CURRENT TRENDS AND FUTURE DIRECTIONS IN THE IMPLEMENTATION OF HPV VACCINES IN VIETNAM:A LITERATURE REVIEW

La Que Lam[1*], Do Thi Thanh Toan[2]

[1] *General Medicine, Hanoi Medical University*

[2] *School of Preventive Medicine and Public Health, Hanoi Medical University*

Received 17 July 2024

Accepted 30 August 2024

Abstract: Our study described the phased implementation of HPV vaccination programs targeting adolescent girls and next expansion efforts, which achieved high coverage rates in pilot areas through school-based and health center-based strategies. Despite these successes, the overall vaccination uptake remains low with the barriers such as financial constraints, logistical difficulties, and cultural barriers. Clinical trials have confirmed the vaccine's high efficacy and safety, consistent with global data. Key advancements in the program include leveraging school infrastructure for vaccine delivery and integrating the HPV vaccine into the National Expanded Program on Immunization. Effective communication strategies and robust community engagement have been pivotal in addressing misconceptions and increasing acceptance. During this literature review, we systematically searched for scientific articles and related documents from online databases such as PubMed, Scopus, and Google Scholar, selecting studies related to the development and implementation of HPV vaccines in Vietnam. Articles lacking sufficient data or relevance to the research topic were excluded. In the future, continued efforts should focus on sustainable funding, public awareness, and logistical improvements to enhance vaccine accessibility, particularly in remote regions. International partnerships and adherence to global best practices are also crucial for further progress. This review underscores the urgent need for comprehensive strategies to mitigate HPV-related disease burdens in Vietnam, offering valuable insights for global public health initiatives.

Keywords: HPV vaccination, Vietnam, vaccination implementation, immunization programs

[*] Corresponding author
E-mail address: laquelam.hmu@gmail.com
https://doi.org/10.56086/jcvb.v4i3.160

1. Introduction

Human Papillomavirus (HPV) is a common viral infection that affects epithelial cells, with over 200 identified types and some of them are associated with various cancers and other diseases [1]. HPV is primarily transmitted through sexual contact, and certain high-risk types, such as HPV-16 and HPV-18, are responsible for the majority of cervical cancer cases [2]. This disease is most prevalent disease associated with HPV [3]. Besides cervical cancer, HPV can also lead to other malignancies including anal, oropharyngeal, penile, vulvar, and vaginal cancers [4,5]. Low-risk types of HPV can cause genital warts and respiratory papillomatosis [6].

The impact of HPV in Vietnam is significant, with cervical cancer being one of the leading causes of cancer-related morbidity and mortality among Vietnamese women. Epidemiological studies indicate a high prevalence of HPV infections: cervical cancer is the 8th most common cancer among women overall and the 5th most common among women aged 15 to 44 [7]. The burden of HPV-related diseases poses a substantial public health challenge, impacting not only individuals but also the healthcare system due to the costs associated with treatment and prevention. Efforts to mitigate this burden include vaccination programs and screening initiatives [8], although coverage and implementation face various logistical and cultural barriers [9].

2. Objectives

Addressing HPV in Vietnam requires comprehensive strategies that includes education, vaccination, and enhanced access to screening and healthcare services to mitigate the incidence and impact of HPV-related diseases [10]. The high prevalence and significant health burden of HPV in Vietnam highlight the urgent need for effective prevention strategies. So this study aims to review the current trends in HPV vaccine development within Vietnam, offering a detailed overview of the progress achieved to date.

3. Methods (Searching strategy)

During the process of conducting this literature review, we searched for scientific articles and related documents from online databases such as PubMed, Scopus and Google Scholar using keywords like "HPV vaccine," "Vietnam," and "implementation." . The criteria for selecting documents included studies related to the development

and implementation of HPV vaccines in Vietnam. We excluded articles that did not provide sufficient data or were not directly related to the research topic. A total of 23 articles were systematically reviewed to ensure comprehensive coverage and accuracy.

