Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/1bksbx07

DEVELOPING A CONTEXTUAL HPV VACCINATION MODEL FOR PAKISTAN: COMPARATIVE LEARNINGS FROM INDIA AND SRI LANKA

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Abstract
The prevalence of cervical cancer among Pakistani women and the lack of a national HPV vaccination campaign have continued to make cervical cancer a major cause of cancer related deaths in women in Pakistan. The proposed approach to hybrid HPV vaccination in Pakistan is suggesting the synthesis of the strategies demonstrated as successful in India and Sri Lanka, which are the countries with similar regional, infrastructural, and cultural contexts. Through a sharing case study design involving secondary data, the study compares the cost-effective implementation of the locally produced Cervavac vaccine in India and the initial success demonstrated in Sri Lanka on the challenges of a school-based approach that integrates with the support of the community and religious leaders in centralized rollout. The model incorporates the low-cost sourcing of vaccines in Chinese manufacturers, two delivery models; urban school-based and rural Lady Health Worker-led outreach, and the culturally sensitive awareness efforts. It further suggests it should utilize the National Immunization Management System (NIMS) of Pakistan to track and coordinate policies in real-time at both federal and provincial levels. The results emphasize the fact that this kind of a model is not only possible but also scalable, culturally relevant and affordable in terms of the financial needs of the public health system in Pakistan.

Key words: HPV vaccination, Cervical cancer prevention, Pakistan, Hybrid immunization model, Cervavac, Cecolin, Lady Health Workers (LHWs), School-based vaccination, Public health strategy, South Asia, NIMS.

Introduction

Cervical cancer is a major source of cancer-related mortality and morbidity among women in low- and middle-income countries but it is also one of the most preventable malignancies(1–5). The

prevalence of persistent HPV infection with high-risk types, of which HPV 16 and 18 years contribute to an estimated 70 percent of all cervical cancer(6–8). The invention of HPV vaccines has transformed the paradigm of prevention care by providing a safe and effective lifesaving medicine that can be used to remove cervical cancer as a public health burden(9–13).

Over the past few years, various nations in the world have incorporated national HPV vaccination strategy and there has been a very high level of success. In South Asia, India and Sri Lanka lead with their advancement in progress, India as its scale and affordability, and Sri Lanka as the first mover and trusted by the communities. These two countries present great lessons to those countries with similar demographics and health system issues(14–19). Although cervical cancer rates of incidence and mortality are very high in Pakistan, the HPV vaccine has not been introduced into the Expanded Program on Immunization (EPI) in that country. Cultural resistance, lack of national awareness, financial and infrastructural limitations are some barriers that have stalled national action(20–24).

The study seeks to address this gap by suggesting that a hybrid HPV vaccination model best met the fundamental themes of the socio-cultural and economic setting in Pakistan(25). This model provides a guide to successful implementation of HPV vaccine in Pakistan by drawing lessons learned in India, where innovative local production and distribution of vaccines has now found a way to decentralization, and Sri Lanka, where centralization, school-based, and trust-based schools were directed. This paper posits that by integrating global suggestions with regional best-practices and national experiences, it is possible to envisage a plan that will not only target the decrease in disease burden, establishment of equity in women health and also lead Pakistan to the desired goal set by the World Health Organization (WHO) of the elimination of cervical cancer, by 2030(26,27).

Material and Methods

This study uses case study research design and is completely based on secondary data to come up with a hybrid HPV immunization model that fits the Pakistan scenario. The methodology is centered around deriving lessons of India and Sri Lanka, two countries within the South Asia region that have different but effective results in relation to HPV vaccine implementation. The selection of these countries was done in view of regional importance, similarity in the structure of public health, and social systems and culture dynamics to that of Pakistan.

Data Collection

The information was gathered by accessing many information sources that are made publicly available. The most significant sources of information involved worldwide policy material, reports prepared by the World Health Organization (WHO) and the Gavi, the Vaccine Alliance, which provided strategic and technical advice regarding HPV vaccine implementation (26–28). Indian and Sri Lankan national health ministry publications offered an insight into the vaccination rollout plans, programmatic issues, and delivery methodologies (17,29–31).

