International Academy of Human Reproduction (IAHR)

A WHITE PAPER TOWARDS THE ELIMINATION OF CERVICAL CANCER

"INTEGRATING MANDATORY CATCH-UP HPV VACCINATION INTO GLOBAL POSTPARTUM DISCHARGE PROTOCOLS AND IAHR CONSENSUS RECOMMENDATIONS"

ENDORSED BY:

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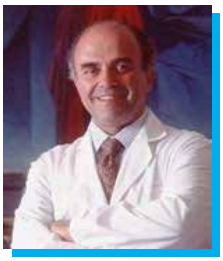
FROM THE IAHR PRESIDENT'S DESK



Dr. Andrea Genazzani
President, International Academy of Human Reproduction (IAHR)

The fight against cervical cancer exemplifies one against global inequity. While cervical cancer is the fourth-most common cancer for women across the globe, there are striking global disparities in disease and mortality burden. A marked disparity exists in cervical cancer burden observed between higher resource and lower resource countries, with 90% of all new cases of cervical cancer emerging in low to middle income countries (Rodney Hull;et;al;2020)

The road to cervical cancer elimination is longer and much difficult in countries with lower resources and HPV vaccination confers primary prevention of most cervical cancers, since screening protocols that are most effective in high income countries are not the most effective in low to middle income countries (K. Gopalkrishnan, et:al;2025). It has been reported that only 41% of low to middle income countries have an actual funded cervical cancer screening strategy in operation, and screening is often opportunistic, meaning there is no national organized screening invitation protocol for the target population (Asangbeh-Kerman SL., et:al;2022)

Hence, the World Health Organization (WHO) protocol for cervical cancer elimination is based on a 90–70–90 strategy, aiming for 90% of girls vaccinated with the HPV vaccine, 70% of women screened with high-performance tests, and 90% of women with pre-cancer or invasive cancer receiving treatment by 2030.

While 125 countries had implemented an HPV vaccination program as of 2021, only 21% of girls worldwide were vaccinated for HPV as of 2022 (Almonte M, et:al;2024). World Health Organization (WHO) immunization coverage estimates reveal that South-East Asia Region, the HPV Vaccination coverage by age 15, first dose, in females was only 4% in 2024 while in the African Region it was 28% and in Eastern Mediterranean Region it was 0%. Global coverage for the first dose of HPV vaccine in girls grew from 27% in 2023 to 31% in 2024, while far from the 90% target by 2030. (WHO Immunisation Coverage Fact Sheet - 2024)

While Gynecologists are pivotal in HPV prevention through vaccination, limitations of resources due to limited implementation of inter-sectoral program models for HPV vaccine integration in national health programs by the governments, lack of public awareness and traditional socio-cultural beliefs, alongside numerous other factors, lead to vaccine hesitancy amongst the eligible population of 9 to 14 years, wherein the efficacy of the HPV vaccines are reportedly the highest. Most girls who miss this opportunity window, are likely to present themselves at Gynecologists clinics during ante-natal checkups at pregnancy, which provide an excellent touch point for counseling on cervical cancer prevention.(Ghada Saad–Haddad:et:al,2016)

Studies show that health education & counselling by gynecologists, significantly increases awareness and acceptance of HPV vaccination among postpartum women, with high completion rates of the vaccine series and strong patient satisfaction. (Abbey B BERENSON; et:al; 2016)

Aligned to WHO's Global Strategy to Eliminate Cervical Cancer (2020) recommending integration of HPV vaccination with postpartum and SRHR services, especially in high-burden, low-access settings, IAHR as well recommends "Integrating Mandatory Catch-up HPV Vaccination into Global Postpartum Discharge Protocols" as a vital step toward eliminating HPV-related diseases and cancers and improving women's reproductive health worldwide

FROM THE FIGO PRESIDENT'S DESK

Prof Kihara Anne Beatrice,
President, The International Federation of Gynecology and Obstetrics (FIGO)

Cervical cancer remains a pressing global health challenge, disproportionately affecting women in low- and middle-income countries despite being largely preventable. This white paper "*Towards the Elimination of Cervical Cancer: Integrating Mandatory Catch-Up HPV Vaccination into Global Postpartum Discharge Protocols*" provides an evidence-informed framework that aligns with the World Health Organization's global elimination strategy of 90-70-90 and offers a pragmatic pathway to strengthen national maternal immunization agendas.