4. Results

4.1. HPV Vaccination Programs in Vietnam

4.1.1. Implementation of HPV Vaccination in Vietnam

The program of HPV vaccination in Vietnam aimed at reducing the prevalence of HPV-related diseases through immunization. HPV vaccination firstly introduced in 2006, following global recognition of the vaccine's efficacy in preventing cervical cancer and other HPV-associated conditions [11]. In 2007 and 2008, National Institute of Hygiene and Epidemiology (NIHE), in collaboration with other health organizations such as PATH initiated pilot programs to assess the feasibility of widespread HPV vaccination [12]. These efforts are anticipated to result in the official inclusion of the HPV vaccine in the National Expanded Program on Immunization (NEPI) starting in 2026 for girls aged 11[13].

The rollout of the HPV vaccine in Vietnam followed a phased approach, initially targeting high-risk groups such as adolescent girls aged 11 to 14. This demographic was prioritized because vaccination is most effective before the onset of sexual activity[14]. The government employed a combination of school-based programs and community outreach initiatives to maximize coverage. (LaMontagne et al., 2014) Over the years, the coverage has expanded a broader range of age groups and expected to integrate the HPV vaccine into routine immunization schedules in the future[13,16].

Vietnamese government has implemented several policies and initiatives to promote HPV vaccination to combat cervical cancer [12]. Recognizing the vaccine's potential to significantly reduce the incidence of cervical cancer, the Vietnamese government has implemented policies to support its uptake, although vaccination and screening rates remain relatively low in Vietnam[11]. These include public awareness campaigns to educate the population about the benefits of the vaccine, partnerships with non-governmental organizations to enhance outreach and education efforts [17,18]. The ongoing efforts and government-backed programs aim to address the gaps and

improve public health outcomes through enhanced vaccination and screening coverage.

4.1.2. Coverage and Uptake of HPV Vaccination in Vietnam

The coverage and uptake of HPV vaccination in Vietnam demonstrate a concerted effort by the government and health organizations to combat cervical cancer, yet significant challenges persist. A key strategy to enhance vaccine coverage has been the adoption of WHO's global plan to eliminate cervical cancer. This strategy includes achieving full HPV vaccination coverage for 90% of girls by age 15, ensuring that 70% of women are screened for cervical cancer at ages 35 and 45, and providing treatment and care for 90% of women diagnosed with pre-cancerous lesions or invasive cancer[19]. The Vietnamese government has been working to align its national policies with these targets, focusing on increasing awareness and accessibility of the HPV vaccine. However, as of 2021, only 12% of girls and young women aged 15-29 had this vaccination. This low uptake can be attributed to several factors, including limited public awareness, cultural attitudes towards vaccination, and logistical challenges in reaching remote and rural populations [11]. The initial phases of the vaccination program revealed that while there was widespread support for the HPV vaccine among policymakers, healthcare providers, and community members, translating this support into high vaccination rates proved challenging.

High vaccine coverage in pilot areas was achieved through effective collaboration between the health, education, and community sectors. In the school-based delivery strategy, 96% coverage was achieved, while the health center-based strategy achieved 99% coverage, indicating high community acceptance of the vaccine [20]. The success of these strategies was attributed to targeted information, education, and communication (IEC) activities that addressed community concerns and emphasized the health benefits of vaccination [12]. Despite these successes, expanding these strategies nationwide has proven challenging due to resource constraints and varying levels of acceptance and accessibility across different regions.

4.2. Clinical Trials and Research in Vietnam

4.2.1. Overview of Conducted Clinical Trials

Vietnam has undertaken several clinical trials to evaluate the introduction and efficacy of HPV vaccines, largely facilitated by the NIHE in collaboration with PATH. The "HPV Vaccines: Evidence for Impact" project, conducted from 2006 to 2010, marked a significant milestone in HPV vaccination research in Vietnam. This project included formative research to identify critical issues affecting vaccine delivery, which laid the groundwork for subsequent demonstration projects [12] .