Additional sources were peer-reviewed academic journals, news articles, policy briefs, and white papers that discussed program development, pilot assessment, and population reaction (1,2,5). To contextually be accurate in regards to the situation in Pakistan, information was sourced out as per the local facilities in the country i.e., the Aga Khan University, the Indus Health Network, as well as government-operated platforms including the Expanded Program on Immunization (EPI) (23,25,32,33). These aided in determining the preparedness of the health system in Pakistan to introduce a new vaccine on a large scale.

Data Analysis

The corresponding data analysis focused on two national case studies: the 2023 introduction of its indigenous HPV vaccine Cervavac into India, and a school-based national program in Sri Lanka in 2017 (17,19,30,34). In the case of India, the strategies regarded the cost-cutting measures of local production, a single dose of planning, mass implementation by schools in the cities, and satellite-reach to the community through Accredited Social Health Activists (ASHAs) and Auxiliary Nurse

Midwives (ANMs). The stakeholder engagement models and media campaigns were also investigated (13,17,18).

In the case of Sri Lanka, they prioritized on the centralized form of governance, as well as incorporating school health systems as well as involving religious leaders and educators to create a trusting community(14,30). The information regarding the level of coverage, operational issues, and initial results was thoroughly analyzed in order to gain understanding of what made the program both plausible and successful within the context of conservative culture.

Thematic comparison of both case studies compressed their insights into one another and contrasted major strategies with the relevant realities of the healthcare system in Pakistan, especially due to abundant Lady Health Workers (LHWs) and the supportive EPI framework (24–26). This has enabled the design of a hybrid delivery model that is both representative of best practices as well as takes into consideration that the delivery has to be country specific, taking into account logistical, financial and the cultural constraints of Pakistan.

Results

A comparative analysis of the HPV vaccination programs in India and Sri Lanka indicated the unique strengths in HPV vaccination program implementation strategy used in the two countries, which were then applied to the hybrid approach to the HPV vaccination program implementation in the Pakistani context.

1. The Results of India: Scale and Affordability

The HPV program in India is focused on domestic and affordable production of the vaccines, and the ability to scale the supply. The implementation of the Cervavac produced by Serum Institute of India resulted in devastating cost cuts to USD 2- 4 per dose, and introduced the possibility of a nationwide rollout to be financially viable. India followed the same recommendation of the WHO and shifted to a single dose schedule that made the vaccination distribution more convenient and had a positive impact on accessibility.

Pilot programs including Punjab, and Delhi achieved high coverage and were learned to be widely acceptable. These achievements were enabled by school based campaigns, which were enforced through the local community outreach through ANMs and ASHAs.

Table 1: Key Features and Outcomes of India's HPV Vaccination Program

Feature	Details	Example
Vaccine Used	Cervavac (Quadrivalent, locally made)	Used in Delhi rollout
Cost per Dose	USD 2–4	Compared to USD 20+ in private sector
Delivery	Schools + ASHA/ANM outreach	Sikkim & Punjab pilots
Coverage	High in pilot states	Punjab achieved >80%

2. Sri Lanka’s Outcomes: Centralization and Community Trust

The Sri Lanka program of 2017 was a centralized program that happened through schools and targeted girls of 10 years. It reached a coverage level exceeding 80 percent in two years due to good synergy between the Ministries of Health and Education and the School Health Promotion Program (SHPP). Normalization of the vaccine among the conservative populations was achieved through the employment of multilingual communication materials and involvement of religious leaders.

Table 2: Key Features and Outcomes of Sri Lanka's HPV Vaccination Program

Feature	Details	Example
Start Year	2017	First in South Asia
Target Group	10-year-old girls	Grade 5 students in public schools
Coverage	>80% within 2 years	MOH report, 2019
Community Role	Religious & local leader involvement	Buddhist & Muslim clergy support

3. Proposed Hybrid HPV Vaccination Model for Pakistan

As shown in Table 3 below, the following is a model of HPV vaccination implementation which can be adjusted to the specifics of Pakistani healthcare and governance system. The plan involves purchasing vaccines through Innovax (Cecolin) and Walvax (Walrinvax) which are two Chinese firms providing WHO-prequalified or pending vaccines with projected prices of USD 8(PKR 2,500)/- to USD 14(4,000)/- per dose. This is a lot cheaper compared to Gardasil USD 32 (PKR 9,000) which is already available privately in Pakistan. Direct procurement skips dependence on Gavi and fosters sustainable prices of the rollout among the citizens. To deliver, the model proposes city-centered school-based immunizations as tested and achieved in Karachi during polio inoculation campaigns and rural-based general vaccination through LHWs as in Tharparkar, where Lady Health Workers routinely offer maternal and infant care services door-to-door.

