Cost-effectiveness of human papillomavirus vaccination and cervical cancer screening in Thailand
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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 assessed the cost-effectiveness of various screening and vaccination strategies for cervical cancer prevention in pre-adolescent girls and women. The authors concluded that the use of a low cost pre-adolescent human papillomavirus vaccination followed by human papillomavirus testing five times per lifetime was the most cost-effective intervention. The analytical approach of the study appears appropriate. Although some methods and results were poorly reported, the authors conclusions appear appropriate and reflect the evidence available.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The study objective was to assess the cost-effectiveness of various screening and vaccination strategies for cervical cancer prevention in females aged nine years and older.

Interventions
The cervical cancer prevention strategies included were: vaccination of girls younger than 12 years old for human papillomavirus types 16 and 18; screening of women over 35 years old; and combined vaccination and screening. The tests used in the screening strategies were cytology, conventional human papillomavirus DNA test, rapid human papillomavirus DNA test, and visual inspection with acetic acid (VIA). The strategies involved different numbers of clinical visits (one, two, or three), different frequencies (one to five times per lifetime), and different age ranges. Twenty-five combinations were compared in the study; no screening or vaccination was also considered.

Location/setting
Thailand/community care and primary care.

Methods
Analytical approach:
A published Monte Carlo simulation model was adapted to the Thailand setting; this was used to combine data from published literature. The time horizon was a lifetime. The authors stated that a societal perspective was adopted.

Effectiveness data:
The effectiveness data came from published literature. A statistical approach, based on likelihood scoring function, was applied to the epidemiological data; some author assumptions were also used. Background mortality was estimated from World Health Organization (WHO) life tables. The main clinical effectiveness estimates were vaccine efficacy, test accuracy and coverage; these estimates were based on the simulation model when it was published previously.

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
The benefit measure was life years, discounted at an annual rate of 3%. The reduced cancer incidence with each strategy was reported.
Cost data:
The cost categories were vaccine costs, wastage, freight and supplies, administration, immunisation support and programme costs. Costs associated with women's time and transportation to and from the site of care were also included. The cost data came from a previously published study, WHO CHOICE, and the International Labour Organisation. The cost of delivering the human papillomavirus vaccine was based on the authors' assumptions. Costs were presented in 2005 international dollars (INT$) and were were discounted at an annual rate of 3%.

Analysis of uncertainty:
One-way and two-way sensitivity analyses were carried out to examine the impact of variations in model inputs on the incremental cost-effectiveness ratio (ICER).

Results
The mean reduction in cervical cancer incidence and the incremental costs per life years saved were reported for each of the 25 combinations.

Assuming lifelong efficacy and 80% vaccine coverage, the mean reduction in lifetime cancer risk was 55% with pre-adolescent vaccination alone, 5% to 33% with screening one to five times per lifetime, and 57% to 70% with combined vaccination and screening one to five times per lifetime. Five-visit human papillomavirus DNA test combined with vaccination was associated with the largest cancer risk reduction of 70%.

At a vaccine cost per dose of INT$ 10, vaccination alone was more effective and less costly than screening alone. The five-visit human papillomavirus DNA test combined with vaccination had an ICER from INT$ 6,380 to INT$ 7,720, provided the cost per dose was from INT$ 10 to INT$ 200. The per capita gross domestic product in Thailand (INT$ 8,100) was used as a threshold for the ICER.

The sensitivity analyses showed that these results were sensitive to changes in vaccine efficacy and coverage.

Authors' conclusions
The authors concluded that the use of low cost pre-adolescent human papillomavirus vaccination followed by human papillomavirus screening five times per lifetime was the most cost-effective cervical cancer prevention strategy.

CRD commentary
Interventions:
The interventions were adequately described and appeared to be appropriate comparators. It was likely that all the relevant comparators were included in the study (25 combinations were tested); a no-intervention strategy was appropriately included. Given the number of comparators included, it was likely that the interventions would be generalisable to other study settings.

Effectiveness/benefits:
A significant proportion of the effectiveness data were taken from the effectiveness data identified in the previously published simulation model used. However, it was unclear if systematic methods were used to identify the effectiveness data in this previous study. It was unclear if systematic methods were used to derive the remaining effectiveness data in this study. Therefore, it was unclear if the best available evidence was included in the study. The authors stated that the data on the natural history of the disease were based on the best available data regardless of the setting, but the model was calibrated to the Thailand context using country-specific epidemiological data. However, the evidence included and the techniques used were not described and so their quality was unclear.

The benefit measure of life years was valid, as it captured the impact of the disease on the most relevant dimension of health, which was survival. However, life years did not take account of morbidity, whereas measures such as quality-adjusted life-years would do this and may be of interest for the study interventions.

Costs:
The study perspective was clearly stated; the cost categories included appeared to appropriately cover this perspective. Limited information on the methods of the cost analysis and sources of cost and resource data were provided, so their quality and appropriateness was unclear. Additional information on the cost analysis was provided in a separate online
appendix. The costs appear to have been appropriately discounted and adjusted for inflation.

Analysis and results:
The analytical approach was adequately described; additional details were provided in the online appendix. Adequate sensitivity analysis was undertaken to assess the uncertainty of the study results. However, the overall model uncertainty could have been better assessed with probabilistic sensitivity analysis. The life years saved and costs of each of the interventions were not reported. Although selected incremental results were reported, this seemed appropriate given the large number of strategies being compared. The authors discussed several limitations with their study.

Concluding remarks:
The analytical approach of the study appears appropriate. Although some of the methods and results were poorly reported, the authors conclusions appear to be appropriate and reflect the evidence available.

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