REVIEW

Editorial Process: Submission:08/29/2024 Acceptance:06/04/2025

Introduction of the HPV Vaccine among Young Girls to Reduce the Long-Term Risk of Cervical Cancer in Eswatini: Programmatic Decision and Roll Out

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Abstract

Background: Cervical cancer is a significant public health concern in Eswatini. In June 2023, the Eswatini government launched a national school based vaccination program aimed at administering two doses of the human papillomavirus (HPV) vaccine to adolescent girls, with the second dose administered six months after the first. **Objective:** This study seeks to assess the feasibility of school based HPV vaccination introduction campaign for prevention of cervical cancer among women in the Kingdom of Eswatini in Africa. The lessons learned, and challenges faced during the implementation of the national HPV vaccination program designed to prevent HPV infection are documented to improve HPV vaccination campaign in Africa. **Methods:** The review study details the planning and execution of the HPV vaccination initiative within Eswatini's school based campaign, targeting 82,400 girls aged 9-14 years from 12 to 23 June 2023 schooldays. **Results:** The national goal was to vaccinate 82,400 girls. The campaign achieved a national coverage rate of 55.9%, with 46,512 girls successfully vaccinated. The Manzini region recorded the highest coverage at 60.1%, while the Shiselweni region had the lowest at 48.2%. **Conclusions:** The introduction of the large-scale HPV vaccination campaign in schools proved successful. However, challenges such as misconceptions about eligibility criteria and misinformation persisted, impacting vaccine uptake and coverage. Continued efforts in community mobilization, public education on eligibility, and integration with healthcare services are essential for sustaining the program. Strengthening partnerships and mobilizing resources will also be critical for its long-term success.

Keywords: HPV vaccine- adolescents- cervical cancer- Eswatini

Asian Pac J Cancer Prev, **26 (6)**, 1891-1897

Introduction

Cervical cancer is a significant global health issue, particularly affecting low- and middle-income countries (LMICs) where access to screening and preventive measures remains limited. According to the World Health Organization (WHO), cervical cancer is the fourth most common cancer in women globally, with an estimated 604,000 new cases and 342,000 deaths in 2020 [1]. The majority of these cases occur in LMICs, where there is often inadequate healthcare infrastructure and limited access to HPV vaccination and screening programs.

In Africa, cervical cancer is a leading cause of cancer-related mortality among women. The incidence rates are among the highest globally, exacerbated by limited access to HPV vaccination, screening, and treatment services [2]. Factors contributing to high incidence include limited healthcare resources, low awareness, and cultural barriers to seeking healthcare services.

Eswatini faces a significant burden of cervical cancer, with high incidence and mortality rates among women. Cervical cancer is the most common cancer in Eswatini, accounting for a substantial portion of cancer-related deaths [3]. The country's healthcare system is challenged by limited resources and infrastructure, impacting the delivery of preventive services such as HPV vaccination and screening. The rationale for focusing on increasing HPV vaccination coverage among individuals in Eswatini is grounded in several critical points:

1. Vulnerability: Women (HIV-positive) have compromised immune systems, increasing their susceptibility to HPV infection and subsequent cervical cancer.

2. Epidemiological Context: Eswatini has a high prevalence of HIV and cervical cancer, making targeted interventions crucial for reducing cervical cancer

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incidence.

3. Preventive Strategy: HPV vaccination is a proven preventive measure against HPV infection and cervical cancer, yet coverage among HIV-positive individuals is often lower due to various barriers.

4. Health Equity: Improving vaccination coverage among women promotes health equity by addressing the specific needs of a vulnerable population.

5. Impact on Public Health: Increasing vaccination coverage contributes to the overall reduction in cervical cancer incidence and related mortality rates, aligning with global health goals. Strengthening partnerships between the Ministry of Health, and international organizations can leverage resources and expertise to scale up HPV vaccination efforts.in addressing these research questions and quality improvement strategies, Eswatini can enhance HPV vaccination coverage among individuals, thereby reducing the incidence of cervical cancer in this vulnerable population. Continued efforts in research, policy development, and program implementation are essential to achieve these goals and mitigate the burden of cervical cancer in Eswatini.

Objective

To evaluate the feasibility and effectiveness of school-based HPV vaccination introduction campaign in Eswatini, specifically focusing on identifying challenges and lessons learned during the implementation phase. This assessment aims to enhance future vaccination efforts and improve HPV prevention strategies among women at risk for cervical cancer.