This would be started by pilot projects in Islamabad, Karachi, Lahore, Quetta, Gilgit, Muzaffarabad and Peshawar- which are the major cities of the country with a high concentration of population and also of a vaccination structure. NIMS (National Immunization Management System) would allow these pilots to register the vaccinated girls and track coverage in real-time. The model suggests religious approvals by the Council of Islamic Ideology and communication through media (Urdu and local languages) in order to overcome stigma. The system of parent-teacher sessions already used in dengue prevention in Punjab would be modified to treat HPV vaccine hesitancy. The proposed model is a realistic, economical design based upon documented systems in Pakistan and local case studies.

Table 3: Proposed Hybrid HPV Vaccination Model for Pakistan (With Specific Examples)

Component	Strategy	Specific Example
Vaccine Procurement	Direct purchase from Chinese manufacturers (Innovax: Cecolin, Walvax: Walrinvax)	Negotiate with Innovax for WHO-prequalified Cecolin at USD 8(PKR 2,500)/dose via federal MoH
Cost per Dose	Target below $11-12 (PKR 4,000) for public affordability	Gardasil costs $32(PKR 9,000) in private sector; Cecolin offers 60–70% cost reduction
Delivery Mechanism	Urban: School-based clinics; Rural: LHW home visits	Karachi: Deliver via school health rooms; Tharparkar: Use LHWs already active in MNCH
Coverage Strategy	Pilot in high-burden, high-capacity districts	Start in Islamabad, Karachi, Lahore, Quetta, Peshawar, Gilgit city, Muzaffarabad based on cancer registry data and EPI reach
Community Role	Engage religious scholars, teachers, and mothers. Give trainings to teachers at Primary and secondary level	Punjab: Collaborate with imams via Auqaf Dept. like during polio drives
Monitoring System	Track real-time data using NIMS with district dashboards	Sindh EPI uses NIMS successfully for COVID-19 and measles tracking
Awareness Campaigns	TV, radio, and local influencers in Urdu and local language	Use Punjab Health Department's dengue awareness model as template
Funding Model	Federal health budget allocation via PSDP or NIH	Secure 5-year commitment through Ministry of Planning and MoH joint proposal

4. Detailed Federal and Provincial Strategy Tables for HPV Vaccination in Pakistan

The federal and provincial strategy tables offer a simple, practical system of HPV vaccination implementation throughout Pakistan. On the policy integration side, the government could take the lead by making HPV vaccines part of the Expanded Program on Immunization (EPI) and seek collaboration with DRAP to fast-track registration of cost-effective alternatives such as Cecolin. Purchasing vaccines would be approached on a central negotiating basis with Chinese manufacturers to make it affordable. Financing via Public Sector Development Programs (PSDP) and running countrywide media campaigns, including Urdu and regional content, on PTV and popular radio stations by the federal government to soften the stigma would also be the federal government's responsibility. A transparent method of coverage tracking would be done through the National Immunization Management System (NIMS) to monitor.

Implementation at provincial level would take advantage of available health infrastructure. The delivery backbone would be in the form of urban school-based clinics and rural outreach via Lady Health Workers (LHWs). This would build trust within the community through imam and teacher trainings whereas district health offices would drive the capacity-building workshops. The selected pilot districts such as Islamabad, Karachi, Lahore, Quetta, Gilgit, Muzaffarabad and Peshawar were determined by the burden of cervical cancer and immunization preparedness. Therefore, the real-time would be based on provincial feedback tools, including health helplines and parent-teacher forums to guide adjustments to strategy and communications.

