Cost-effectiveness of human papillomavirus vaccine in reducing the risk of cervical cancer in Ireland due to HPV types 16 and 18 using a transmission dynamic model

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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.

CRD summary
The objective was to evaluate the cost-effectiveness of combining a cervical cancer screening programme with a national human papillomavirus (HPV) vaccination programme compared with the screening programme alone. The authors concluded that vaccination against HPV types 16 and 18 would be cost-effective. Despite limited reporting around the clinical data, the authors provided a relatively transparent analysis. The conclusions reached by the authors appear to be appropriate.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to evaluate the cost-effectiveness of combining a cervical cancer screening programme with a national human papillomavirus (HPV) vaccination programme compared with a screening programme alone to prevent cervical dysplasia and cervical cancer related to HPV types 16 and 18 in the Irish health care setting.

Interventions
This study investigated annual vaccination of 12-year-old girls combined with a population-based cervical cancer screening programme, in which women aged 25 to 44 years were screened every three years and then every five years up to the age of 60. This intervention was compared with the screening programme alone. Strategies of annual vaccination of 12-year-old girls, with catch-up vaccinations for up to ages 15, 17, 19 or 26 years, combined with the screening programme, were also compared.

Location/setting
Ireland/primary care.

Methods
Analytical approach:
An independently developed dynamic agent-based model, which took account of the herd immunity effect, was used. The time horizon of the study was 70 years. The authors reported that the perspective was that of the health care payer, which was the Health Service Executive.

Effectiveness data:
The effectiveness data were derived from published studies. The main clinical parameter was the vaccine efficacy against cervical cancer. This was derived from the published Future II study.

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
Life-years gained were used as the measure of benefit and future health benefits were discounted at an annual rate of 3.5%.

Cost data:
The direct costs were those relating to: vaccination; cytology tests; and treatment of the health states of cervical intraepithelial neoplasia (CIN) 1, CIN 2 or 3, and invasive cervical cancer. The resource use data for diagnosis and treatment of cervical cancer were obtained from the published literature and expert clinical opinion. The unit costs for in-patient procedures were derived from Irish Diagnosis Related Group data. The unit costs for cytology were derived from the Irish Cervical Screening Programme. The costs of chemotherapy were derived from a hospital pharmacy department. The unit costs for other resource categories were derived from UK sources and converted using an exchange rate of one UK pound sterling to 1.40223 Euros (EUR). The price year was 2005 and all costs were reported in EUR. Future costs were discounted at an annual rate of 3.5%.

Analysis of uncertainty:
A one-way sensitivity analysis was performed for each model parameter. In addition, a probabilistic sensitivity analysis was undertaken by including probability distributions for each of the model parameters. The results of this analysis were presented as a cost-effectiveness acceptability curve, in which the probability of the intervention being cost-effective was reported for each willingness to pay threshold.

Results
The incremental cost per year per cohort of 12-year-old girls vaccinated was EUR 6.8 million when compared with screening alone. The life-years gained per vaccinated year group were 401.8.

The costs and benefits were combined using an incremental cost-effectiveness ratio (ICER, i.e. the additional cost per life-year gained). Compared with screening alone, the ICER for vaccination of 12-year-olds with screening was EUR 17,383 (95% confidence interval: 3,400 to 38,400) per life-year gained.

The results of the probabilistic sensitivity analysis showed that, at thresholds of around EUR 40,000 per life-year gained, the probability of the intervention being cost-effective was over 90%.

With catch-up vaccination programmes, the ICERs per life-year gained were: EUR 18,893 for up to 15-year-olds (compared with no catch-up); EUR 20,646 for up to 17-year-olds (compared with up to 15-year-olds); EUR 22,038 for up to 19-year-olds (compared with up to 17-year-olds); and EUR 24,534 for up to 26-year-olds (compared with up to 19-year-olds).

These results were sensitive to the discount rate, the cost of the vaccine and administration of the vaccination programme, the vaccine coverage, the requirement for a booster dose, and the proportion of cases of pre-malignant and invasive cervical cancer caused by HPV 16 or 18.

Authors’ conclusions
The authors concluded that vaccination against HPV types 16 and 18 would be cost-effective from the perspective of the Irish health care payer.

CRD commentary
Interventions:
The interventions were reported clearly and in detail.

Effectiveness/benefits:
Although the sources of the literature were provided, neither the methods used to identify the primary studies nor the inclusion criteria were reported. Therefore, it is difficult to ascertain if the best available evidence was used.

Costs:
The categories of costs were consistent with the stated perspective. All the major relevant costs appear to have been included. The authors reported the main sources from which the unit costs and resource use data were derived, which will help when replicating the analysis in other settings. All the adjustments to the cost data were adequately reported including the exchange rates used and discounting. The price year and time horizon of the analysis were also reported, which makes it possible to revalue the results for future years. The level of reporting was extremely transparent, allowing the reader to ascertain fully which resource use data and costs were included.
Analysis and results:
The authors conducted an appropriate incremental analysis, and the results for the non-dominated strategies were fully and clearly presented. The impact of uncertainty was investigated in detail using both one-way and probabilistic sensitivity analyses. Probabilistic sensitivity analysis is considered to be the gold standard, as the overall model uncertainty can be investigated. Overall, the methods were well reported and the results were reported in detail. In their discussion, the authors appropriately noted the limitations of their study.

Concluding remarks:
Despite limited reporting around the clinical data, the authors provided a relatively transparent analysis. The conclusions reached by the authors appear to be appropriate.

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MeSH
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