This document highlights the critical role of Human Papillomavirus (HPV) vaccination in reducing the incidence of cervical and other HPV-related cancers. It emphasizes the unique opportunity of the postpartum period as an effective, underutilized platform to deliver catch-up vaccination, particularly for women who may have missed earlier doses in adolescence. By embedding HPV vaccination into standardized global postpartum discharge protocols, health systems can maximize coverage, improve equity, and enhance cost-effectiveness by integration within existing maternal and child health services.

The chapters address policy guidelines, immunological considerations, health system enablers, and implementation models, while also tackling vaccine hesitancy and the importance of male immunization for herd protection. Collectively, this white paper provides policymakers, governments, and global health partners with actionable recommendations to institutionalize postpartum HPV vaccination, thereby accelerating progress toward the elimination of cervical cancer as a public health threat.

Endorsed by European Board and College of Obstetrics and Gynaecology (EBCOG)

EBCOG

European Board and College of Obstetrics and Gynaecology

Leuven, 29th September 2025

Re: THE *WHITE PAPER TOWARDS THE ELIMINATION OF CERVICAL CANCER: "INTEGRATING MANDATORY CATCH-UP HPV VACCINATION INTO GLOBAL POSTPARTUM DISCHARGE PROTOCOLS" AND* IAHR CONSENSUS RECOMMENDATIONS

A Note From The Desk Of EBCOG

HPV vaccination is one of the most cost-effective public health interventions. **EBCOG supports the WHO Global Strategy to Accelerate the Elimination of Cervical Cancer** and the achievement of the 90-70-90 targets: 90% of girls fully vaccinated with the HPV vaccine by age 15; 70% of women screened with a high-performance test; and 90% of women diagnosed with cervical disease receiving appropriate treatment.

EBCOG encourages adherence to the European Commission's recommendations, **which call for vaccinating at least 90% of the EU's target population of girls and for significantly increasing vaccination coverage among boys.** Scientific evidence has consistently shown that HPV vaccination is most effective in preventing HPV-related disease when administered at younger ages. This approach will help strengthen HPV vaccination programmes. **The primary target group is girls aged 9–14**, most commonly between 12 and 14, with catch-up vaccination offered between ages 15 and 18. According to updated recommendations, **a single-dose schedule** is sufficient for young girls.Secondary target groups include boys and older females.

However, considering the challenges in vaccinating younger girls in parts of the Global South**, postpartum vaccination** can be offered for catch-up immunization among women (aged <26 years) who missed vaccination during adolescence. Integrating HPV vaccination into postpartum and family planning services can help reach vulnerable and high-risk populations, thereby contributing to the reduction of cervical cancer-related mortality.

Kind regards,

Professor Helle Karro
Secretary-General, EBCOG

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FROM THE EDITOR'S DESK

Dr. S. Shantha Kumari,

Secretary General, IAHR- 2025

Cervical cancer in women is unfortunately still a global health issue and the responsibility to reduce it is on every one of us as gynecologists taking care of women's health.

Understanding the virology, transmission dynamics, and oncogenic mechanisms of HPV is crucial for developing effective prevention strategies, including vaccination and screening programs, to reduce the global impact of HPV-associated cancers. External and internal host factors responsible for HPV infections in women, include cigarette and alcohol consumption, risky sexual behaviour (early sexual activity, unprotected sex, having multiple sexual partners, or sex trading), medication, genetic traits, and an altered immune response at post-partum state, which may enhance the persistence of the viral load, leading to sequelae later in life.

Widespread HPV vaccination programs have led to dramatic declines in HPV prevalence and cervical cancer precursors in many countries. Given that most women engage with healthcare providers during their pregnancy, the various touch points for counselling and offering HPV vaccination in the postpartum period include- Antenatal Check-Up (Health Education Classes); Postpartum Check-Up; Breastfeeding Support Sessions & Community Health Events. Prophylactic HPV VACCINATION can not only prevent cervical cancer but 4 additional cancers in women: vulvar, vaginal, anal and oropharyngeal & warts.

FIGO, The International Federation of Gynaecology and Obstetrics recommends vaccination and screening for girls and women to reduce cervical cancer burden, and The American College of Obstetricians and Gynaecologists (ACOG) recommends postpartum HPV vaccination, as women are more susceptible to HPV infection in the postpartum period. Since leading International and National Bodies recommend that HPV vaccination can be administered during breast-feeding, a controlled post-partum HPV vaccination program is a reasonable method for achieving an excellent completion rate for the three doses of HPV vaccination. Integrating HPV vaccination into postpartum care has improved vaccine coverage wherever tried, and improved HPV vaccine completion rates have been reported when counselling, strict monitoring and follow-up of postpartum HPV vaccinations in women were ensured. A majority of women reported a high degree of satisfaction with post-partum vaccination.