The project piloted two distinct vaccine delivery strategies: a school-based approach and a commune health center-based approach. These strategies were tested in diverse geographical areas, including urban, rural, and mountainous regions. The school-based strategy involved vaccinating girls enrolled in grade 6 at schools, followed by outreach at health centers to capture those missed. The health center-based strategy focused on vaccinating 11-year-old girls at commune health centers [15].

The trials also demonstrated high vaccine coverage rates, achieving 96% in the school-based strategy and 99% in the health center-based strategy. Over two years, 6,358 of 7,016 eligible girls received all three doses of the vaccine, indicating high acceptability and feasibility of both delivery methods [20].

The trials provided critical insights into the operational aspects of HPV vaccine delivery. Key findings included the importance of robust community engagement, effective training for health workers and teachers, and the need for strong inter-sectoral collaboration. The research also highlighted the role of tailored IEC strategies in addressing community concerns and ensuring high vaccine uptake. Parental concerns about vaccine safety and side effects were initially barriers to acceptance, but these were mitigated through transparent communication and government endorsement [17,21]. The involvement of local authorities and community leaders was crucial in gaining public trust and achieving high vaccination coverage.

4.2.2. Efficacy and Safety Data

The efficacy and safety of the HPV vaccine in the Vietnamese population were consistent with global findings. The vaccine was shown to be highly effective in preventing HPV infections and subsequent cervical pre-cancers. The demonstration project confirmed that the vaccine was well-tolerated, with adverse events being rare and

mild, similar to those observed in international trials [17,20,21].

Vietnam's data on vaccine efficacy and safety align closely with global statistics, showing over 90% effectiveness in preventing infections with HPV types 16 and 18, which are responsible for the majority of cervical cancer cases [22,23]. This efficacy is observed in populations with no prior exposure to these HPV types, emphasizing the importance of vaccinating young adolescents before the onset of sexual activity.

4.3. Challenges in HPV Vaccine Development and Implementation

Vietnam's journey towards implementing the HPV vaccination program has encountered several significant challenges. One of the primary challenges has been financial constraints. The cost of the HPV vaccine remains prohibitively high for many families in Vietnam, particularly in rural and underserved areas. This high cost is a significant barrier to achieving widespread vaccine coverage [18]. Integrating the HPV vaccine into the national immunization program requires substantial initial investment for vaccine procurement, cold chain enhancement, and training healthcare workers. Moreover, sustaining the program demands continuous funding, which can be challenging in a resource-limited setting [18,24].

To address the financial barrier, it is crucial to explore sustainable funding mechanisms, such as government budget allocations, international aid, and partnerships with private sector entities. Additionally, a gradual reduction in vaccine costs through negotiations with manufacturers or subsidies could make the vaccine more accessible to a broader population. Vietnam's goal should be to eventually include the HPV vaccine in the NEPI to ensure it is provided free of charge to the target population.

Another challenge is the logistical difficulty in reaching remote and rural populations. Vietnam's diverse geography, with its mountainous regions and dispersed rural communities, poses significant obstacles to ensuring equitable vaccine distribution. Maintaining the cold chain during transportation to these areas is particularly difficult, yet crucial to preserve the vaccine's efficacy [25].

Cultural and social barriers also play a significant role in vaccine acceptance. In Vietnam, as in many other countries, there

are prevailing misconceptions about the HPV vaccine. Common concerns include fears about potential side effects and the unfounded belief that the vaccine might promote early sexual activity among adolescents. These misconceptions are often fueled by inadequate health education and misinformation spread through informal communication channels [16]. Additionally, traditional beliefs and practices can influence parental decisions about vaccinating their children, requiring tailored communication strategies to address these concerns effectively [26].

