ELIMINATION PLANNING TOOL: ADVANCING TOWARDS CERVICAL CANCER ELIMINATION

INDIA

The **Elimination Planning Tool (EPT)** enables countries to create effective, sustainable cervical cancer strategies that are specifically adapted to their unique demographic and healthcare needs.

By assisting policymakers in planning, costing, and tailoring their cervical cancer programmes across the three pillars of the **WHO** global strategy – **HPV vaccination**, cervical **screening**, and **cancer treatment** - the EPT supports countries to plan their roadmap towards elimination. Visit [web address] to access the EPT.

EXECUTIVE SUMMARY INDIA

Cancer is a leading cause of death in women and among the top three causes of premature mortality in almost all countries worldwide. The true burden of cancer in women has gone largely unrecognised and has far-reaching consequences for families and society more broadly.[1]

Cervical cancer, caused by persistent infection with the human papillomavirus (HPV), is one of the most preventable cancers. Prophylactic vaccines against HPV, as well as screening for HPV followed by treatment of pre-cancerous lesions, are both highly effective and cost-effective ways to prevent cervical cancer. In November 2020, the World Health Organization (WHO) launched a Global Strategy to accelerate the elimination of cervical cancer as a public health problem. The strategy recommends that countries achieve the **'90-70-90'** intervention targets by 2030, described below. [2]

WHO's 90-70-90 targets

In November 2020, the **World Health Organisation (WHO)** launched a Global Strategy to accelerate the elimination of cervical cancer as a public health problem., achieved by implementing the **triple intervention** targets (pillars) by 2030:

90%

of girls fully vaccinated with the HPV vaccine by age 15.

70%

of women screened with a high-performance test (such as the HPV test) by 35, and again by 45 years.

90%

of women identified with cervical precancer or cervical cancer receive adequate treatment and care.

Countries will be considered to have eliminated cervical cancer as a public health problem when rates of new cases fall below 4 per 100,000 women-years. Modelling showed that if these targets are reached in 78 low-and lower-middle income countries ('LMICs'), cervical cancer would be eliminated in all LMICs and a total of 74.1 million cancer cases and 62.6 million deaths would be averted over the course of a century.[3],[4]

Additionally, for every **USD $1** invested in the strategy, an estimated **USD $3.20** return (assuming 2-dose vaccination and twice lifetime screening) will be obtained from increased workforce participation across all 78-LMICs over a period of 30 years, with this return on investment rising to USD $26 when societal benefits are taken into account.2

In **India**, there were an estimated **127 526** new cases of cervical cancer in 2023, resulting in an age-standardised incidence rate of 17.7 per 100,000 women. In the same year, an estimated **79 906** women died from the disease, resulting in an age-standardised mortality rate of **11.2** per 100,000 women.5 It is predicted that without any intervention, a total of **2 194 998** women in **India** will die from the disease between 2020-2070, rising to **2 666 436** by 2120.

If **India** achieves the WHO's proposed '90-70-90' targets by 2030, cervical cancer could be eliminated as a public health problem in **India** by **2 062** , and **10 652 121** lives would be saved by 2120 (Figure 1A). Assuming 1-dose vaccination and twice lifetime screening, implementation of this strategy in **India** will require a total budget of USD **1 811 870 133** during the first 10 years of implementation. In terms of resourcing required, the elimination strategy will require **155 932 943** HPV-vaccine doses and **61 395 938** HPV-tests during the first 10 years. Additionally, for every USD $1 invested in the elimination strategy, an estimated USD **1.87** will be returned to the economy over a period of 30 years due to increased workforce participation, increasing to USD 3.92 over a 50-year timeframe. In this analysis, it was assumed routine HPV vaccination for 9-year-olds was rapidly scaled-up to 90% coverage in 2020, including a catch-up in the initial year for 10–14-year-olds, screening was scaled-up from 45% in 2023 to 70% in 2030, and access to cancer treatment was scaled-up to 50% in 2023, reaching 90% by 2030.

