

COST-EFFECTIVENESS OF SINGLE-DOSE HPV VACCINATION IN NEPAL: AN ECONOMIC EVALUATION

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Objective

- Evaluate the cost-effectiveness of Nepal's 2025 nationwide single-dose HPV vaccination campaign.

Introduction

- Cervical cancer is the leading cause of cancer death and the second most common cancer among women in Nepal.
- Each year, approximately 2,200 women are diagnosed with cervical cancer, and ~1,493 die (~4 deaths per day); the age-standardized incidence is 14.20 per 100,000 women.
- Over 80% of cases are attributable to preventable high-risk Human Papilloma Virus (HPV) types 16 and 18 (GLOBOCAN, 2022), yet rural women remain most vulnerable due to limited screening and treatment access.
- Among women aged 15-44 years, HPV is the top cause of cancer death, affecting women during their peak productive and caregiving years.
- In 2025, Nepal launched a nationwide single-dose HPV vaccination campaign using Cecolin® to protect girls aged 9-14 years.

Methods

- Design:** Static cohort (girls aged 9 -14 years); Health system perspective.
- Horizon:** Costs and QALYs were discounted at 3% annually over a lifetime horizon
- Intervention:** The intervention was single-dose Cecolin®, compared against no HPV vaccination (comparator).
- Data sources:** GLOBOCAN 2022, Global Burden of Disease (GBD); EQ-5D-5L (India, mapped to Nepal), Integrated Health Management Information System Nepal; Nepal's Annual Health Program Budget Report (2024) were used.
- Threshold:** The cost-effectiveness threshold was set at USD 489.65 per QALY gained. (Costs converted at 1 USD = 134 Nepalese Rupees (2025 average).
- Software:** Data analysis was performed using Microsoft® Excel (Version 16.107.4).

Conclusions

1. Single dose HPV vaccination proved to be cost-saving prevention due to its low delivery cost. Every USD 2.99 invested per girl averts USD 40.70 in future treatments.

2. The program achieved high coverage (93.7% or 1.46 million girls) through health system integration, school-based delivery & community mobilization.

3. Nepal demonstrates that high-impact cancer prevention is achievable and affordable in low- and middle-income countries (LMICs).

Natural history and vaccine effectiveness:

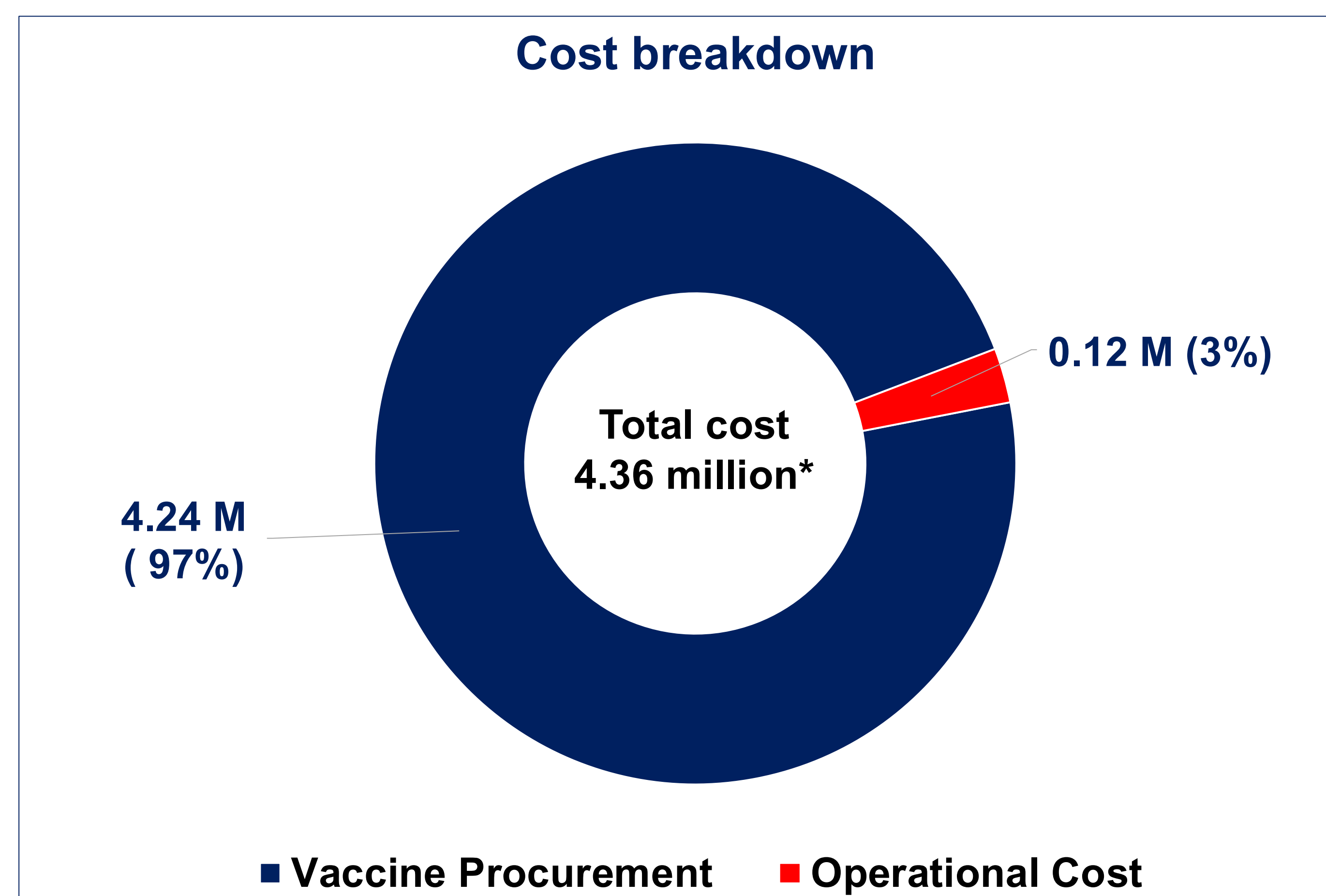
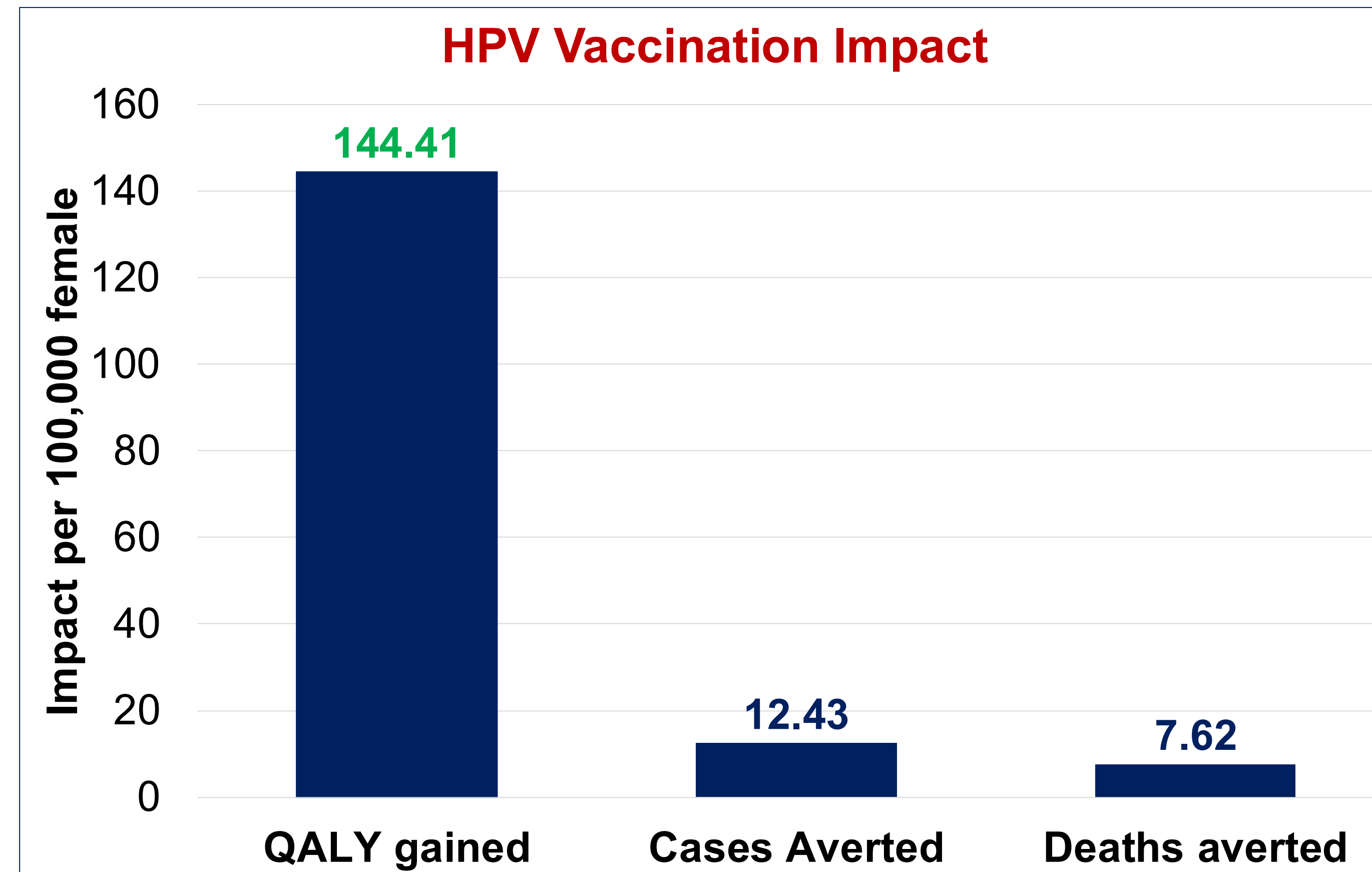
- Pathway:** Progression is modeled from initial high-risk HPV infection to cervical intraepithelial neoplasia (CIN1), CIN2/3, and ultimately invasive cervical carcinoma (ICC).
- Vaccination reduces acquisition of high-risk HPV types 16/18 by 87.5%, blocking entry into the precancer–cancer progression pathway.