Marked by profound physical, hormonal, emotional, and social changes, that is associated with psychological changes, pregnancy is a unique confluence of factors that contributes to women being more receptive to counseling during this time. This period is therefore often referred to as a "TEACHABLE MOMENT" in health behavior change (Phelan, Citation2010) ;(McBride et al. citation2003). Unlike other "teachable moments" in acute healthcare settings, pregnancy typically provides a window of opportunity, spanning up to 40 weeks, involving multiple contacts between the pregnant women, their family members and healthcare professionals (National Institute for Health and Care Excellence, Citation2008).

This White Paper by the International Academy of Human Reproduction -IAHR provides ample data, analytics and evidence, reviewed from multiple published literatures and calls upon the gynecologists and policy makers all over the world, not to miss the opportunity and embed HPV vaccination into standardized global postpartum discharge protocols, with the FIRST DOSE AT DISCHARGE and the subsequent doses at follow up antenatal visits. This tweak in Post Partum Discharge Protocols in the health systems across the world, can maximize coverage, enhance cost-effectiveness and move towards the WHO goal of Global Cervical Cancer Elimination.

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Introduction: Understanding Human Papilloma Virus (HPV)

Human Papilloma Virus (HPV) is a diverse group of DNA viruses belonging to the Papillomaviridae family, characterized by their ability to infect epithelial cells of the skin and mucous membranes. Over 200 types of HPV have been identified, with varying oncogenic potential. HPV is primarily transmitted through direct skin-to-skin contact, most commonly via sexual intercourse, making it one of the most prevalent sexually transmitted infections worldwide[1].

Sexually transmitted HPV types fall into two groups[2]

Low risk	High risk
Types 6 and 11	Types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, and 68
Cause genital warts	Cause several types of cancers (especially type 16 and 18)

Epidemiological data reveal that HPV infection affects a significant proportion of sexually active individuals globally, with an estimated 80% of women acquiring the virus at some point in their lives[3]. The global burden of HPV-related diseases is substantial, with cervical cancer contributing to 604,127 cases annually. India alone contributes to 123,907 of these cases[4]

In females, HPV can cause not only cervical cancer but also other cancers in the ano-genital areas (anal, vaginal and vulvar cancers), as well as oropharyngeal cancers. HPV can also lead to genital warts and recurrent oral papillomatosis. In males, HPV can cause penile and anal cancers, along with genital warts and recurrent oral papillomatosis[5].

The natural history of HPV infection typically involves initial viral entry and replication in basal epithelial cells, often resulting in transient infections that are cleared by the immune system within 1-2 years. However, persistent infection with high-risk HPV types can lead to the integration of viral DNA into the host genome, disrupting cell cycle regulation and promoting progression from precancerous lesions to invasive carcinoma over several years[6].

Understanding the virology, transmission dynamics, and oncogenic mechanisms of HPV is crucial for developing effective prevention strategies, including vaccination and screening programs, to reduce the global impact of HPV-associated cancers

HPV Vaccination: A Critical Tool for Prevention of HPV-Related Diseases and Cancers

HPV vaccines are essential in preventing HPV-related diseases and cancers. Currently, three types of HPV vaccines are available across the world[7]

- Bivalent vaccines target HPV types 16 and 18
- Quadrivalent vaccines targets HPV types 6, 11, 16, and 18
- Nonavalent vaccine covers nine HPV types (6, 11, 16, 18, 31, 33, 45, 52, and 58), broadening protection to cover additional 5 oncogenic HPV types

When administered, the vaccines stimulate the immune system to produce strong neutralizing antibodies that prevent HPV infection by blocking the virus from entering cells. The immune response is robust and long-lasting, especially when given to younger individuals before exposure to HPV[8].

Clinical trials have demonstrated high efficacy of HPV vaccines in preventing persistent infection and precancerous lesions caused by various HPV types, with protection rates exceeding 90% in HPV-naïve individuals.[9]

Real-world data confirm these findings, showing significant reductions in HPV infections, genital warts, and cervical precancers in vaccinated populations. Safety profiles are excellent, with mostly mild side effects such as injection site pain and no serious adverse events linked to vaccination.[10]

Widespread HPV vaccination programs have led to dramatic declines in HPV prevalence and cervical cancer precursors in many countries. Herd immunity effects have also reduced HPV infections among unvaccinated individuals. These successes highlight the potential of HPV vaccination to substantially lower the global burden of cervical and other HPV-related cancers, especially when combined with effective screening and treatment strategies[5].