Materials and Methods

The authors performed a descriptive cross-sectional review study of the HPV vaccination programme through a retrospective review of electronic health records in the national Central Medical Information System (CMIS). All public and private schools that offered school-based HPV vaccination in 2023 were included in the study. All electronic records of girls aged 9 to 14 years who were in or out of schools in Eswatini in 2023 formed part of the study population. Convenience sampling was conducted to assess the feasibility and acceptability of the vaccine following the records of accredited data. Initial assessment was based on the studies conducted in South Africa. The lessons learnt were documented and incorporated in the health system for quality improvement to strengthen national program and extension of HPV campaign to reduce cervical cancer incidence while tackling the enabling determinant. The lessons learn were assessed using WHO framework for HPV vaccination in low- and middle-income countries such as Eswatini. The waiver of consent were obtained from National Department of Health as well as the schools and the parents of the adolescents recruited consented to recruited the information on their students. No sampling was performed, and all eligible participant records were included for analysis.

To address the research question "How can HPV vaccination coverage be increased among individuals in Eswatini to reduce cervical cancer incidence?" using quality improvement (QI) methodology, we can employ several frameworks and approaches, including the Fishbone framework and a conceptual framework for quality improvement.

Fishbone Framework (Ishikawa Diagram)

The Fishbone diagram helps to identify potential causes (or barriers) contributing to low HPV vaccination coverage among individuals. Here's how it can be applied:

Main Categories (6 M's)

1. Manpower (People)

* Lack of trained healthcare providers to administer HPV vaccines.

* Healthcare provider misconceptions about vaccine safety or efficacy for individuals.

2. Methods (Processes)

* Inadequate integration of HPV vaccination into routine HIV care services.

* School based vaccination programs are capital intensive and have unclear processes.

3. Machines (Equipment)

* Limited of proper storage facilities or cold chain equipment for HPV vaccines.

* Insufficient availability of vaccination supplies (needles, syringes, etc.).

4. Materials (Supplies)

* Shortage of HPV vaccines at healthcare facilities.

* High cost or unavailability of HPV vaccines.

5. Measurements (Metrics)

* Incomplete vaccination coverage data.

* Challenges of monitoring and evaluation systems for vaccination programs.

6. Environment (Setting)

* Limited community awareness about HPV vaccination benefits for individuals.

* Socio-cultural barriers or stigma associated with HPV vaccination among individuals.

Conceptual Framework for Quality Improvement

Inputs

Human Resources

Trained healthcare providers capable of administering HPV vaccines and providing counselling.

Infrastructure

Healthcare facilities equipped with necessary cold chain facilities and vaccination supplies.

Information

Evidence-based guidelines and educational materials for healthcare providers and patients about HPV vaccination.

Funding

Financial resources to support vaccination programs

and infrastructure.

Outputs

Increased HPV Vaccination Coverage

Percentage increase in the number of individuals vaccinated against HPV.

Improved Healthcare Provider Knowledge

Enhanced understanding among healthcare providers about the importance and logistics of HPV vaccination for individuals.

Enhanced Patient Awareness

Increased awareness among individuals about HPV infection risks and benefits of vaccination.

Process:

Integration of services

Ensure HPV vaccination is integrated into routine care services.

Education and training

Conduct training sessions for healthcare providers on HPV vaccination guidelines and communication strategies.

Supply chain management

Improve logistics and supply chain management to ensure continuous availability of HPV vaccines.

Monitoring and evaluation

Establish systems to monitor vaccination coverage and evaluate program effectiveness regularly.

Impact

Health Outcomes

Reduced incidence of cervical cancer among individuals.

Cost-effectiveness

Potential cost savings associated with reduced healthcare expenditures related to cervical cancer treatment.

Social Impact

Improved quality of life and reduced stigma associated with HPV and cervical cancer among individuals and their communities.

Description

The HPV vaccination campaign in Eswatini utilized a fishbone framework to identify barriers and guide quality improvement (QI) efforts, addressing the complexities of increasing vaccination rates among individuals. This structured approach ensured thorough planning, implementation, and evaluation aimed at reducing cervical cancer incidence.