Part A: Federal-Level Strategy

Component	Strategy	Example
Policy & Regulation	Include HPV vaccine in EPI and DRAP regulatory list	MoH coordinates with DRAP for Cecolin approval
Vaccine Procurement	Negotiate directly with Innovax and Walvax for bulk purchase	Federal MoH secures procurement at USD 8-11(PKR 2,500–3,500)/dose
Funding Allocation	Use PSDP and NIH budget line for adolescent immunization	Federal Cabinet allocates funds for 5-year HPV plan
National Awareness	Media campaigns in Urdu & regional languages	PTV & FM-100 run HPV PSAs with religious leader endorsements
Monitoring & Reporting	Integrate with NIMS and EPI dashboards	Federal health IT enables real-time district-level data access

Part B: Provincial-Level Strategy

Component	Strategy	Example
Delivery Model	Urban: School-based clinics; Rural: LHW-based outreach	Karachi schools; Tharparkar LHWs for door-to-door delivery
Community Engagement	Train imams, teachers, and mothers to educate households	Auqaf Dept. and PTAs engaged in Punjab
Capacity Building	Train LHWs, vaccinators, and teachers on HPV education	Sindh DHOs lead monthly sessions on adolescent immunization
Pilot Sites	Rollout in districts with high cancer burden & EPI access	Islamabad, Lahore, Quetta, Karachi ,Islamabad, Gilgit, Muzaffarabad and Peshawar selected for Phase 1
Feedback Mechanisms	Set up helplines and parent feedback forums	KP health helpline expanded to cover HPV queries

Discussion

The research presented a hybrid HPV vaccination modality to Pakistan based on the examples of South Asian contexts India and Sri Lanka. This discussion examines the practicality, advantages, limitations, and the future consequences of implementing such a model in Pakistan health and policy landscape.

Local Context and Lessons of Comparison

The success of India was based upon logistics designed to scale and its affordability. This cost reduction was due to the utilization of Cervavac, a locally manufactured vaccine and the current price USD 2- 4 per dose set made widespread rollout a viable financial possibility (34–36). Their approach was to vaccinate in schools in urban settings and cover the rural population through ASHAs and ANMs(13,17,19). The initial pilot development in Sikkim, Delhi, and Punjab demonstrated >80% coverage, making it clear that the first investment in localized delivery planning is worthwhile.

On the contrary, Sri Lanka focused on central coordination and community trust. It involved HPV vaccination as a part of school health services and used medium campaigns to involve religious leaders and parents via regular media messages in the local languages (14,30). The methods assisted in overcoming social-cultural resistance and became nationwide in more than 80 percent in just two years of implementation. Pakistan is in the middle of these two models- it has the same population size as India as well as the cultural conservatism of Sri Lanka. However, its adoption of HPV policy, awareness, and its availability on a public-sector basis is low (3,4,26,37). HPV vaccines are currently exclusive to the private sector, where they cost over USD 32 a dose, which has significantly reduced uptake.

Table: Comparative Overview of India, Sri Lanka, and Pakistan

Country	Key Features	Vaccination Strategy	Coverage & Cost
India	Local production (Cervavac); large-scale rollout	Urban: School-based; Rural: ASHAs and ANMs	>80% in pilots (USD 2–4/dose)
Sri Lanka	Central coordination; strong community trust	Integrated into school health; religious and parent engagement	>80% nationwide within 2 years
Pakistan	Limited awareness; private-only access	No national program; private clinics only	<1% est. coverage (USD 32+/dose)

Hybrid Strategy Justification

The hybrid model incorporates affordability, accessibility, as well as cultural relevance. It suggests the purchase of vaccines manufactured in China including, Innovax (Cecolin) and Walvax (Walrinvax) that cost less than half that of Gardasil(19,31,38,39). The Cecolin is already WHO prequalified enabling direct importation and regulatory approval through Pakistan DRAP (26). In its delivery, the model distinguishes between rural and urban strategies. The school-based vaccination will fit well in urban cities such as Islamabad, Karachi, Lahore, and Islamabad, Gilgit and Muzaffarabad, where there is high enrolment and facilities, which have been used in other campaigns (e.g. deworming drives). In rural areas, door-to-door work is best achieved through the widespread network of Lady Health Workers (LHW). In communities, these frontline workers already have the trust in maternal and child health services.