Guidelines and Recommendations for HPV vaccination

Universally Centers for Disease Control and Prevention (CDC) Recommendations for HPV vaccination are well accepted[11]

Recommended Ages

Routine Vaccination	For all adolescents starting at age 11 or 12 years, though vaccination can begin as early as age 9
Catch-up Vaccination	Can be given up to age 26 if not previously vaccinated
Adults 27-45 Years	Shared clinical decision-making is recommended for adults aged 27 to 45 years who are not adequately vaccinated, based on individual risk factors.

Dosing schedule

For those initiating vaccination before age 15	A 2-dose schedule (0 and 6-12 months)
For those starting at age 15 or older	A 3-dose schedule (0, 1-2, and 6 months)

Special Considerations for Gynecologists

Immunocompromised Patients	Women with immunocompromising conditions should receive a 3-dose schedule regardless of age at initiation
Screening and Vaccination	HPV vaccination does not replace cervical cancer screening. Gynecologists should continue to follow screening guidelines while promoting vaccination.
Postpartum Vaccination	Integrating HPV vaccination into postpartum care is an effective strategy to increase vaccine uptake among women who missed earlier vaccination opportunities
Counseling	Address vaccine hesitancy by providing clear information about vaccine safety, efficacy, and the importance of preventing HPV-related cancers.

Gynecologists are pivotal in HPV prevention through vaccination. Adhering to current guidelines ensures optimal protection for patients, reduces HPV-related disease burden, and moves toward the goal of eliminating HPV-associated cancers. Incorporating HPV vaccination into routine and postpartum care, coupled with patient education, will maximize vaccine coverage and public health impact.

Rationale for HPV Vaccination in the Postpartum Period

a. HPV infections in postpartum women

Women are susceptible to HPV infections at different phases of life. Cervical ectropion in women of child-bearing age thinning of the cervical epithelium during pregnancy, and injuries to the cervix during vaginal delivery may increase the risk of HPV infection in postpartum women. Moreover, women with multiple vaginal deliveries and those of young age at their first full-term delivery have a higher risk of cervical cancer. Therefore, HPV vaccination can be advantageous for postpartum women.[12]

b. Immunological Considerations Postpartum

The postpartum period represents a unique immunological state characterized by gradual restoration of immune function following pregnancy-induced modulation. Thus, the postpartum period is immunologically suitable for HPV vaccination, ensuring adequate immunogenicity and protection.[13]

c. Opportunity for Catch-Up Vaccination During Postpartum Care

Postpartum care visits provide a critical and often underutilized opportunity to administer catch-up vaccinations, including HPV vaccine, especially for women who missed vaccination during adolescence or early adulthood. Given that many women engage with healthcare providers during this period, integrating HPV vaccination into postpartum care can improve vaccine coverage. Postpartum visits allow healthcare providers to assess vaccination history and offer timely immunization, reducing missed opportunities. Further studies have shown that postpartum HPV vaccination is safe in the postpartum period and in lactating women.[14,15]

In summary, the postpartum period is an ideal time to educate mothers about the risks of HPV and important family health issues, as women are often motivated to optimize their health for themselves and their families. Healthcare access is optimal during this time, making it the perfect opportunity for immunization. Offering the HPV vaccine at this stage can effectively help prevent HPV-related diseases and cancers in women who missed vaccination earlier in life.

d. Potential to Reduce HPV Transmission to Partners and Newborns

Postpartum HPV vaccination can not only protect the vaccinated women but may also reduce HPV transmission to sexual partners by lowering viral shedding and infection rates. Although vertical transmission of HPV to newborns is rare, vaccination may further minimize this risk, potentially reducing neonatal respiratory papillomatosis linked to HPV exposure during birth.[16] Thus, postpartum HPV vaccination contributes to broader community protection and supports the prevention of HPV-related diseases across generations.