Governance and Coordination

The Eswatini Ministry of Health (MOH) has an established framework for managing public health programs. The Senior Management Team (SMT) oversees quality health service delivery, with program components reporting to it through Technical Working Groups (TWGs). For the HPV rollout, a hybrid coordination structure was created, involving three key programs: the Expanded Programme on Immunization (EPI) for logistics, the National Cancer Control Unit (NCCU) for coordination, and School Health Programs (SHP) for vaccine delivery in schools. The campaign implemented a multiple-age cohort approach, targeting girls aged 9 to 14.

Funding and Resource Mobilization

The MOH allocated SZL 19,011,097 from its 2022/2023 budget for the Gardasil 4 vaccine, with additional funding raised to cover operational costs, totalling SZL 34,313,699.15.

Community Engagement

Effective advocacy and communication were crucial for the campaign's success, especially in combating misinformation about the HPV vaccine. Strategies included sensitizing school principals and teachers, as well as training healthcare workers on the vaccine and communication tools to foster demand.

Training and Capacity Building

Healthcare workers, including 484 nurses, received training on the HPV vaccination process, incorporating WHO materials. Additionally, a micro-planning workshop facilitated coordination across regions, confirming campaign dates and logistics.

Safety and Logistics

The campaign adhered to national immunization safety standards, with no significant adverse events reported beyond typical side effects. A total of 80,500 HPV vaccines were ordered and distributed across five regional depots, ensuring timely availability for the campaign.

Supportive Supervision and Service Delivery

Supportive supervision was implemented to oversee field operations, ensuring coverage and addressing challenges in real-time. The vaccination strategy targeted schools and included outreach to out-of-school girls. The launch event, held on June 12, 2023, featured significant attendance and media coverage, emphasizing the government's commitment to the campaign and motivating community participation.

The HPV vaccination campaign in Eswatini demonstrated effective coordination and community engagement, ongoing efforts will be essential for sustaining high vaccination rates and ultimately reducing cervical cancer incidence.

Inclusion Criteria

This review study included vaccinated girls 9 – 14 years during the school-based campaign which was ten school days from 12 – 23 June 2023.

Exclusion Criteria

Girls aged 9-14 years that were vaccinated before

and post the campaign were not included in this review. Girls that were below 9 years and above 14 years were excluded in this review.

Data Synthesis

All electronic records of girls aged 9 to 14 years who were in or out of schools in Eswatini in 2023 formed part of the study population. The data was extracted from CMIS which had details of all vaccinated girls. The review presents HPV vaccination campaign daily performance and HPV vaccination national performance.

Results

Below Figure 1 shows the daily performance of the vaccination campaign.

During the launch of the campaign, 182 girls were vaccinated. After the launch, the campaign saw an exponential increase in the rate of vaccination where a total of 5,832 girls were vaccinated on the second day. Following the second day of the campaign, the increase in the cumulative totals showed that the vaccination campaign was making steady progress until it reached a plateau on the 23rd of June which was the last day of the campaign. The Figure 2 shows that the total number of girls vaccinated daily declined significantly towards the end of the campaign.

Vaccination Campaign Performance

The HPV vaccination campaign in Eswatini exhibited notable performance, as illustrated in Figure 1. Initially, 182 girls were vaccinated on the launch day. However, vaccination numbers surged to 5,832 by the second day. Following this peak, the campaign demonstrated steady progress until it plateaued on June 23, the final day of vaccination efforts, after which daily vaccination rates declined significantly.

National Vaccination Coverage

Figure 2 presents data on vaccination coverage by age group. The highest coverage was observed in 11-year-olds at 66.2%, while 14-year-olds had the lowest coverage at 37.3%. This age distribution highlights variations in acceptance and participation across different groups.

Key Insights from the introduction of HPV vaccine

This manuscript describes the successes, challenges and lessons learned from the national introduction of human papillomavirus (HPV) vaccination in Eswatini focusing on three key domains, namely programme decision-making, planning and implementation.

1. Campaign Launch and Engagement

The campaign received substantial support and media coverage, which played a vital role in raising awareness and encouraging parental participation.

2. Vaccination Performance

The campaign showed a strong initial response, with a peak on the second day followed by a plateau in total vaccinations.

3. Age-Specific Coverage

The disparity in vaccination rates, particularly the lower coverage among 14-year-olds, indicates the need for targeted engagement strategies.

4. Challenges Identified

The observed plateau suggests potential vaccination fatigue. Additionally, understanding the lower uptake among certain age groups is essential for refining future efforts.

