Health and economic impact of HPV 16/18 vaccination and cervical cancer screening in Eastern Africa

Campos NG, Kim JJ, Castle PE, Ortendahl JD, O'Shea M, Diaz M, Goldie SJ

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 various strategies of cervical cancer screening and human papillomavirus 16/18 vaccination in Eastern Africa. The authors concluded that vaccination was cost-effective provided the cost per vaccinated girl was less than $10. Where this cost was between $10 and $25, vaccination followed by screening at age 35 provided good value for money. The analysis used a methodologically valid framework and detailed information was provided in an appendix. The authors’ conclusions appear robust.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The study examined the cost-effectiveness of various strategies of cervical cancer screening and human papillomavirus (HPV) 16/18 vaccination in Eastern Africa.

Interventions
The interventions under examination were: three-dose HPV 16/18 vaccination of pre-adolescent girls; screening of adult women over age 30 using HPV DNA testing or visual inspection with acetic acid (VIA); and pre-adolescent vaccination followed by screening at older ages.

Strategies varied depending on the number of doses (in case of vaccination) and test choice, frequency and diagnostic protocol (in the case of screening).

Location/setting

Methods
Analytical approach:
The analysis used a previously published computer-based decision analytic model to simulate the natural history of disease and the impact of vaccination and/or screening. A lifetime horizon was considered. The perspective adopted in the study was not stated explicitly but appeared to be societal.

Effectiveness data:
Clinical inputs were taken from studies identified through a comprehensive literature review. Country-specific registries were used for most epidemiological data such as age-specific cervical cancer incidence or type-specific HPV prevalence (16 versus 18 specimens). Conventional statistical approaches were used to pool evidence from multiple sources, where available. Treatment effect for vaccine was generally taken from clinical trials but depended on number of doses received and coverage, attrition rate and assumptions on immunity. Sensitivity and specificity of screening was a key input of the model and was taken from several published studies.

Monetary benefit and utility valuations:
Not considered.

Measure of benefit:
Years of life saved was the summary benefit measure. A 3% annual discount rate was applied.

Cost data:
The economic analysis included costs of vaccination, VIA, HPV DNA test and women’s time and transport. The cost of vaccination was calculated on the authors’ opinion as there was no official price of vaccine and immunisation campaigns. Various costs per vaccinated girls were considered and were assumed to include vaccine acquisition, wastage, freight and supplies, administration, immunisation support and programmatic costs. Time costs were taken from previous studies and assumptions were based on official indicators. Direct medical costs were estimated for Kenya and were derived for the other countries by establishing a reasonably accurate relationship between per capita gross domestic product (GDP) in African countries. Costs were in international dollars ($). The price year appeared to be 2005. A 3% annual discount rate was used.

Analysis of uncertainty:
Several one-way sensitivity analyses were performed to investigate the issue of uncertainty using assumptions based on published sources or authors’ opinions.

Results
The cost-effectiveness for Zimbabwe was not reported because of severe hyperinflation that took place in 2009.

In pre-adolescent girls, vaccination provided the lowest incremental cost-effectiveness ratio (ICER). For example, in the base case (coverage 70%, attrition rate 15%) assuming a cost per vaccinated girl of $10 or lower, vaccination had an ICER below the per capita GDP in all four countries ($160 in Kenya, $90 in Mozambique, cost-saving in Tanzania and $20 in Uganda). Screening for HPV at age 35 was dominated (less effective and more expensive) and vaccine plus screening at age 35 was above the GDP threshold in Kenya ($2.090) and Mozambique ($1,260) but below the threshold in Tanzania ($740) and Uganda ($1,000).

At a cost per vaccinated girl above $10, vaccine plus screening was the most cost-effective strategy. At a cost per vaccinated girl above $50, vaccination was dominated.

In women older than age 30, results varied on the basis of assumptions about frequency of screening and type of screening. Overall, provided that HPV DNA testing was available, HPV DNA testing was more cost-effective than VIA. For example, screening with one-visit VIA once per lifetime was dominated and the ICERs associated with screening with HPV DNA testing once per lifetime were $1,400 in Kenya, $770 in Mozambique, $450 in Tanzania, and $840 in Uganda (compared to no screening).

Assumptions about test performance, population coverage and loss to follow-up were key drivers of the analysis.

Authors’ conclusions
The authors concluded that vaccination was cost-effective provided the cost per vaccinated girl was less than $10. If the cost per vaccinated girl was between $10 and $25, vaccination followed by screening at age 35 with one-visit HPV DNA testing provided good value-for-money.

CRD commentary
Interventions:
Selection of comparators was appropriate as various strategies were included and different combinations of screening frequencies were considered.

Effectiveness/benefits:
Clinical and epidemiological data appeared to be from relevant and valid sources. Country-specific estimates were used for epidemiological inputs. Vaccine efficacy was taken from clinical trials. Several assumptions were needed for vaccine and screening coverage, attrition rate and vaccine immunity. Most clinical inputs were varied in the sensitivity analysis. A description of the various methodological approaches used to calibrate the decision model was clearly reported.

Use of years of life saved appeared an appropriate benefit measure and enabled comparisons with other studies. It was
unclear whether the inclusion of quality of life scores would have changed model's results.

Costs:
It appeared that a broad perspective was used in the analysis but this was not stated explicitly. Direct and indirect costs were included. Extensive details of unit costs and quantities of resources used were reported in the appendix of the study. Data sources were based on studies that reported country-specific estimates and relied also on some explicitly reported assumptions. The price year was stated explicitly and this enabled reflation exercises in other time periods. Costs were varied in the sensitivity analyses. Overall the economic side of the study was reported satisfactorily.

Analysis and results:
Study results were reported for each country and for all scenarios. Only incremental cost-effectiveness ratios were reported as total costs. Years of life saved were not given. The issue of uncertainty was investigated using a deterministic approach, which considered variations in individual inputs one at a time. Various alternative scenarios were considered appropriately. The authors acknowledged that study results strongly depended on assumptions on vaccine cost, coverage and attrition rate. Study findings might be relevant to other African countries with similar epidemiological estimates.

Concluding remarks:
The analysis used a methodologically valid framework and detailed information was provided in the appendix of the paper. The authors' conclusions appear robust.

Bibliographic details

PubMedID
21717458

DOI
10.1002/ijc.26269

Original Paper URL

Indexing Status
Subject indexing assigned by NLM

MeSH
Adolescent; Adult; Africa, Eastern; Child; Cost-Benefit Analysis; DNA, Viral /analysis; Female; Human papillomavirus 16 /immunology; Human papillomavirus 18 /immunology; Humans; Middle Aged; Papillomavirus Vaccines /immunology; Uterine Cervical Neoplasms /diagnosis; Vaccination /economics

AccessionNumber
22012016376

Date bibliographic record published
26/07/2012

Date abstract record published
16/04/2013