The touch points for creating awareness and offering HPV vaccination in the postpartum period include

- Ante-natal Check-Up (Health Education Classes)
- Postpartum Check-Up
- Breastfeeding Support Sessions
- Community Health Events

Strategies to enhance HPV vaccination during the postpartum period

a. Strengthening Health Education[17]

- Providing postpartum women with information about HPV, its risks, and the benefits of vaccination can empower them to make informed decisions.
- Customized educational programs that consider cultural differences, literacy levels, and language needs can improve comprehension.
- Utilizing multimedia resources, offering counseling during postpartum appointments, and conducting community outreach activities help raise awareness.
- Involving partners and family members in educational efforts can facilitate supportive decision-making.

It is important to recognize that both prenatal and postpartum periods present valuable opportunities for counseling about HPV-related cancers and administering the vaccine[18]

b. Role of Medical Societies and Recommending Bodies

Medical societies (e.g., American College of Obstetrics and Gynecologists (ACOG), International Federation of Gynecology and Obstetrics (FIGO), World Health Organization (WHO), Federation of Obstetric and Gynecological Societies of India (FOGSI), All India Coordinating Committee of the Royal College of Obstetricians and Gynecologists (AICC-RCOG) and International Academy of Human Reproduction (IARH) can provide evidence-based guidelines to integrate HPV vaccination into postpartum discharge protocols. Endorsements from reputable bodies can increase trust and acceptance among healthcare providers and patients.

Examples to illustrate

- ACOG has mentioned that HPV vaccine can and should be given to breastfeeding women aged 26 years and younger who have not been previously vaccinated.19
- WHO confirms that HPV vaccination given to lactating women do not affect the safety of breastfeeding for mothers or infants.20
- FOGSI guidelines also recommend that lactating women are eligible to receive the HPV vaccination[21]

Implementation Models for Postpartum HPV Vaccination

HPV vaccination has been a cornerstone in the global strategy to prevent HPV diseases and cancers. Postpartum period presents a critical window for catch-up HPV vaccination especially for women who have missed routine adolescent vaccination, leveraging healthcare contact during delivery and postpartum care. Several implementation models have been piloted globally or can be proposed to integrate HPV vaccination into postpartum care

No	Program	Details
1	Hospital-Based Vaccination Programs	Administering HPV vaccines before discharge from maternity wards ensures high coverage
2	Integrated Maternal-Child Health Clinics	Combining HPV vaccination with routine postpartum and infant immunization visits can improve uptake
3	Community Outreach and Education	Engaging community health workers to educate postpartum women in home or community settings can help improve HPV vaccination rates
4	Electronic Health Record (EHR) Reminders and Tracking	Utilizing EHR systems to identify eligible postpartum women and prompt vaccination during visits enhances adherence
5	Policy and Mandate Integration	Mandating HPV vaccination as part of postpartum discharge protocols, can ensure wider and systematic coverage

Future efforts should focus on overcoming logistical challenges, addressing vaccine hesitancy, and establishing global guidelines to mandate postpartum HPV vaccination as a standard of care.

Overcoming Vaccine Hesitancy: Role of Healthcare Providers and Health System Enablers

a. Challenges that are impediment to HPV vaccination in postpartum period[22]

- Many women think they are too young to have cancer
- Concerns about vaccine passing into breast milk
- Transport and cost of vaccine can prevent completion of vaccination schedule
- Many women do not return until the next pregnancy

b. Why the postpartum period serves as a valuable moment to offer HPV vaccination