Ensuring sustainability beyond the campaign is crucial for long-term reductions in cervical cancer incidence.

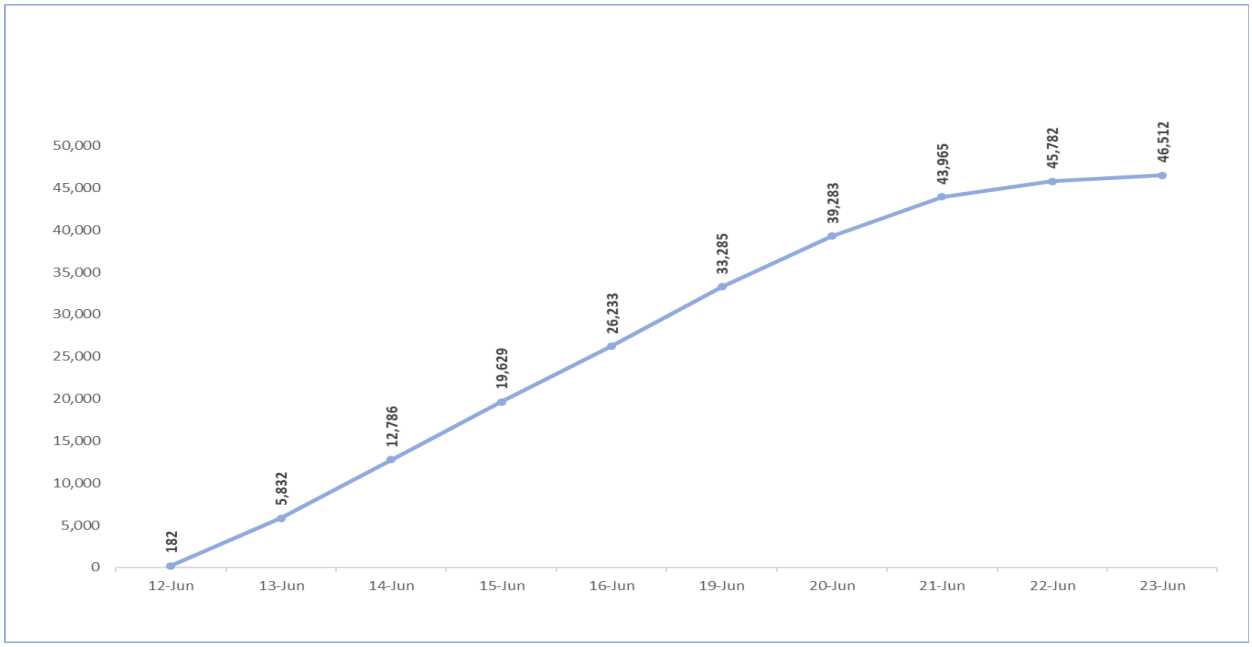

Figure 1. HPV Vaccination Campaign Daily Performance

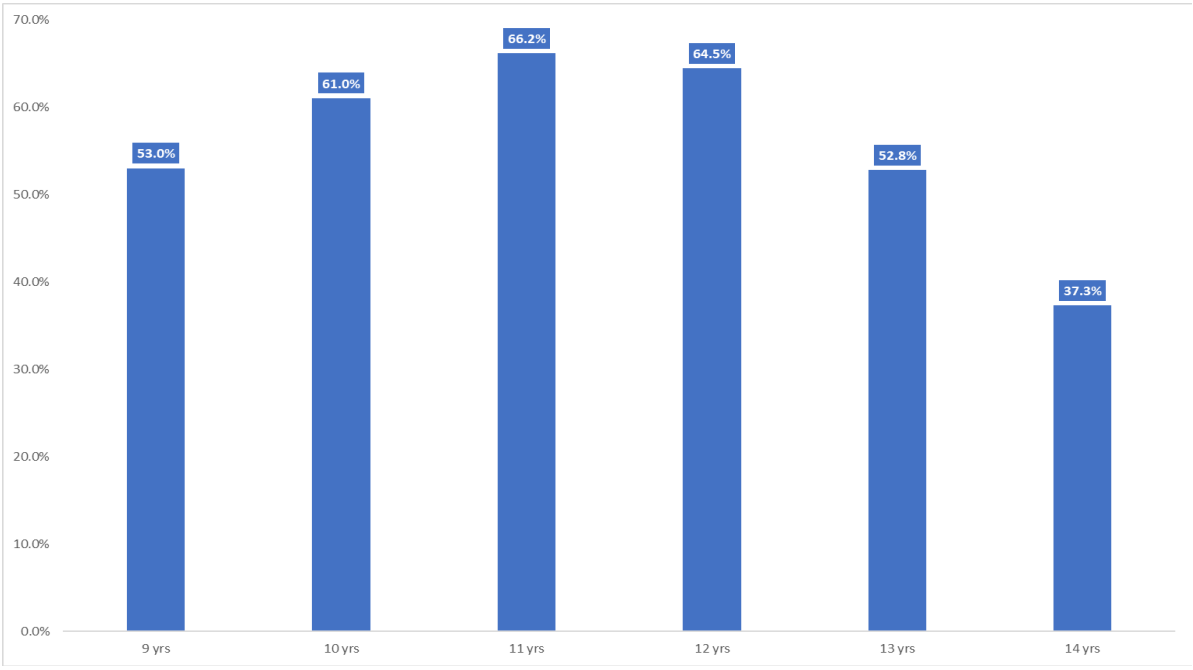

Figure 2. HPV Vaccination National Performance

5. Next Steps

A thorough evaluation will be conducted to address reasons for the plateau and age-specific differences.

Future campaigns will adapt strategies to better engage underrepresented age groups.

Ongoing monitoring of cervical cancer incidence will be necessary to assess the long-term effectiveness of the vaccination initiative.

While the HPV vaccination campaign in Eswatini showed strong community support and initial success, addressing challenges such as vaccination fatigue and disparities in age coverage will be vital for maximizing impact in future efforts.

Discussion

Eswatini's experience and lessons learned during new vaccine introductions helped the country accomplish the nationwide scale-up of the HPV vaccination, both from the point of view of the technical considerations, planning phase and implementation phase was consistent with other countries' experiences such as that of Senegal [4, 5]. This is critical for a successful new vaccine introduction to ensure that it is high-quality, brought timely and within resources allocation [6]. These strong partnerships and high-level political commitments are critical to introducing the vaccine, the success of the HPV vaccine introduction and the sustainability of the programme.

The vaccination campaign launched with an initial turnout of 182 girls on the first day. Remarkably, this number surged to 5,832 girls vaccinated on the second day, indicating a strong initial response and effective outreach. Following this peak, the cumulative vaccination numbers continued to grow steadily, demonstrating sustained interest and participation. However, the campaign reached a plateau by June 23, the final day, with a noticeable decline in daily vaccination rates towards the end.

