Cost-effectiveness of adding an HPV vaccine to the exiting cervical cancer screening programme in South Africa

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Introduction

- In South Africa, cervical cancer is the most common cancer in women
  - Crude annual incidence rate of 30 per 100 000
  - 6 800 new cases of cervical cancer each year
  - 3 700 deaths each year
- The national cancer screening policy
  - The goal is to screen 70% of women attending public sector services
  - The gap between this policy and its implementation is significant
- The HPV vaccine offers a new approach to cervical cancer prevention

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Study aim

- To investigate whether a cervical cancer prevention programme that incorporates an HPV vaccine is potentially more cost-effective than the current strategy of screening alone
- Part of a broader study exploring challenges and barriers to potential vaccine introduction in the public sector (Harries et al 2009)

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Specific study objectives

- To develop a Markov state transition model to describe the screening and management of cervical disease within the South African context
- To estimate the cost-effectiveness of two strategies defined as cost per life year saved and cost per QALY gained

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Modelling

- We developed a static Markov state transition model to estimate the lifetime costs and life expectancy of a hypothetical cohort of women age 12 to 85
  - Adaptation of a previously published model (Kulasingam et al 2007, Myers et al 2000)
- In the model we compared two strategies for the base-case scenario
  - Screening using conventional cervical cytology 3 times at 10-year intervals starting at age 30
  - Vaccination of 12 year-old girls followed by screening as described above

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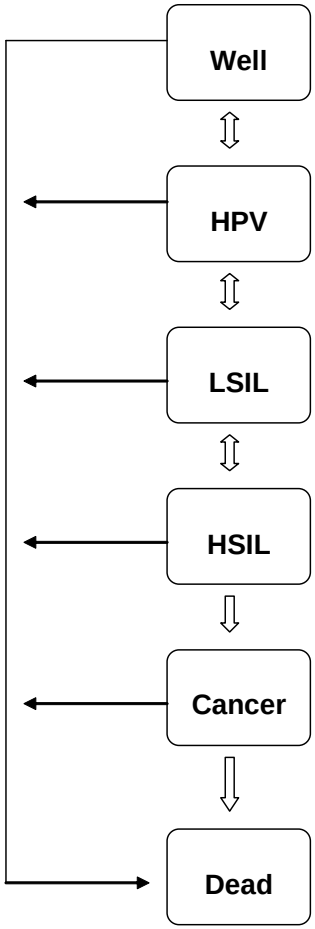
Natural history of disease



Base case assumptions

- Screening
  - Eligibility: age 30, 40 and 50
  - Coverage: 50%
  - Loss to follow up: 15%
- Vaccination
  - Age: 12
  - Coverage: 80%
  - Efficacy against HPV 16 and 18: 90%
  - % completing 3 doses/booster: 100%/50%
  - Duration of efficacy: lifetime
- Treatment parameters were based on expert opinion

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Methods: costs

- Public health service and societal perspectives
- Vaccination, screening and treatment costs
- Bivalent vaccine at US$ 120 per dose
- School-based vaccination
- Vaccine wastage cost at 15% and programme costs at 25%
- Direct and indirect patient costs

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Data sources

- MRC and ASSA for data on cancer and all-cause mortality
- Manufacturers for prices of screening tests and vaccines
- Local published costing studies for health service cost data and patient cost
- Published studies for transition probabilities and quality of life weights

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Sensitivity analysis

- Sensitivity analysis was undertaken on the following parameters
  - screening tests (VIA and HPV DNA test)
  - vaccine (price, efficacy, delivery options)
  - discounting (different discount rates)
  - mortality rates from other causes (excluding HIV-related mortality)

Results: Cost-effectiveness
(health service perspective 2007 US$)

Strategy	Lifetime cost	Life years saved	QALY gained	ICER (life years)	ICER (QALY)
Undiscounted					
Screening only	642	51.95	51.74	dominated	dominated
Vaccine plus screening	493	52.07	52.04	more cost-effective	more cost-effective
Discounted at 3%					
Screening only	181	24.13	24.08	-	-
Vaccine plus screening	281	24.22	24.15	4,495	1,460

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Results: Cost-effectiveness
(societal perspective 2007 US$)

Strategy	Lifetime cost	Life years saved	QALY gained	ICER (life years)	ICER (QALY)
Undiscounted					
Screening only	755	51.95	51.74	dominated	dominated
Vaccine plus screening	517	52.07	52.04	more cost-effective	more cost-effective
Discounted at 3%					
Screening only	216	24.13	24.08	-	-
Vaccine plus screening	289	24.16	24.15	3,320	1,078

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Discussion

- Is it cost-effective?
  - Yes, if GDP per capita US$ 5,724 is used as a threshold
  - Comparable with studies on the cost-effectiveness in South Africa:
    - cervical cancer screening (Goldie et al 2005)
    - ART interventions (Cleary et al 2006)
- Is it affordable?
  - Not, at the current vaccine price
  - Yes, if the vaccine price were to be reduced by 60% (below US$48 per dose)
- Findings were sensitive to discount rate, vaccine price and increases in mortality from HIV/AIDS

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Limitations

- A lack of epidemiological data on HPV and cervical cancer in South Africa made it difficult to calibrate the model
- We did not consider “herd immunity” - this could have underestimated the benefit of vaccination
- The costs of palliative care for invasive cervical cancer were excluded – this could have underestimated the cost of cancer treatment
- We assumed a lifelong duration of vaccine efficacy, significantly impacting on cost-effectiveness of the vaccine

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Conclusions

- Adding a vaccine to the current screening programme to prevent cervical cancer in South Africa can potentially be a cost-effective strategy
- If the vaccine price is reduced by around 60%, vaccination followed by screening might be a very affordable policy option
- This new health intervention should be publicly funded

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The next step

- Estimation of the budget impact of scaling up of the intervention
- Likely to be considerable because of the larger size of the population eligible for vaccination

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Acknowledgements

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