Health Technology Assessment of Strategies for Cervical Cancer Screening in India

POLICY BRIEF

SUMMARY

Cancer of the uterine cervix is the second most common cancer among women world-wide. It is also the second most common cancer among Indian women, which constitute the largest burden of cervical cancer patients in the world. One out of every five women in the world suffering from this disease is an Indian. The establishment of a strong link between high-risk persistent human papillomavirus (HPV) infections and the occurrence of cervical cancer has resulted in the recent development of HPV related control strategies for the prevention of cervical cancer. Introduction of screening led to reduction in occurrence of cervical cancer cases from 19% to 58% along with decrease in cancer deaths from 28% to 70% as compared to no screening in a lifetime cohort of 1 lakh women. There was reduction in lifetime risk of cervical cancer among Indian women from 2.18% in the case of no screening to 0.879 - 1.729 % with implementation of various screening strategies. This reduction in cancer cases and associated mortality translated into gain of 3141 to 6848 life years and 3630 to 8198 QALYs among various screening strategies implemented in a cohort of 1 lakh women. The study concludes that VIA every 5 years is the most cost-effective option with an incremental cost of INR 21,196 (USD 320) per QALY gained in the context of India.

Introduction

The establishment of link between high-risk human papillomavirus (HPV) infection and occurrence of cervical cancer has resulted in recent development of HPV related control strategies for prevention of the same.

The present study was designed to assess the cost effectiveness of 3 screening strategies i.e., visual inspection with acetic acid (VIA), Papanicolaou test (Pap smear) and HPV DNA test at a frequency of every 3 years, 5 years and 10 years in the context of India.

Methodology: The present study based on a markov model, societal perspective and discount rate of 3% estimated the lifetime costs and consequences in a hypothetical cohort of 30 year old women screened with either of the screening strategy at various time intervals.

Diagnostic accuracy of the screening strategies and data on transition probabilities was based on the results of the existing meta-analysis studies. Primary data was collected for assessing per person cost of screening, cost of treating cervical cancer and quality of life.

Results: Introduction of screening leads to reduction in lifetime occurrence of cervical cancer cases from 19% to 58% and cervical cancer deaths from 29% to 70% as compared to no screening. Among various screening strategies, VIA every 5 years was found to be most cost-effective at an incremental cost of INR 16,905 (US$ 255) per QALY gained.

Table1: Reduction in cervical cancer cases and deaths with implementation of various screening scenarios for women (as compared to no screening) screened in the age group of 30-65 years

Screening strategy	Frequency	Cancer cases averted (%)	Deaths averted (%)
Visual inspection with acetic acid	3 Years	52	65
	5 Years	37	50
	10 Years	22	31
PAP smear	3 Years	49	63
	5 Years	33	48
	10 Years	19	29
HPV DNA test	3 Years	58	70
	5 Years	43	56
	10 Years	26	36

Rationale

As India is on the path towards universalizing national level screening program, the present study was designed to assess the cost-effectiveness of three screening strategies of VIA, Pap smear and HPV DNA as compared to no screening scenario at the frequency of every 3 years, 5 years and 10 years among women in the age groups 30-65 years in India. In addition, we also evaluated the costs and consequences of a scenario comprising of screening with HPV vaccination as compare to screening alone or do nothing.

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POLICY RECOMMENDATIONS

1. Screening with VIA every 5 years among the women of age 30-65 years is recommended for India.

2. A minimum 30% of screened positive patients are needed to be treated for VIA every 5 years to remain cost effective. Similarly, lifetime risk of cervical cancer of at least 0.7 is required for VIA 5 yearly to be cost effective.

3. In terms of equity considerations and specifically considering the screening strategy of VIA every 5 years, it was seen that there was around 30% more reduction in cervical cancer cases and subsequent mortality in the bottom 1/3rd of the income population group as compared to upper 2/3rd of the income group in India. Similarly, in terms of financial risk protection, bottom 1/3rd of the income group had greater reduction in OOP expenditure (INR 1073 vs INR 770 respectively) and more households averted catastrophic health expenditure (520 vs 245 respectively) as compared to upper 2/3rd in the cohort of 1 lakh women screened with VIA 5 yearly

. Crude incidence rates of HPV-related cancers

	Male	Female
Cervical cancer	-	14.9
Anal cancer	0.1-0.6	0.0-0.5
Vulva cancer	-	0.1-0.5
Vaginal cancer	-	0.0-1.0
Penile cancer	0.4-2.3	-
Oropharynx	2.2	0.4

Table 2. Burden of cervical cancer

	Incidence	Mortality
Annual number of new cases/deaths	96922	60078
Crude rate	14.9	9.2
Age-standarized rate	14.7	9.2
Cumulative risk 0-74 years (%)	1.6	1.0
Ranking of cervical cancer (all years)	2nd	2nd
Ranking of cervical cancer (15-44 years)	2nd	2nd

