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Cost-effectiveness and public health impact of a 9-valent human papilloma virus vaccination program in Ukraine

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Background

- According to the ICO/IARC Information Centre on HPV and Cancer Information Report,[1] Ukraine has a population of 20.1 million women aged 15 years and older who are at risk of developing cervical cancer. Current estimates indicate that every year, 4,756 women are diagnosed with cervical cancer and 2,089 die from the disease. Cervical cancer is the 4th most frequent cancer among women in Ukraine and the second most frequent cancer among women between ages 15 and 44. Despite the significant burden of HPV-related diseases in Ukraine, currently the HPV vaccination (HPVv) is not included in the national immunization program (NIP), and only covered at regional level with a low vaccine coverage. Understanding health economic and epidemiological impact of vaccination is crucial to make an evidence-based decision on the expansion of the NIP in this country

Objective

- To estimate the expected economic and public health impact of 9-valent HPV vaccine (9vHPV; HPV 6/11/16/18/31/33/45/52/58) implementation in the NIP in Ukraine in comparison with no HPV vaccination (screening only scenario)

Methods

- A published and validated HPV dynamic transmission model,[2] built in Mathematica®, was adapted and calibrated to assess the public health impact and the cost-effectiveness of vaccinating 11-year-old girls with a two-dose schedule with gradual increase of vaccination coverage up to 80% by 5th year of the program
- The age-structured mathematical model comprised demographic variables describing the age structure of the population, behavioural variables describing sexual activity, and epidemiologic variables describing transmission of HPV infection and any HPV-related diseases. The model assumed a 100-year time horizon, lifelong immunity following vaccination, herd immunity, ongoing cytology screening, and a discount rate of 3% for costs and benefits
- Ukraine-specific data have been used, ie, demographic,[3] epidemiological,[1] screening,[1] and economic parameters. Costs of treatment, screening, and diagnostic tests were based on national health-care price tariffs used in the Ukraine Program of Medical Guarantees, 2023.[4] The costs were converted in USD (exchange rate 1 USD = 36.5686 UAH, according to National Bank of Ukraine in February 2023)

Results

- Over 100 years, 9vHPV vaccination strategy in single cohort of girls 11 years of age may prevent 191,770 HPV-related cancer cases may prevent 191,770 HPV-related cancer cases and save 74,987 lives. By disease type, 172,850 (43.4%) cervical cancer cases, 3,121 (37.3%), and 3,281 (33.1%) cases of vaginal and vulvar cancers may be avoided, respectively. Vaccination may prevent an additional 2,208,855 (58.6%) cases of anogenital warts in females and 1,034,947 (35.4%) in males. The cumulative number of quality-adjusted life-years (QALY) gained from the HPV vaccination program compared with no vaccination was 663,179 QALYs. ICER of 9vHPV was 2,068 $ per QALY gained, which is significantly below the willingness-to-pay threshold of 13,602 $ per QALY (assumed as 3xGDP per capita[5]) and is below 1xGDP per capita threshold (4,534 $) in Ukraine. Sensitivity analysis over the cost of disease, cost of vaccination, vaccine effectiveness, and utilities confirmed the robustness of an assessment

Table 1. Epidemiological impact of 9vHPV inclusion in Ukrainian NIP in comparison with no vaccination and only cervical cancer screening over 100 years

HPV-related disease[a]	Incidence Cases prevented (%)		Mortality Deaths prevented	
	Female	Male	Female	Male
Cervical cancer	172,850 (43.4%)	–	67,267 (38.6%)	–
CIN 1	3,688,640 (71.8%)	–	–	–
CIN 2+	4,116,030 (72.1%)	–	–	–
Vaginal cancer	3,121 (37.3%)	–	1,534 (33.6%)	–
Vulvar cancer	3,281 (33.1%)	–	1,621 (30.0%)	–
Genital warts	2,208,855 (58.6%)	1,034,947 (35.4%)	–	–
Penile cancer	–	4,317 (43.4%)	–	1,156 (39.7%)
Anal cancer	6,201 (34.8%)	2,000 (21.8%)	2,396 (33.6%)	1,013 (21.0%)

[a]Head and neck cancers and RRP were not included in the analysis due to the requirements of Ukrainian HTA body.

Figure 1. Estimated HPV 16/18/31/33/45/52/58-related incidence of cervical cancer over 100 years

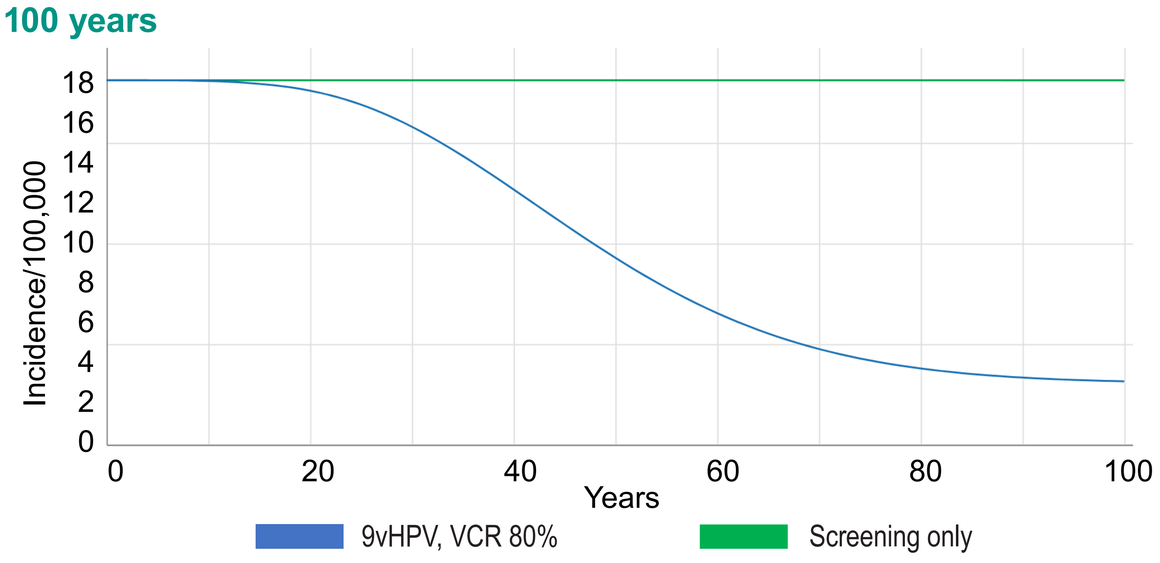

Table 3. Cost-effectiveness analysis of HPV vaccination strategy

Comparator	Discounted total costs per person (USD)[a]	QALYs per person (QALY)[b]	Incremental costs per person (USD)	Incremental QALYs per person (QALY)	ICER (USD per QALYs gained)[c]
Screening only	960.28	27.92870	–	–	–
9vHPV, girls	1,017.78	27.95650	57.50	0.02780	2,067.98

[a]Costs rounded to 0.01.
[b]QALYs rounded to 0.00001.
[c]Costs/QALY rounded to 1.

Limitations

- Direct medical costs associated with potential complications and palliative care in HPV-related cancers were not included in the model. This may result in cost underestimation of treatment
- Indirect costs were not taken into consideration
- Head and neck cancers and recurrent respiratory papillomatosis were not included in the analysis and that underestimates the cost-effectiveness of 9vHPV

Conclusion

- The present study suggests that inclusion of 9vHPV in the national immunization program is a highly cost-effective approach for the healthcare system in Ukraine and may result in improvement of the public health and economic impact

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Disclosure

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