A cost-effectiveness analysis of adding a human papillomavirus vaccine to the Australian National Cervical Cancer Screening Program

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 study examined the cost-effectiveness of adding a human papillomavirus (HPV) vaccine to the current Australian National Cervical Screening Program to prevent the development of cervical cancer. The authors concluded that adding an HPV vaccine to Australia's current screening regimen for girls aged 12 years was a cost-effective strategy from the perspective of the third-party payer. As regards the quality of the study methodology, despite limited reporting on some sources used to derive the clinical estimates, the authors' conclusions are likely to be valid given the extensive use of sensitivity analysis and the clear presentation of the results.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
The objective of the analysis was to examine the cost-effectiveness of adding a human papillomavirus (HPV) vaccine to the current Australian National Cervical Screening Program (NCSP) for girls aged 12 years in order to prevent the development of cervical cancer.

Interventions
The study examined a national immunisation programme, given as part of a school-based programme for girls aged 12 years, added to the current NCSP in comparison with screening alone. The current screening approach consists of starting screening in women between the ages of 18 and 21 years, and screening every 2 years until the age of 70 years unless abnormal Pap smears are found.

Location/setting
Australia/community (school).

Methods
Analytical approach:
A published Markov model was updated to simulate the natural history of HPV infection and the impact of the two strategies under examination. The model was based on typical pre-cancer and cervical cancer health states. A patient lifetime horizon was considered. The authors stated that the perspective of the government was adopted.

Effectiveness data:
The clinical estimates came from published studies, but the method of selecting these studies was not described. It is therefore possible that the studies might have been identified selectively. Most of the epidemiological data came from national registries, while vaccine effectiveness was derived from data from a pivotal clinical trial. As found in the trial, vaccine was assumed to be 100% effective for HPV 16 and 18, which cover about 70% of HPV types. Screening accuracy and coverage were taken from a published cost-effectiveness analysis. Transition probabilities among health states were obtained from recent published studies, details of which were not given (although key results were described). Non-cancer mortality was taken from Australian National databases. The authors stated that plausible values were selected from among the available evidence.

Monetary benefit and utility valuations:
Utility valuations associated with health states of the model were based on data derived from a published study.
involving a sample of women in the USA (further details not given). The duration of the health states was determined from a survey of 16 gynaecological oncologists.

Measure of benefit:
The summary benefit measures were the life-years (LYs) and quality-adjusted life-years (QALYs). These were estimated using the decision model. A 5% discount rate was applied.

Cost data:
The health services included in the analysis were screening (Pap test and colposcopy/biopsy), vaccine (acquisition and administration), treatment of cancer (different stages) and terminal care. The costs of screening, follow-up and treatment were derived from Medicare Australia Schedule Fees. The costs of the school delivery programme came from the Municipal Association of Victoria's Cost of Victorian Local Government Immunisation Service. The costs were in Australian dollars (AUD). The price year was 2005. A discount rate of 5% was applied to future costs.

Analysis of uncertainty:
A deterministic, univariate sensitivity analysis was undertaken to identify the most influential model inputs, using published (or plausible) ranges of values for the key estimates. An alternative scenario involving a catch-up programme for women aged 14 to 26 years was also considered.

Results
The lifetime risk of cancer was 2.4% without screening, 0.77% with screening alone and 0.37% with vaccination and screening.

The expected costs and benefits (LYs and QALYs) were only presented graphically.

The incremental cost with vaccination added to current screening over screening alone was AUD 51,103 per LY gained and AUD 18,735 per QALY.

The sensitivity analysis suggested that the cost-effectiveness of vaccination worsened substantially with a shorter duration of vaccine efficacy, lowered vaccine coverage, reduced vaccine efficacy and increased vaccine costs. However, only when the duration of vaccine efficacy was reduced to 10 years (lifetime in the base-case) did the incremental cost per QALY become higher than AUD 50,000.

Variations in other key model inputs did not substantially alter the base-case findings. Under a worst-case scenario, the incremental cost was AUD 255,580 per LY gained (AUD 77,845 per QALY).

In terms of the age of the eligible cohort, the most attractive cost-effectiveness ratio (AUD 43,445 per LY and AUD 15,891 per QALY) was achieved when only girls aged 16 years were vaccinated.

Authors' conclusions
The authors concluded that adding an HPV vaccine to Australia's current screening regimen for girls aged 12 years was a cost-effective strategy for reducing the incidence of cervical cancer.

CRD commentary
Interventions:
The rationale for the choice of the comparators was clear. The new approach for population-wide immunisation was compared with the standard of care in the Australian setting. This baseline strategy of screening only for cervical cancer might not represent the routine pattern of care in other health care systems where vaccination against HPV has already been implemented. However, in the sensitivity analysis, alternative vaccination programmes (in different populations) were considered and these may be relevant for other settings.

Effectiveness/benefits:
The clinical data used in the analysis were mainly derived from published studies that, with a few exceptions concerning the use of national databases, were not described. It is therefore not possible to make an objective assessment of the
validity of these estimates given the paucity of data on the design, sample size and follow-up in these clinical sources. However, the extensive sensitivity analysis and the selection of the most plausible values for the base-case analysis enhance the robustness of the clinical estimates. The use of the two benefit measures, in addition to the lower expected figures associated with QALYs in comparison with LYS, highlights the importance of assessing quality of life for women with cancer.

Costs:
The cost categories included appear to have been consistent with the perspective adopted in the study. A breakdown of the cost items was not provided and some costs were presented as macro-categories. The costs were derived from the national health care service and reflected the local accounting system. Resource use was mainly derived from published studies. The key assumptions made in the study were investigated in the sensitivity analysis.

Analysis and results:
The synthesis of the costs and benefits was appropriately carried out, but the total costs and benefits were only reported graphically and only the values of the cost-effectiveness ratios were reported. The sensitivity analysis was well conducted and presented. A wide range of possible scenarios and alternative assumptions was considered in the sensitivity analysis. These features represent strengths of the study.

Concluding remarks:
The methods used in this modelling study (transition patterns, assumptions, cycle length and other details) were presented clearly. However, there was little information about the sources used to derive the clinical estimates. The extensive use of sensitivity analysis and the clear presentation of the results enhances the robustness of the study and the validity of the authors’ conclusions.

Funding
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Bibliographic details

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Adolescent; Australia /epidemiology; Cost-Benefit Analysis; Decision Support Techniques; Female; Human papillomavirus 16; Humans; Markov Chains; Mass Immunization /economics /statistics & numerical data; National Health Programs /economics; Papillomavirus Infections /economics /epidemiology /prevention & control; Papillomavirus Vaccines /economics /therapeutic use; Quality of Life; Quality-Adjusted Life Years; Uterine Cervical Neoplasms /economics /epidemiology /prevention & control

AccessionNumber