Table 3. Burden of cervical HPV infection India

	No. Tested	% (95% CI)
HPV prevalence in women with normal cytology	35349	7.0 (6.7-7.2)
HPV 16/18 prevalence:		
Normal cytology	8845	5.0 (4.6-5.5)
Low-grade cervical lesions	177	28.2 (22.1-35.3)
High-grade cervical lesions	253	62.8 (56.7-68.6)
Cervical cancer	2006	83.2 (81.5-84.8)

Table 2: Cost effectiveness of screening strategies

Strategy	Cost per women in INR (US$)	QALY per women	Incremental cost in INR (US$) per QALY gained	Status
VIA: 10 years	3,284 (49.6)	18.4838		ND
HPV: 10 Years	4,189 (63.2)	18.4871	273,904 (4,137)	ND
VIA: 5 Years	**4,457 (67.3)**	**18.5029**	**16,905 (255)**	**ND**
VIA: 3 Years	7,613 (115)	18.5186	200,666 (3,031)	ND
HPV: 3 Years	10,241 (155)	18.5265	333,583 (5,039)	ND
Pap: 3 years	8,100 (122.3)	18.5161		D
Pap: 10 Years	3,503 (53)	18.4796		D
Pap: 5 years	4,853 (73.3)	18.4995		D
HPV: 5 Years	6,036 (91.2)	18.5089		ED

*VIA: Visual inspection with acetic acid; Pap: Papanicolaou test; D: Dominated; ND: Non-Dominated; ED: Extended Dominance; ICER: incremental cost effectiveness ratio; QALY: Quality adjusted life years; INR: Indian National Rupees; US$: Unites States Dollar

Conclusion

Introduction of screening leads to reduction in occurrence of cervical cancer cases from 19% to 58% along with decrease in cancer deaths from 28% to 70% as compared to no screening in a lifetime cohort of 1 lakh women. This further implies reduction in lifetime risk of cervical cancer among Indian women from 2.18 in the case of no screening to 0.879 - 1.729 with implementation of various screening strategies. Furthermore, the decrease in incidence cancer cases with screening led to savings in terms of lifetime reduction in per women OOP expenditure of INR 636 (USD 9.6) to INR 810 (USD 12.2). Finally, the study concludes that among various screening strategies, VIA every 5 year is the most cost effective screening method in the context of India.

Cost and cost effectiveness

1. The overall lifetime cost incurred by the cohort of 1 lakh women in the scenario of no screening was INR 194 million (USD 2.93 million) and treatment expenditure (on invasive cancer) constituted 90% of this cost (INR 175 million; USD 2.65 million) (Table 6). Similarly, among various screening scenarios, the overall cost ranged from INR 327 (USD 4.94 million) to INR 951 million (USD 14.38 million) and the treatment expenditure constituted 12% (INR 114 million; USD 1.72 million) to 42% (INR 137 million; USD 2.07 million) of the overall cost. This proportional decrease in the cost of treatment during the scenario of screening led to savings in terms of lifetime reduction in per women OOP expenditure of INR 636 (USD 9.6) to INR 810 (USD 12.2) among various screening strategies.

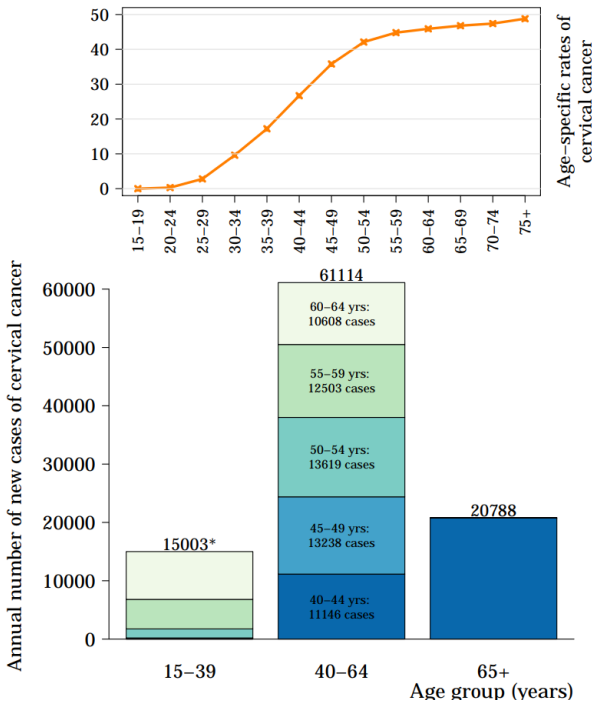

Figure 1: Annual number of cases and age-specific incidence rates of cervical cancer in India (estimates for 2018

2. The incremental cost per QALY gained with screening varied from of INR 33,354 (USD 504) to INR 92,209 (USD 1394) as compared to no screening as shown in table 8. Similarly, the incremental cost per cervical case prevented and death averted was found to be in the range of INR 598,675 (USD 9050) to INR 284,815 (USD 4306) and INR 682,287 (USD 10,314) to INR 264,715 (USD 4002) respectively with various screening strategies as compared to the scenario of no screening.

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References:

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3) https://hpvcentre.net/statistics/reports/IND_FS.pdf