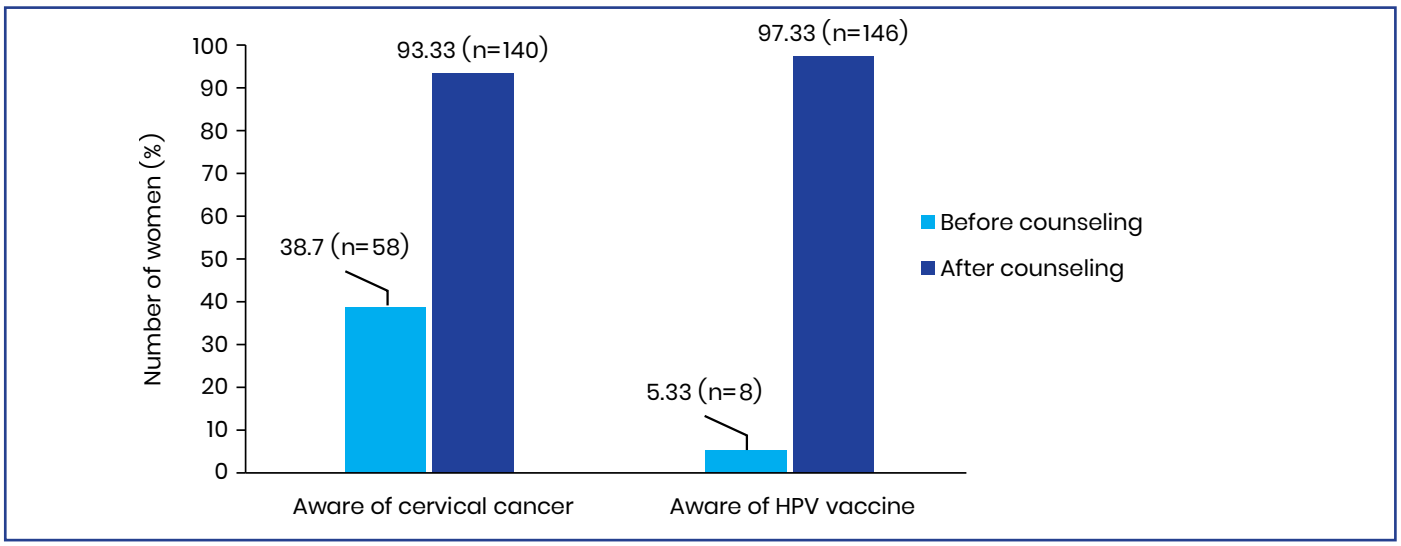
- Many women only visit doctors during pregnancy.
- Routine care, including vaccination, is often missed outside this window.
- This period offers a window of opportunity to educate and vaccinate those who might not otherwise receive them

Gynecologists are trusted sources; their strong recommendation is the most influential factor in vaccine acceptance. They can strongly support integrating HPV vaccination into postpartum care, coordinating follow-ups with wellness visits, and prioritizing patient education.[22]\

c. Published Evidence

i) In a study conducted among third trimester pregnant women attending antenatal clinic in India, women who were HPV vaccination naïve were given a pre-test, health education on cervical cancer and HPV vaccination, counseling, and a post-test after delivery. Participants willing to be vaccinated received the first HPV vaccine dose before discharge and subsequent doses during postpartum follow-up. The endpoint of this study was to assess the impact of health education on HPV vaccine awareness, acceptance of the first dose, compliance with the full vaccine series, and reasons for non-vaccination.[23]