Table: Specific Elements of Hybrid Strategy in Pakistan

Component	Details	Pakistan-specific Example
Vaccine Procurement	Purchase WHO-prequalified vaccines from China (e.g., Cecolin, Walrinvax)	Cecolin at USD 8-11(PKR 2,500–3,500) per dose approved via DRAP
Urban Delivery	School-based vaccination in cities with high enrolment	Karachi & Lahore use school health rooms, similar to deworming or polio campaigns
Rural Delivery	Door-to-door delivery using Lady Health Workers (LHWs)	Tharparkar and Dera Ghazi Khan mobilize LHWs during measles and MNCH outreach
Cold Chain & Logistics	Use EPI storage and transport systems at district level	Solar refrigerators used in interior Sindh & Balochistan under existing programs
Cultural Alignment	Localize messaging and engage community leaders	Religious endorsements and PTA sessions in Punjab schools

Breaking the Cultural Barriers

Social stigma is one of the greatest impediments to the uptake of the HPV vaccine in Pakistan. HPV is a disease associated with sexual behaviour and thus the subject is delicate, particularly within the traditional society (40). In response to this the model focuses on the use of religious leaders, community elders and parent-teacher associations (PTAs). It is possible to obtain critical legitimacy based on religious endorsements (fatwas) by credible scholars that have previously been used successfully in polio campaigns. Sensitization campaigns should also be localized. With access to radio (such as FM-100) and community WhatsApp groups, as well as using regional-language programming, public health could teach families about the HPV-cancer connection rather than promiscuity. The school posters and student led outreach models employed in previous dengue prevention interventions in Punjab could be easily implemented in HPV awareness.

Financial Sustainability

Although the funding through Gavi (financial support by Gavi, the Vaccine Alliance, a public-private partnership) has helped numerous low- and middle-income countries, the model purposely does not include it to highlight a local ownership and an ultimately sustainable setup (28). Rather, it suggests the funding via the Pakistani Public Sector Development Program (PSDP) or the Ministry of National Health Services (MoNHS). The vaccine procurement together with training, logistics, and evaluation would be funded by a specific budget line of 5 years.

Economic rationality is strong. At PKR 3,000 (USD 10.59) per dose, the cost of vaccinating 10 million girls over 5 years would be PKR 30 billion (USD 105,000,000), which is probably much less than what it costs the nation in the treatment of advanced cervical cancer. The investment would save on hospitalization in the future, cost of chemotherapy, and lost time/productivity more so among women of reproductive age.

Implementation Challenges

Although the hybrid model has an excellent rationale, it is exposed to a number of risks:

- There can be political turnover that interrupts the continuity of multi-year programs.
- The resistance of health workers can arise when there is poor training and incentives.
- Parental reluctance can persist even with the creation of awareness particularly in remote areas or tribal places.

- Vulnerability of the vaccine may be compromised by cold chain logistic especially in regions with high temperatures.

To counter these risks, it is important to conduct early piloting, ensure robust inter-ministerial cooperation (Health, Education, Information), and constant technical assistance by WHO and NGOs (IRD, Aga Khan Health Services) (22,24,25,32,41).

Long-Term Implications

The hybrid model, when successful, can establish a precedent in the field of adolescent health programs in Pakistan. It creates avenues to school-based health screening/menstrual health education/secondary prevention interventions such as visual inspection of cervix/ Liquid base cytology or Pap smears. It is also a demonstration of the emphasis that Pakistan will put into the WHO cervical cancer elimination agenda and it can be used to better its rating in international health standards. When the model has proved to be effective, it could be emulated in a similar country with same demography but different religious orientation (like Bangladesh, Afghanistan, North African Countries) (3,4,30,37).

Conclusion

Therefore, the proclaimed hybrid HPV vaccination system is not merely a technically and economically profitable idea, it is also culturally sensitive and politically savvy. Its success is not dependable upon invention aside being reliant on integration of lessons learned, systems already in place, and the voices of communities it aims to safeguard.

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