Besides, the target demographic for the HPV vaccine, primarily adolescent girls, poses unique challenges [12]. Unlike infants and young children who are typically the focus of routine immunization programs, reaching adolescent girls requires new strategies and systems [27]. This age group is less likely to visit healthcare facilities for regular check-ups, making it essential to collaborate with schools and community organizations to ensure their participation in vaccination programs. Coordination with educational institutions to organize school-based vaccination sessions adds another layer of complexity to the implementation process [15,28].

4.4. Innovations and Advancements in HPV Vaccine Development

Despite these challenges, Vietnam has made significant strides in advancing HPV vaccine development and implementation through various innovative approaches. One notable advancement has been the use of school-based vaccination programs. By leveraging the existing infrastructure of schools, health authorities have been able to efficiently reach a large number of eligible girls. This approach capitalizes on the regular attendance of students, ensuring that they receive all required doses of the vaccine. The school-based strategy has proven highly effective, achieving high coverage rates in pilot programs [20]. This method not only simplifies the logistics of vaccine delivery but also integrates health education into the school curriculum, promoting broader awareness of HPV and cervical cancer prevention among students and their families .

The successful integration of the HPV vaccine into the NEPI represents a significant advancement. This integration was facilitated by strong collaboration between the health and education sectors, as well as community-based organizations [20,21]. Utilizing the existing NEPI infrastructure, including

trained personnel, established cold chain systems, and routine immunization schedules, has allowed for the efficient addition of the HPV vaccine to the national immunization calendar without disrupting other vaccination activities [29] .This approach has demonstrated that HPV vaccination can be seamlessly incorporated into broader public health initiatives, maximizing resource utilization and coverage.

Effective communication has been pivotal in overcoming cultural and social barriers to HPV vaccine acceptance. Formative research was conducted to understand community attitudes, beliefs, and information needs regarding the HPV vaccine. This research informed the development of IEC materials designed to resonate with different audiences. These materials were disseminated through multiple channels, including schools, community meetings, local media, and social networks, ensuring broad reach and impact [14,30]. Engaging community leaders, healthcare providers, and teachers as vaccine advocates has also been a successful strategy in building trust and addressing misconceptions about the vaccine .

4.5. Collaborative Efforts and International Partnerships

The success of HPV vaccine implementation in Vietnam can be largely attributed to robust collaborative efforts and international partnerships. PATH, an international non-profit organization dedicated to improving global health, played a crucial role in supporting the Vietnamese government by providing technical assistance and facilitating international cooperation. PATH has been instrumental in Vietnam's HPV vaccination journey, particularly through the HPV Vaccines: Evidence for Impact project [11]. This project, funded by the Bill & Melinda Gates Foundation, aimed to generate evidence for decision-making and operational planning for HPV vaccine introduction in low- and middle-income countries. Vietnam, along with India, Peru, and Uganda, was chosen as a demonstration site for this project. The collaboration involved extensive formative research to understand the critical issues affecting vaccine delivery and to design effective strategies tailored to the local context .

The NIHE and the National Center for Health Education and Communication (NCHEC) were key national partners in the implementation process. These institutions

have worked closely with PATH to identify and test HPV vaccine delivery strategies in diverse geographic areas, including urban, rural, and mountainous regions. The collaborative efforts included conducting IEC activities to sensitize and mobilize communities before vaccination campaigns [12,14].

The World Health Organization (WHO) has played a crucial role in supporting Vietnam's HPV vaccination efforts, providing technical guidance and policy recommendations that have shaped national strategies for cervical cancer prevention.The WHO Cervical Cancer Elimination Modelling Consortium (CCEMC) includes several dynamic models of HPV infection, such as the Policy1-Cervix model from The Daffodil Centre at the University of Sydney, the Harvard model from Harvard University, and the HPV-ADVISE model from Laval University in Quebec[31–33]. These models have been instrumental in evaluating strategies for cervical cancer prevention through HPV vaccination and screening, further enhancing the effectiveness of Vietnam's efforts.