The results of this study were as follows

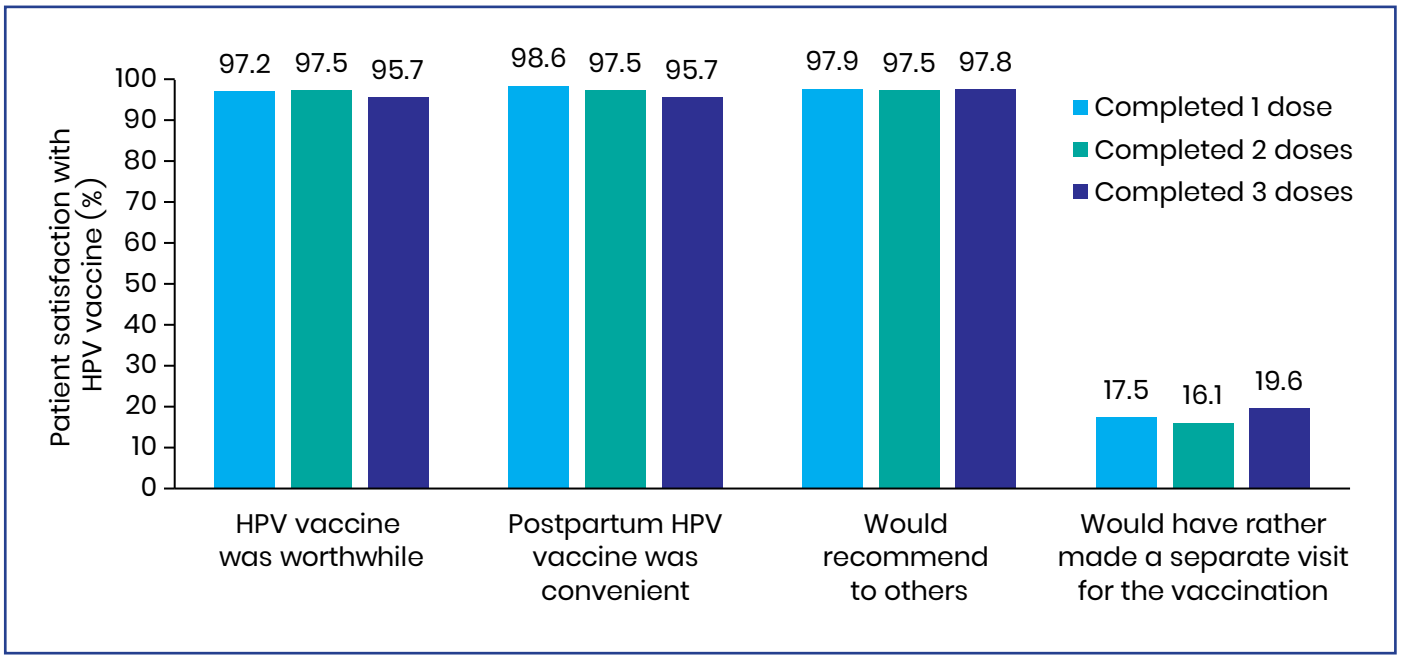


In the baseline survey, 38.7% were aware of cervical cancer. 20.68% knew that HPV was the main cause for cervical cancer. 5.33% were aware of HPV vaccination. After the health education, 93.33% became aware of cervical cancer and 97.33% of HPV vaccination. 90% came to know that HPV is the main cause for cervical cancer. After the educational intervention, 70% received first dose HPV vaccination before discharge in puerperium. 86.63% women completed all 3 series of HPV vaccination, and 94.5% felt it was worthwhile to receive the vaccine during puerperium.

The authors concluded that counseling plays a major role in increasing the awareness of cervical cancer and HPV vaccination in postpartum women.

ii) In another study, postpartum women aged 18-26 years were offered the quadrivalent HPV vaccine. Women were vaccinated during hospitalization after delivery, at the 6-week postpartum visit, and at a third dedicated vaccination visit. The primary outcome was the completion of all three vaccinations. Secondary outcomes included the influence of knowledge and attitudes of HPV, decisional conflict, and satisfaction.

A total of 150 women were enrolled. Overall, seven (4.7%) women did not receive any doses of the vaccine, 62 (41.3%) received one dose, 35 (23.3%) received two doses, and 46 (30.7%) completed the series and received all three doses of the vaccine. Knowledge of HPV and HPV-related disease, attitudes about HPV, and decisional conflict were not associated with completion of the vaccine series ($p>0.05$). The vaccine was well tolerated with few side effects.



The majority of women reported a high degree of satisfaction with postpartum vaccination; 97.2% thought vaccination was worthwhile, 98.6% thought postpartum vaccination was convenient, and 99.3% were happy they participated. Furthermore, 50.4% of women reported that they would not have otherwise asked about vaccination. After vaccination, only 17.5% said they would have rather made a separate trip for vaccination.

The authors concluded that a strategy of postpartum HPV vaccination is convenient and associated with a high degree of patient satisfaction.

Development and Immunological Mechanisms of HPV Vaccine: Catch-Up and Maternal Immunization Considerations in prenatal period with transfer of immunity to the neonate[27-45]

a. Pharmaco-development of the HPV Vaccine

HPV vaccines were initially designed to protect against the most common high-risk HPV types, especially types 16 and 18, which cause approximately 70% of cervical cancers. Subsequently, additional oncogenic types (31, 33, 45, 52, and 58) were incorporated. Currently, Gardasil 9 offers broad protection against these multiple high-risk HPV strains.

b. Vaccine Composition

HPV vaccines are subunit vaccines based on virus-like particles (VLPs). These VLPs are produced through recombinant DNA technology by expressing the HPV L1 capsid protein in yeast (such as *Saccharomyces cerevisiae*) or baculovirus-insect cell systems. While VLPs resemble the HPV outer shell, they contain no viral DNA, rendering them non-infectious and non-oncogenic.

c. Vaccine Types

- Bivalent (Cervarix): Targets HPV types 16 and 18, formulated with the AS04 adjuvant.
- Quadrivalent (Gardasil): Protects against HPV types 6, 11, 16, and 18, using an aluminum hydroxy phosphate sulfate adjuvant.
- Nonavalent (Gardasil 9): Expands coverage by including HPV types 31, 33, 45, 52, and 58 in addition to the quadrivalent types.

d. Immunological Mechanisms of HPV Vaccine

HPV vaccines are not absorbed or metabolized systemically in the conventional manner. After intramuscular injection, antigen-presenting cells (APCs) at the site capture the virus-like particles (VLPs) and carry them to nearby lymph nodes. This process activates the adaptive immune system, leading to the production of neutralizing IgG antibodies as well as memory B and T cell responses. Antibody levels peak approximately one month after the final vaccine dose and then stabilize at consistent levels. These antibodies persist long-term, remaining detectable for over 10 years post-vaccination. Currently, booster doses are not recommended for immunocompetent individuals.

