Cost and effectiveness evaluation of prophylactic HPV vaccine in developing countries
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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 study examined the cost-effectiveness of a prophylactic human papillomavirus (HPV) vaccination programme of 12-year-old girls compared to no immunisation. The authors concluded that a national programme of HPV immunisation was likely to be cost-effective in Thailand from the perspective of the health care provider. The study used valid cost-effectiveness methodology but some important assumptions were made and these should be considered when assessing the robustness of the authors’ conclusions.

Type of economic evaluation
Cost-utility analysis

Study objective
The study examined the cost-effectiveness of a universal prophylactic human papillomavirus (HPV) vaccination programme of 12-year-old girls compared with no immunisation.

Interventions
Routine HPV vaccination of all 12-year-old girls was compared against no immunisation. Three doses were used. No additional boosters after the first vaccination programme was assumed.

Location/setting
Thailand/primary care.

Methods
Analytical approach:
The analysis was based on a Markov model with a lifetime horizon. The perspective was that of the health care provider.

Effectiveness data:
The literature was reviewed systematically for Thai sources of evidence for the model. Where Thai data were not available, data from Asia-Pacific or other regions were used supplemented with expert opinion. Incidence of cervical cancer cases and cervical cancer deaths were key inputs of the model and were derived from surveillance data reported by the Thai National Cancer Institute and Thai life tables. Vaccine efficacy was based on a literature review and obtained from a randomised clinical trial. Assumptions for the model included 100% vaccination uptake and lifelong immunisation.

Monetary benefit and utility valuations:
Utility valuations were derived from a previous study by the authors of the current analysis.

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure and were discounted at an annual rate of 3%.

Cost data:
The economic analysis included costs of vaccination and costs associated with treatment of genital warts and cervical cancer (capital cost and labour cost). Economic inputs were derived from the Center of Health Assurance at a Thai institution and were presented as macro-categories. Costs were in Thai baht and were discounted at an annual rate of
Analysis of uncertainty:
A Monte Carlo simulation was carried out using conventional probability distributions for groups of model inputs (beta for clinical data and gamma for unit costs). One-way sensitivity analyses were carried out using ranges of values that were mainly based on expert opinion.

Results
In a cohort of 100,000 women, total costs and QALYs were 803,464,334.7 baht and 2,659,620.8 with vaccination and 398,873,486.4 baht and 2,657,102.3 without vaccination. The incremental cost per QALY gained with vaccination over no immunisation was 160,649.5 baht. Vaccination appeared cost-effective according to the standard threshold recommended by the World Health Organisation (WHO) and based on the per capita gross domestic product (GDP) criterion (Thai GDP 135,415 baht).

Variations in individual inputs changed the magnitude of outcome estimates but did not alter the cost-effectiveness of vaccination. The most influential inputs were vaccine price, proportion of girls covered by the vaccination programme and utility value for genital warts. Incremental cost per QALY exceeded three times the local GDP where the vaccine price was doubled or vaccine uptake was lower than 80%.

Authors' conclusions
The authors concluded that the national programme of HPV immunisation was likely to be cost-effective in Thailand from the perspective of the health care provider.

CRD commentary
Interventions:
The rationale for selection of the comparators was clear as the proposed vaccination strategy was compared against the pattern of care in the authors' setting (no vaccination). No description of practice in Thailand was provided. The authors stated that vaccination of girls at high risk might be an interesting alternative to consider.

Effectiveness/benefits:
Clinical inputs were generally taken from valid sources. For example, vaccine efficacy was taken from a randomised controlled trial and epidemiological estimates were from local sources (where possible). Key assumptions were made on duration of vaccine benefits and vaccine coverage and these had an impact on cost-effectiveness results as shown by the sensitivity analysis. Use of QALYs was appropriate for the disease and enabled comparisons with other studies. Utility weights were taken from Thai patients, but instruments used to elicit preferences were not provided.

Costs:
The economic analysis was consistent with the perspective adopted and cost categories included in the model. Data on unit costs and resource quantities and the price year were not presented, which limited the transparency of the economic side of the analysis. Most economic inputs were derived from a single institution and might not have been representative of other medical centres, especially in developing countries. The impact of variations in cost estimates was considered in the sensitivity analyses.

Analysis and results:
The study results were extensively presented as the authors reported estimates for health outcomes beyond costs and QALYs. An incremental approach was used to synthesise the costs and benefits of the two strategies and the optimal intervention was identified using the commonly used WHO criterion. A clear description of the simulation model and its main assumptions was provided. The model results were validated using real-world data. The sensitivity analysis focused mainly on variations of individual inputs. Use of a probabilistic sensitivity analysis was intended to calculate means and standard deviations for main model outcomes. The authors pointed out that no booster doses were considered in the model. Had booster doses been used, the cost-effectiveness of vaccination would have decreased. It would have been interesting to have estimated the cost-effectiveness of vaccine in this case. No herd immunity was considered and this might have underestimated the benefits of the vaccine. The study results appeared specific to Thailand and might not be transferable to other settings.
Concluding remarks:
The study used valid cost-effectiveness methodology but some important assumptions should be considered when assessing the robustness of the authors’ conclusions.

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