Results

Table 1: Health and Economic Outcomes: No Vaccination vs HPV Vaccination

| Outcome or Cost | No Vaccination | HPV Vaccination | Difference |
|--|----------------|-----------------|------------|
| Cervical cancer cases (per 100,000) | 14.20 | 1.77 | -12.43 |
| Cervical cancer deaths (per 100,000) | 8.70 | 1.08 | -7.62 |
| QALYs lost (per 100,000) | 176.13 | 31.72 | +144.41 |
| QALYs gained (per 100,000) | - | - | +144.41 |
| Vaccination cost (USD per girl) | 0.00 | 2.99 | +2.99 |
| Lifetime treatment cost (USD per girl) | 46.50 | 5.80 | -40.70 |
| Net lifetime cost (USD per girl) | 46.50 | 8.79 | -37.71 |
| ICER (USD per QALY gained) | - | - | -50.83 |

Note: Health outcomes are expressed per 100,000 females, while costs are expressed per vaccinated girl. All values represent discounted lifetime estimates. The ICER is calculated from population-level model outputs and is not directly derived from the per-unit values shown.



* Total Cost includes both per-girl delivery costs and national-level fixed program costs.

- The single-dose HPV vaccination program **is economically dominant (cost-saving)**, achieving better health outcomes at a lower total cost than no vaccination.
- Estimated Incremental Cost-Effectiveness Ratio (ICER):** The negative ICER of USD 50.83 per QALY gained is well below Nepal's threshold of USD 489.65.
- For every girl vaccinated** the program reduces lifetime treatment costs by ≈USD 40.70, yielding a net economic saving of ≈USD 37.71 per girl.

2026 Program Sustainability and next steps:

- In 2026, Nepal is securing domestic co-financing to sustain the HPV vaccination program long-term.
- The next step is integrating HPV vaccination with cervical cancer screening and treatment services.
- Program savings will be reinvested to strengthen women's health services in rural and underserved communities.

Limitations

- The analysis used India-based utility values due to limited Nepal-specific data.
- Long-term vaccine effectiveness data for Nepal are limited.
- GLOBOCAN 2022 incidence estimates are modeled and uncertain, particularly where registry data are sparse.
- Probabilistic sensitivity analysis would better characterize this uncertainty.
- The model assumes full treatment coverage for cervical cancer cases, which likely overestimates averted treatment costs.
- Treatment uptake in Nepal is lower than modeled; however, this is unlikely to affect the overall cost-saving conclusion because delivery costs are low (USD 2.99 per girl).

References

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