This pattern suggests that while the campaign effectively engaged participants initially, interest may have waned over time, highlighting potential challenges in maintaining momentum. Factors contributing to this decline could include vaccination fatigue, reduced awareness as the campaign progressed, or logistical barriers. Understanding these dynamics is crucial for planning future vaccination initiatives to ensure sustained engagement and increased coverage.

School-based vaccination has been shown to result in high coverage and programmes incorporating health facility vaccination into this strategy have shown most effective at reaching the target population [7-9, 4]. Findings support the feasibility of the school-based campaign and that it was well-accepted in Eswatini. Despite some challenges identified, health workers and teachers were well informed about the HPV vaccination programme and indicated having the capacity to deliver services to the target population while maintaining routine immunisation services. This suggests school-based HPV vaccination in similar low-resource settings is possible, provided necessary funding is available. Moving forward, reaching out-of-school girls through engagement with the rural health motivators or by using other strategies will ensure equity in the HPV vaccination programme in Eswatini.

Eswatini conducted significant stakeholder meetings, community meetings sessions, and media briefings with a broad spectrum of individuals [10-12]. Nevertheless, despite these efforts, there was misinformation which led to vaccine hesitancy (vaccine refusal and scepticism) identified in-country during introduction. These were quickly mitigated by health communication specialists informing the public via the radio. Sensitisation documents including pamphlets, flagships and billboards were not

available or not visible in the various areas around the country. Late sensitisation of healthcare workers on the HPV vaccine campaign which resulted in delays on community socialisation. Continuous and more robust sensitisation is needed to targeted audiences such as parents. A properly supported communication strategy, including a social media plan, as well as a crisis management plan, are essential prerequisites for any new vaccine introduction.