The impact of HPV vaccination, cervical screening and cancer treatment play out over different timeframes. In the first 10 years after initiating scale-up, cancer treatment has a substantial impact on deaths averted relative to the other two pillars (Figure 1B), preventing **84 939** cervical cancer deaths by 2030. Cervical screening and precancer treatment have a substantial impact over a 50-year timeframe relative to the other two pillars (Figure 1B), preventing deaths by 2070. HPV vaccination has the most substantial impact after 50 years, with little impact before this time (Figure 1B), preventing **84 939** cervical cancer deaths by 2120.

1. Return per dollar invested in the original elimination strategy was calculated assuming girls-only two-dose HPV vaccination at age 9, including MAC catch-up vaccination for girls aged 10-14 in the first year, twice per lifetime HPV screening at ages 35 and 45 years, and cancer treatment scale-up, applying a 3% discount rate on costs and no discount rate on economic benefits.
2. Does not include start-up costs or any indirect costs.
3. Throughout this document, HPV vaccination is assumed to be girls-only single-dose at age 9 with MAC catch-up vaccination for girls aged 10-14 in the first year, unless otherwise specified.
4. Throughout this document, HPV screening is assumed to occur twice per lifetime at ages 35 and 45 years, unless otherwise specified.
5. Throughout this document, unless otherwise specified, return per dollar invested was calculated assuming girls-only single-dose HPV vaccination, including MAC catch-up vaccination for girls aged 9-14 in the first year, twice per lifetime HPV screening at ages 35 and 45 years, and cancer treatment scale-up, applying a 3% discount rate on costs and no discount rate on economic benefits.

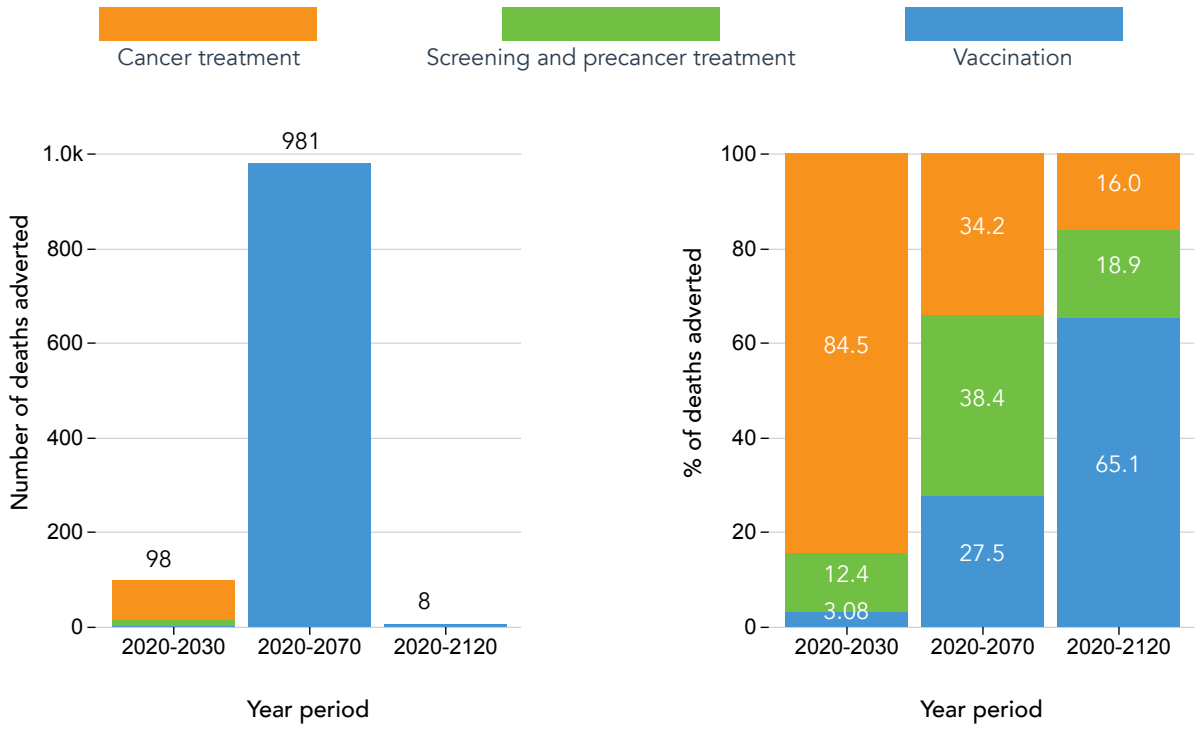


Figure 1: A: Cumulative lives saved if the WHO elimination strategy is implemented. B: Contribution of each elimination pillar to the number of lives saved in **India** if the elimination strategy were implemented in 2020.

