, (p<0.05).

The ORs were higher for those aged 80 years and older than for younger participants.

No significant differences were found in hospitalisations for influenza and pneumonia overall, by age and by presence of major disease.

After the influenza season, the ORs for hospitalisation were not statistically significant overall or by sub-groups, except for hospitalisation due to all respiratory conditions. This was significantly lower for vaccinated people aged 80 years or older (OR 0.7; 95% CI: 0.6 - 1.0; p<0.05).

When only people aged 65 to 79 years were examined by influenza season, those vaccinated generally presented lower ORs than those unvaccinated, although the results were not statistically significant. The exception was in hospitalisation for all respiratory conditions in the 1996 - 1997 season (OR 0.7, 95% CI: 0.5 - 1.0, p<0.05).

Additional analyses combining hospitalisations due to respiratory conditions and CHF showed that vaccinated individuals experienced fewer hospitalisations (OR 0.8, 95% CI: 0.7 - 0.9; p<0.05). Overall, they had 6.7 fewer hospitalisations per 1,000 person-periods than did unvaccinated patients, and 8.1 fewer hospitalisations per 1,000 persons-periods among individuals aged 65 to 79 years.

After adjusting for confounding factors, the OR for dying in hospital during the influenza session for vaccinated versus unvaccinated individual was 0.7 (95% CI: 0.5 - 0.9). Those vaccinated were less likely to have disenrolled from the NHS Economic Evaluation Database (NHS EED)
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plan than unvaccinated individuals (OR 0.5, 95% CI: 0.4 - 0.5).

The analysis adjusting for ethnicity obtained similar results among the sub-group of members whose ethnicity was known.

**Clinical conclusions**
Influenza vaccination for persons aged 65 years or over reduced the hospitalisations for respiratory conditions and CHF during the influenza season. It was also associated with reductions in the death rate in the hospital. However, overall there were no significant differences in the hospitalisations between vaccinated and unvaccinated people after the influenza season.

**Measure of benefits used in the economic analysis**
No summary measure of benefit was used in the economic analysis. Therefore, the study was, in effect, a cost-consequences analysis.

**Direct costs**
The direct costs considered in the economic analysis were those of first hospitalisation for pneumonia and influenza, all respiratory conditions and CHF, although more disaggregated cost categories were not identified. The unit costs and the quantities of resources used were not presented separately, except for the cost of the vaccine. The costs were estimated using a logistic regression model and a general linear model, so as to assess the effects of influenza vaccination on hospitalisation and on the costs. The maximal allowable costs covered by the insurer were used to estimate the hospitalisation costs, while insurance claim records were reviewed to obtain the resource use data. The costs were estimated per person, assuming first that the person was unvaccinated and second that the person was vaccinated. Therefore, the costs were estimated on the basis of both actual data and authors' assumptions. Possible cost-savings from vaccination were calculated for groups with statistically significant associations with hospitalisation. Discounting was not performed. The price year was 1994.

**Statistical analysis of costs**
Lower and upper estimates of costs were calculated from the combined lower and upper 95% CI estimates from the models.

**Indirect Costs**
The indirect costs were not considered.

**Currency**
US dollars ($).

**Sensitivity analysis**
A sensitivity analysis was not performed.

**Estimated benefits used in the economic analysis**
See the 'Effectiveness Results' section.

**Cost results**
Vaccinated individuals cost an estimated $85 (95% CI: 45 - 113) less per influenza season, not counting the cost of the vaccine (a mean cost of $2.85).
The cost-saving for vaccinated individuals aged 65 to 79 years was $75 (95% CI: 42 - 96).

The savings for vaccinated individuals without major disease was $79 (95% CI: 52 - 94)

**Synthesis of costs and benefits**

Not applicable since a cost-consequence approach was adopted in the analysis.

**Authors' conclusions**

Vaccination against influenza among elderly Hawaii citizens was associated with fewer hospitalisations for respiratory conditions and congestive heart failure (CHF), and cost-savings.

**CRD COMMENTARY - Selection of comparators**

The choice of the comparator (no influenza vaccination) was appropriate since it allowed the active value of the vaccination programme to be assessed.

**Validity of estimate of measure of effectiveness**

The study design, a retrospective cohort study, may be subject to some limitations. A randomised controlled trial would have been more appropriate to minimise the impact of bias and confounding factors. However, because of ethical considerations, it could not be easily performed. The patient groups were not comparable at analysis and, as the authors reported, the effectiveness of vaccination might have been underestimated since those individuals at higher risk of hospitalisation were most likely to have received vaccination. Adjustments for confounding factors were made in the analysis, and the study sample seems to have been representative of the study population. It was not stated clearly whether the sub-group analyses performed were planned before the study, or whilst it was being carried out. The authors listed some potential bias in the analysis that might have influenced the results. More specifically, deaths were only documented if they occurred in a hospital setting, some members might have received influenza vaccinations outside the plan, and the data for pneumonia vaccination might have been incomplete.

**Validity of estimate of measure of benefit**

Not applicable since a cost-consequence approach was adopted. Therefore, the reader is referred to the comments in the 'Validity of estimate of measure of effectiveness' field (above).

**Validity of estimate of costs**

Although the authors did not state the perspective adopted, it appears to have been that of the health care provider. Not all of the relevant categories of cost were considered in the analysis (i.e. the costs of the vaccine and vaccination were not considered when calculating the potential cost-savings; nor were the costs of subsequent hospitalisations considered). The authors reported the price year and the source of the unit costs. Discounting was not performed, which was appropriate as the costs were estimated for the follow-up period of the study participants, which was less than two years. The costs were treated stochastically. Sensitivity analyses were not conducted, and the unit costs and the quantities of resources used were not presented separately.

**Other issues**

The authors compared their results with those from other studies and found them to be similar. The authors addressed the issue of generalisability by stating that the results may not extend to other populations, although they highlighted the fact that influenza vaccination may lead to wide-ranging benefits, independent of the study setting.

**Implications of the study**

According to the results of their study, the authors suggested that influenza vaccination should be recommended for
the immunisation of all adults 65 years or older. Some caution should be exercised when interpreting these results because of some limitations of the effectiveness analysis, which have been highlighted already.

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