These collaborative efforts have led to significant achievements in HPV vaccination coverage and acceptance in Vietnam. The demonstration projects and subsequent evaluations provided valuable insights that informed the national roll-out of HPV vaccines [12]. The involvement of community-based organizations, local authorities, and educational institutions ensured broad support and effective implementation of vaccination campaigns.

4.6. Future Directions and Recommendations

There are several critical areas where Vietnam can focus to sustain and expand the gains achieved in HPV vaccination. Firstly, ensuring sustainable financing for the HPV vaccination program is essential. This could involve exploring various funding mechanisms, including government budget allocations, international aid, and partnerships with private sector entities. Negotiating lower vaccine prices or securing subsidies could significantly reduce costs, making the vaccine more accessible. A key long-term goal should be the inclusion of the HPV vaccine in the NEPI, which would ensure that it is available free of charge to all eligible individuals, particularly those in remote and underserved areas.

Enhancing public awareness and education about the HPV vaccine’s benefits and safety is another crucial step. Ongoing IEC

campaigns should continue to address misconceptions and provide accurate information to build public trust. Engaging influential community leaders and healthcare providers as advocates for the vaccine can help reinforce positive messages and increase acceptance.

To overcome logistical challenges, especially in remote areas, Vietnam can invest in strengthening the cold chain infrastructure and improving transportation logistics. Mobile vaccination units and partnerships with local organizations could also be explored to reach hard-to-access populations .

Finally, continued collaboration with international partners and adherence to global best practices will be vital for the ongoing success of the HPV vaccination program. Sharing Vietnam's experiences and lessons learned with other countries can contribute to the global effort to eliminate cervical cancer and improve women's health worldwide.

5. Conclusion

The study provides detailed information on the current trends and future directions in the development of HPV vaccines in Vietnam, including implementation strategies, coverage and uptake challenges, clinical trials, and collaborative efforts. The stated objectives of the review have been achieved by comprehensively examining the progress and obstacles in HPV vaccination programs. Prospects for further research include exploring sustainable funding mechanisms, enhancing public awareness, and improving logistical frameworks to ensure equitable vaccine access, especially in remote areas. Continued international collaboration and adherence to global best practices will be essential in advancing HPV vaccination efforts and mitigating the burden of HPV-related diseases in Vietnam.

References

[1] Cubie HA. Diseases associated with human papillomavirus infection. Virology 2013;445:21–34. https://doi.org/10.1016/j.virol.2013.06.007.

[2] Itarat Y, Kietpeerakool C, Jampathong N, Chumworathayi B, Kleebkaow P, Aue-aungkul A, et al. Sexual behavior and infection with cervical human papillomavirus types 16 and 18. Int J Womens Health 2019;11:489–94. https://doi.org/10.2147/IJWH.S218441.

[3] Cervical cancer n.d. https://www.who.int/news-room/fact-

sheets/detail/cervical-cancer (accessed June 22, 2024).

[4] Egawa N. Papillomaviruses and cancer: commonalities and differences in HPV carcinogenesis at different sites of the body. Int J Clin Oncol 2023;28:956–64. https://doi.org/10.1007/s10147-023-02340-y.

[5] Andrioaie IM, Luchian I, Dămian C, Nichitean G, Andrese EP, Pantilimonescu TF, et al. The Clinical Utility of Circulating HPV DNA Biomarker in Oropharyngeal, Cervical, Anal, and Skin HPV-Related Cancers: A Review. Pathog Basel Switz 2023;12:908. https://doi.org/10.3390/pathogens12070908.

[6] Low-risk Human Papillomavirus: Genital Warts, Cancer and Respiratory Papillomatosis. Academic Press; 2020. https://doi.org/10.1016/B978-0-12-814457-2.00010-6.

[7] Viet Nam: Human Papillomavirus and Related Cancers, Fact Sheet 2023. Viet Nam 2023.