WHAT IF VACCINATION IS OFFERED TO GIRLS WHO WOULD HAVE BEEN ELIGIBLE BETWEEN 2020-2024 (AGES 10-18) IN THE FIRST YEAR?

Although the elimination strategy recommends vaccination starts with catch-up from 10-14 years, countries may consider an extended age group for the multi-age catch-up, if resources permit. If scale-up of the elimination pillars starts in 2024 with the 90-70-90 targets reached by 2034 but an extended multi-age catch-up vaccination is implemented in the first year, vaccinating girls from age 9 to 18 in 2024 (instead of 9 to 14, as we assumed in our initial estimates), **India** could eliminate cervical cancer by 2 063 . This could save **10 337 914** lives between 2020-2120, saving **130 736** additional lives, compared to the targets being reached by 2034 with catch-up vaccination up-to age 14 years (Figure 2).

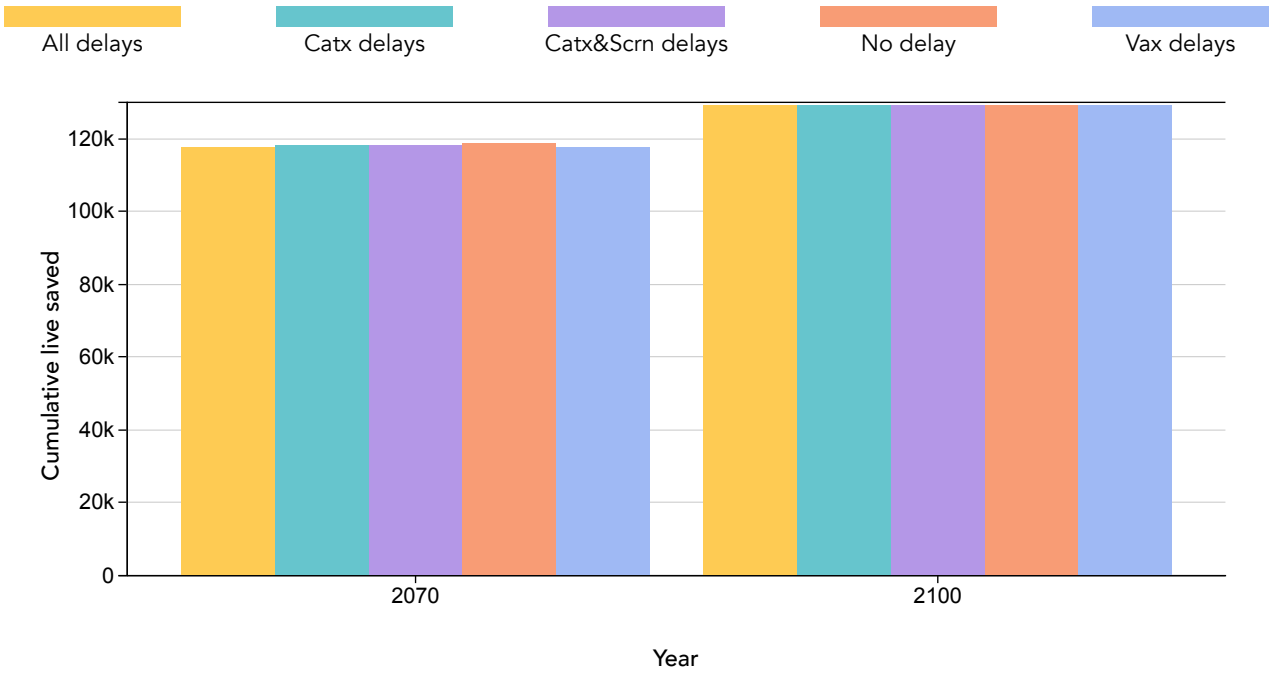
Implementation of this strategy would require a budget of USD **2 053 786 795** during the first 10 years, including **239 331 838** HPV vaccine doses, and **64 825 806** HPV tests, and would provide a return per dollar invested of USD **2.12** over a 30-year timeframe, and USD **4.42** over a 50-year timeframe.