On the third day of the introduction in Eswatini it was reported that in one region the contracted HCW's engaged in a strike which negatively impacted the day's planned activities. However, the misunderstanding between the HCW's and regional leadership was resolved promptly. Additionally, the providers reportedly tried to influence HCW's in other regions to engage in the strike through interpersonal communication channels and social media tools, such as WhatsApp. Other countries such as Senegal have experienced similar challenges during introduction of HPV vaccine [13, 14]. Lack of experience by contracted HCW's to administer vaccines caused delays. Furthermore, vaccination teams were not enough for the allocated days of the campaign. Consideration of school calendar to take into ongoing activities in schools that could not be disturbed. this have resulted to delays in vaccinating children.

Globally, HPV vaccination campaigns have demonstrated significant strengths and weaknesses. Many international initiatives have achieved high efficacy in reducing HPV infection rates and related cancers, with countries like Australia reporting substantial reductions in HPV prevalence through comprehensive national programs. However, challenges such as vaccine hesitancy, logistical barriers to reaching remote populations, and disparities in healthcare infrastructure persist, limiting the broader success of these campaigns.

In Africa, certain countries, such as Rwanda, have achieved notable success with school-based programs and extensive community engagement, resulting in high vaccination coverage rates and reduced cervical cancer incidence. Yet, limited healthcare resources, issues within vaccine supply chains, and cultural barriers to vaccine acceptance remain significant obstacles.

The South African experience reflects similar dynamics. Before the Eswatini HPV campaign, South Africa implemented programs targeting school-aged girls, yielding variable coverage levels across regions. The cervical cancer incidence in South Africa was approximately 31 cases per 100,000 women, with disparities based on geography and population. In contrast, Eswatini recorded an incidence of around 55 cases per 100,000 women before its HPV vaccination campaign. While the campaign aimed to improve coverage significantly among adolescent girls, specific post-campaign figures are unavailable. Sustained vaccination efforts will be vital, requiring updated statistics to assess the campaign's long-term impact effectively. South Africa's targeted vaccination campaigns, often integrated with other adolescent health services, demonstrate the value of addressing healthcare disparities, despite facing challenges like vaccine hesitancy and logistical constraints in rural areas.

In Eswatini, the HPV vaccination campaign displayed unique strengths and weaknesses. High-level commitment, with royal and ministerial support, bolstered visibility and community engagement. Extensive media coverage, including Eswatini TV and print outlets, raised public awareness and promoted vaccine acceptance. The campaign's early success, with 182 vaccinations on the launch day and a peak of 5,832 on the second day, showcased effective planning and community enthusiasm. However, the campaign experienced a plateau towards the end, with declining daily vaccination rates, possibly due to fatigue or saturation among target groups.

Coverage disparities across age groups further underscore the need for targeted strategies, as 11-year-olds achieved the highest coverage at 66.2%, while 14-year-olds recorded only 37.3%. Sustaining vaccination efforts post-campaign and addressing healthcare infrastructure challenges remain critical for ensuring long-term success. The quality improvement project highlighted the importance of leveraging high-level support and media engagement while identifying areas for enhancement, such as age-specific outreach and strategies to maintain momentum throughout campaigns.

In conclusion, the QI project in Eswatini to increase HPV vaccination among girls aged 15 years has shown initial success with significant early uptake and strong community engagement. However, challenges such as maintaining vaccination momentum, addressing age-specific disparities, and ensuring long-term sustainability remain critical. Learning from both successful global and regional campaigns, particularly in terms of comprehensive community engagement, targeted outreach strategies, and integration with existing healthcare services, will be essential for refining future vaccination efforts in Eswatini. By addressing these challenges and building on the project's strengths, Eswatini can enhance its efforts to reduce cervical cancer incidence through improved HPV vaccination coverage.

Disclaimer, acknowledgments, ethical considerations

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position, policies, or views of the Eswatini Ministry of Health.

The authors declare no competing financial interests, personal relationships, or conflicts of interest that could have influenced the work reported in this paper. No financial support was received for the review study, authorship, or publication of this article. The review relied exclusively on existing data and did not involve any studies with human participants or animals performed by the authors.

The authors wish to acknowledge the contributions to the design and implementation of the HPV vaccine introduction by the Eswatini Ministry of Health, WHO, UNICEF, PEPFAR, and the Clinton Health Access Initiative. All authors listed have made a substantial, direct, and intellectual contribution to the work and have approved it for publication.

Author Contribution Statement

All authors contributed equally in this study.

Acknowledgements

None.

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