[8] Mayeaux EJ. Reducing the economic burden of HPV-related diseases. J Am Osteopath Assoc 2008;108:S2-7.

[9] Hershey JH, Velez LF. Public health issues related to HPV vaccination. J Public Health Manag Pract JPHMP 2009;15:384–92. https://doi.org/10.1097/PHH.0b013e3181a23de6.

[10] Phung MT, An PL, Khoja L, Binh PDU, Le HHTC, McLean K, et al. Abstract A113: Insight into cervical cancer prevention awareness, experiences, and attitudes among Southern Vietnamese women. Cancer Epidemiol Biomarkers Prev 2023;32:A113. https://doi.org/10.1158/1538-7755.DISP22-A113.

[11] United Nations Population Fund in Vietnam. An investment case study on HPV vaccination in Viet Nam. UNFPA Vietnam 2023.

[12] HPV Vaccination in Southeast Asia: Lessons Learned From a Pilot Program in Vietnam n.d. https://www.path.org/our-impact/resources/hpv-vaccination-in-southeast-asia-lessons-learned-from-a-pilot-program-in-vietnam/ (accessed July 14, 2024).

[13] en.baochinhphu.vn. MoH to add four more vaccines to Expanded Immunization Program. en.baochinhphu.vn 2024. https://en.baochinhphu.vn/heath-ministry-to-add-four-more-vaccines-to-

expanded-immunization-program-111240610170245145.htm (accessed July 7, 2024).

[14] Nghi NQ, Lamontagne DS, Bingham A, Rafiq M, Mai LTP, Lien NTP, et al. Human papillomavirus vaccine introduction in Vietnam: formative research findings. Sex Health 2010;7:262–70. https://doi.org/10.1071/SH09123.

[15] LaMontagne DS, Nghi NQ, Nga LT, Janmohamed A, Huyen DTT, Hien NT, et al. Qualitative study of the feasibility of HPV vaccine delivery to young adolescent girls in Vietnam: evidence from a government-implemented demonstration program. BMC Public Health 2014;14:556. https://doi.org/10.1186/1471-2458-14-556.

[16] Phan DPT, Pham QT, Strobel M, Tran DS, Tran TL, Buisson Y. Acceptabilité de la vaccination contre les papillomavirus humains (HPV) par les pédiatres, les mères et les jeunes femmes à Hô Chi Minh Ville, Vietnam. Rev DÉpidémiologie Santé Publique 2012;60:437–46. https://doi.org/10.1016/j.respe.2012.03.010.

[17] Paul P, LaMontagne DS, Le NT. Knowledge of cervical cancer and HPV vaccine post- vaccination among mothers and daughters in Vietnam. Asian Pac J Cancer Prev APJCP 2012;13:2587–92. https://doi.org/10.7314/apjcp.2012.13.6.2587.

[18] Tran BX, Than PTQ, Doan TTN, Nguyen HLT, Thi Mai H, Nguyen THT, et al. Knowledge, attitude, and practice on and willingness to pay for human papillomavirus vaccine: a cross-sectional study in Hanoi, Vietnam. Patient Prefer Adherence 2018;12:945–54. https://doi.org/10.2147/PPA.S165357.

[19] Global strategy to accelerate the elimination of cervical cancer as a public health problem n.d. https://www.who.int/publications/i/item/9789240014107 (accessed July 7, 2024).

[20] LaMontagne DS, Barge S, Le NT, Mugisha E, Penny ME, Gandhi S, et al. Human papillomavirus vaccine delivery strategies that achieved high coverage in low- and middle-income countries. Bull World Health Organ 2011;89:821-830B. https://doi.org/10.2471/BLT.11.089862.

[21] Cover JK, Nghi NQ, LaMontagne DS, Huyen DTT, Hien NT, Nga LT. Acceptance patterns and decision-making for human papillomavirus vaccination among parents in Vietnam: an in-depth qualitative study post-vaccination. BMC Public Health 2012;12:629. https://doi.org/10.1186/1471-2458-12-629.