WHAT IF VACCINATION IS OFFERED TO GIRLS AGED 10-25 IN THE FIRST YEAR?

Although the elimination strategy recommends vaccination starts with catch-up from 10-14 years, countries may consider an extended age group for the multi-age catch-up, if resources permit. If scale-up of the elimination pillars starts in 2024 with the 90-70-90 targets reached by 2034 but a high-coverage extended multi-age catch-up vaccination program is implemented for girls up-to age 25 in 2024 (instead of 9 to 14, as originally planned), **India** could eliminate cervical cancer by 2 059 . This could save **10 530 919** lives between 2020-2120, an additional **323 741** lives compared to the targets being reached by 2034 with catch-up vaccination up-to age 14 years.

Implementation of this strategy would require a budget of USD **2 747 698 094** over the first 10 years, including **387 161 131** HPV vaccine doses, and **64 825 806** HPV tests, and would provide a return per dollar invested of USD **2** over a 30-year timeframe, and USD **4.24** over a 50-year timeframe.

1. Throughout this document, the start year of an elimination strategy will be defined as the year when vaccination scale-up commences, while screening and cancer treatment will start scaling-up three years later, following the original elimination strategy scale-up described in the previous section.



WHAT IF ONLY VACCINATION IS SCALED-UP?

If only HPV vaccination is scaled-up to 90% coverage from 2024, and cervical screening and treatment are not scaled-up, **6 580 154** lives would be saved between 2020-2120 (mostly towards the end of the century), and cervical cancer would not be eliminated as a public health problem until 2 076.

Implementation of this strategy would require a budget of USD 956 602 992 over the first 10 years, including 153 420 676 HPV vaccine doses, and would provide a return per dollar invested of USD 1.07 over a 30-year timeframe, and USD 6.76 over a 50-year timeframe. Therefore, benefits are reduced in the scenario where cervical screening and cancer treatment are not scaled-up alongside HPV vaccination, particularly in the first few decades after initiation of implementation.

WHAT IF BOYS ARE VACCINATED AS WELL AS GIRLS?

Although the elimination strategy recommends vaccination focuses on girls initially, countries may consider also vaccinating boys if this is feasible, resources permit, and it does not divert resources from vaccination of the primary target population.6 If scale-up of the elimination pillars starts in 2024 with the 90-70-90 targets reached by 2034 but the HPV vaccination programme targets adolescent boys as well as girls, **India** could eliminate cervical cancer by 2 063 . This could save **10 285 478** lives would be saved between 2020-2120, saving **78 300** additional lives compared to the targets being reached by 2034 with a girls-only vaccination programme.

Implementation of this strategy would require a budget of USD **2 314 863 484** over the first 10 years, including **153 420 676** HPV vaccine doses, and **64 825 806** HPV tests. Therefore, the budget required is **2 314 863 484** higher than the girls-only program. This would provide an overall return per dollar invested of USD **1.79** over a 30-year timeframe, and USD **3.79** over a 50-year timeframe. It should be noted that inclusion of boys in a both-sex program is less cost-effective than girls-only vaccination and that return on investment for a both-sex program is less favourable than that for girls-only vaccination (assuming the same dose-schedule, coverage and price is considered).

SHOULD COUNTRIES CONSIDER A 1-DOSE OR 2-DOSE SCHEDULE OF THE HPV VACCINE?

The WHO Strategic Advisory Group of Experts on Immunization (SAGE) evaluated the evidence on 1-dose HPV vaccination in April 2022 and concluded that a single-dose HPV vaccine provides solid protection against HPV, comparable to 2-dose schedules. SAGE recommends updating dose schedules for HPV vaccination for the general population of females as follows:[7]

- A one or two-dose schedule for the primary target of girls aged 9-14,
- A one or two-dose schedule for young women aged 15-20,
- A two-dose schedule with a 6-month interval for women older than 21.

SAGE recommended that immunocompromised individuals, including those living with HIV, should receive three doses if feasible, and if not at least two doses due to limited evidence regarding the efficacy of a single dose in this group.

Data on the number of countries who have implemented single-dose vaccination is available at the WHO Immunisation Dashboard.8 Many low, middle and high-income countries have implemented, or are implementing, a transition to one dose schedules into their national HPV vaccination programs, including high-income countries such as Australia, United Kingdom and Ireland.

FIRST PILLAR: HUMAN PAPILLOMAVIRUS (HPV) VACCINATION

In 2022, 1-dose HPV vaccination coverage of girls aged 9-14 in India was 0.[9]

The introduction of HPV vaccines into the national immunisation programme is a crucial first step to achieving high coverage of HPV vaccination. Competitive prices for HPV vaccines can be secured through international partnerships including from Gavi, the Vaccine Alliance for eligible countries, as well as the PAHO Revolving Fund. Scale-up of HPV vaccination coverage could be facilitated through a school-based strategy targeting adolescent females or community-based strategies, with the aim to subsequently integrate HPV vaccination into routine immunisation schedules. This should be done in partnership with Ministries of Health, Education and Finance, and must be preceded by a comprehensive communication and sensitisation strategy to build HPV vaccine confidence and address misinformation. Improving monitoring systems and implementing vaccination registers are also important to ensure that disparities in uptake are minimised and high coverage is maintained

SECOND PILLAR: CERVICAL CANCER SCREENING

In 2020, 2 of women were ever screened in India, but the number of women screened with the HPV test is likely to be much smaller.[10]

Screening scale-up should utilise cost-effective high sensitivity tests, such as HPV-based DNA screening, rather than VIA or cytology. This, in combination with strengthening of laboratory services and quality assurance measures, will ensure accuracy of screening results.

Understanding social and cultural barriers is crucial to creating an environment where women feel comfortable attending screening visits. For similar reasons, it is essential to provide information and education for women on the importance of cervical cancer screening. Self-collected HPV testing has been shown to have similar test performance to clinician-collected samples if PCR-based testing is used, and offering self-collection has the potential to greatly increase the acceptability of screening and could help achieve high coverage. Point-of-care HPV screening in rural areas should also be considered, so that women who need precancer treatment can be treated in the same visit.

Cervical screening programmes can be integrated with existing services such as primary care services, by offering HPV screening at sexual health clinics, ante-natal care consultations, family planning consultations or well women clinics. Women living with HIV are six times more likely to develop cervical cancer, and so integrating cervical cancer screening with HIV control pathways can ensure women at higher risk have access to cervical cancer screening.

Implementing surveillance and monitoring systems, and integrating these with national cancer registries, are critical for ensuring women are not lost to follow-up and for monitoring programme success nationally.

All WHO regions have produced implementation frameworks for cervical cancer that include guidance on scaling up the three pillars, including screening and treatment.

THIRD PILLAR: TREATMENT AND CARE

In India, it is estimated that 52.4 of women requiring treatment for cervical cancer in 2020 were able to access radiotherapy.[3]

Lastly, developing and implementing national cervical cancer management guidelines is essential to providing women with high quality cancer treatment and care. Establishing strong referral networks between all aspects of the cancer care spectrum are needed to ensure the timely management of patients and reduce loss-to-follow-up. Diagnosis, treatment, and monitoring of invasive cervical cancer will require high-quality pathology services and oncology services. Safe, effective, and timely surgery accompanied by supportive services such as anaesthetic services and intensive care units are important for the treatment of early-stage cancers. Furthermore, expanding access to radiotherapy units and access to chemotherapy services, as well as palliative care services, is crucial. To support countries as they scale-up this pillar, the WHO has released a framework for strengthening and scaling-up services for the management of invasive cervical cancer.[11]

A number of different strategies can be employed to achieve elimination. A summary for **India** of the health impact, resource use and return per dollar invested for each strategy is presented in below.