[22] Kreimer AR, González P, Katki HA, Porras C, Schiffman M, Rodriguez AC, et al. Efficacy of a bivalent HPV 16/18 vaccine against anal HPV 16/18 infection among young women: a nested analysis within the Costa Rica Vaccine Trial. Lancet Oncol 2011;12:862–70. https://doi.org/10.1016/S1470-2045(11)70213-3.

[23] Thiem VD, Quang ND, Tuan NH, Cheon K, Gallagher N, Luxembourg A, et al. Immunogenicity and safety of a nine-valent human papillomavirus vaccine in Vietnamese males and females (9 to 26 years of age): an open-label, phase 3 trial. Hum Vaccines Immunother 2021;17:1980–5. https://doi.org/10.1080/21645515.2020.1865739.

[24] Levin CE, Van Minh H, Odaga J, Rout SS, Ngoc DNT, Menezes L, et al. Delivery cost of human papillomavirus vaccination of young adolescent girls in Peru, Uganda and Viet Nam. Bull World Health Organ 2013;91:585–92. https://doi.org/10.2471/BLT.12.113837.

[25] Cold Chain Temperature Monitoring in Vietnam: Monitoring Ambient and Cold Chain Temperatures During Delivery of Human Papillomavirus Vaccine n.d. https://www.path.org/our-impact/resources/cold-chain-temperature-monitoring-in-vietnam-monitoring-ambient-and-cold-chain-temperatures-during-delivery-of-human-papillomavirus-vaccine/ (accessed July 14, 2024).

[26] Bingham A, Drake JK, LaMontagne DS. Sociocultural issues in the introduction of human papillomavirus vaccine in low-resource settings. Arch Pediatr Adolesc Med 2009;163:455–61. https://doi.org/10.1001/archpediatrics.2009.50.

[27] Paterson P, Mounier-Jack S, Saliba V, Yarwood J, White J, Ramsay M, et al. Strengthening HPV vaccination delivery: findings from a qualitative service evaluation of the adolescent girls' HPV vaccination programme in

England. J Public Health 2021;43:189–96. https://doi.org/10.1093/pubmed/fdz061.

[28] Egbon M, Ojo T, Aliyu A, Bagudu ZS. Challenges and lessons from a school-based human papillomavirus (HPV) vaccination program for adolescent girls in a rural Nigerian community. BMC Public Health 2022;22:1611. https://doi.org/10.1186/s12889-022-13975-3.

[29] Vu LT, Bui D, Le HT. Prevalence of cervical infection with HPV type 16 and 18 in Vietnam: implications for vaccine campaign. BMC Cancer 2013;13:53. https://doi.org/10.1186/1471-2407-13-53.

[30] PATH. Conducting Formative Research for HPV Vaccination Program Planning: Practical Experience From PATH n.d.

[31] Simms KT, Keane A, Nguyen DTN, Caruana M, Hall MT, Lui G, et al. Benefits, harms and cost-effectiveness of cervical screening, triage and treatment strategies for women in the general population. Nat Med 2023;29:3050–8. https://doi.org/10.1038/s41591-023-02600-4.

[32] Soi C, Shearer J, Chilundo B, Muchanga V, Matsinhe L, Gimbel S, et al. Global health systems partnerships: a mixed methods analysis of Mozambique's HPV vaccine delivery network actors. BMC Public Health 2020;20:862. https://doi.org/10.1186/s12889-020-08958-1.

[33] Drolet M, Laprise J-F, Martin D, Jit M, Bénard É, Gingras G, et al. Optimal human papillomavirus vaccination strategies to prevent cervical cancer in low-income and middle-income countries in the context of limited resources: a mathematical modelling analysis. Lancet Infect Dis 2021;21:1598–610. https://doi.org/10.1016/S1473-3099(20)30860-4.