Strategy	Start year	Year of elimination	Lives saved (by 2070)	Lives saved (by 2120)	HPV vax doses (5y)	HPV vax doses (10y)	HPV tests (5y)	HPV tests (10 y)	Budget in USD (5y)	Budget in USD (10y)	BCR in USD (30y)	BCR in USD (50y)
Original 90-70-90	2020	2062	3 636 211	10 652 121	114 937 352	166 106 312	25 522 342	75 820 933	928M	1.81B	3.92	3.92
Starting in 2024, achieving 90-70-90 by 2030	2024	2065	3 420 192	10 357 380	71 873 848	123 042 808	0	41 523 339	832M	1.96B	4.47	4.47
Starting in 2024, achieving 90-70-90 by 2034	2024	2065	3 271 926	10 207 178	71 873 848	123 042 808	0	36 371 555	831M	1.65B	4.51	4.51
Starting in 2024, achieving 90-70-90 by 2034 and MAC vaccination up to age 18	2024	2059	3 428 806	10 530 919	305 614 302	356 783 262	0	36 371 555	1.93B	2.75B	4.24	4.24
Starting in 2024, achieving 90-70-90 by 2034 and MAC vaccination up to age 25	2024	2059	3 428 806	10 530 919	305 614 302	356 783 262	0	36 371 555	1.93B	2.75B	4.24	4.24
Vaccination only scaling-up to 90% in 2024	2024	2072	2 967 456	9 698 135	114 937 352	166 106 312	0	0	730M	1.16B	5.81	5.81
Starting in 2024, achieving 90-70-90 by 2034 including boys vaccination	2024	2063	3 297 856	10 285 478	71 873 848	123 042 808	0	36 371 555	1.30B	2.31B	3.79	3.79

Table 1. Summary of health impact, resource use and return per dollar invested for different strategies (assuming 1-dose vaccination and twice lifetime screening).

1. Return per dollar invested was calculated applying a 3% discount rate on costs and no discount rate on economic benefits, over a 30-year timeframe.
2. Return per dollar invested was calculated applying a 3% discount rate on costs and no discount rate on economic benefits, over a 50-year timeframe.

CONCLUSION

In 2020, all 194 member states of the World Health Assembly, including **India**, resolved to eliminate cervical cancer as a public health problem. The data provided by the Elimination Planning Tool demonstrates that **India** can achieve cervical cancer elimination by 2 076 if scale-up is rapidly implemented from 2024. We also show that, if scale-up starts in 2024 and the 90-70-90 targets are reached in 2030, a return of 4.47 for every dollar invested would be realised over a 50-year period, whilst saving the lives of .

> **As stated in Together for Health's 2023 report, Investing in Global Cervical Cancer Prevention, "The unnecessary loss of a woman to cervical cancer doesn't just create unbearable grief for her families and loved ones… The impact of a woman on the lives around her – as a mother, as an entrepreneur, as a community leader, as a friend – is a resource that cannot be replaced once lost.**[12]

Saving all these lives will only be possible if scale-up across all three pillars is achieved. With the WHO's endorsement of single-dose HPV vaccination schedules for immunocompetent girls aged 9-14, the reach of vaccination programmes can be even greater than anticipated when the cervical cancer elimination strategy was launched in 2020. But in order to save lives both in the long-term and short-term, it's essential that both screening and treatment are scaled-up alongside vaccination.

By delivering cervical cancer prevention and services, **India** is delivering women's right to health and demonstrating for generations to come that **India** is committed to gender equality, minimising the risk of families entering poverty, and protecting children. In line with this, achieving cervical cancer elimination in **India** will support several sustainable development goals (SDGs), including SDG 1 (ending poverty), SDG 3 (good health and wellbeing), SDG 5 (gender equity) and SDG 10 (reducing inequalities). The scale-up of HPV vaccination, cervical cancer screening and cancer treatment is also intrinsic to achieving universal health care.

Cervical cancer elimination is within reach for **India**. We urge policymakers to join this global movement and achieve this ambition for the women of **India**, today and tomorrow.

ACKNOWLEDGMENTS

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