e. Immune Response in HPV-Naïve Girls Aged 9–14 Years

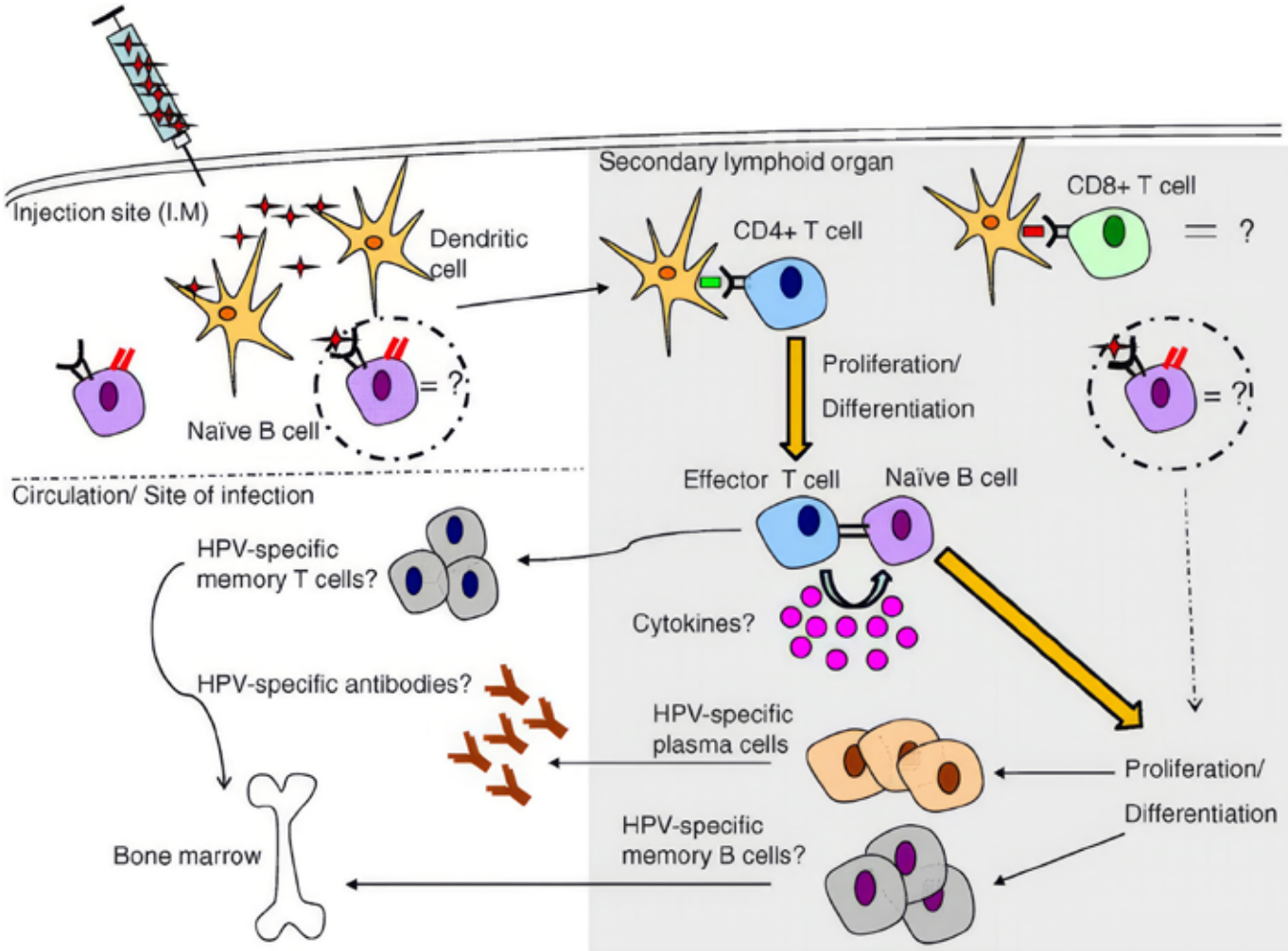
Girls aged 9–14 years are immunologically naïve to HPV but primed for vaccination, making them the optimal target group. Their antibody responses are 2–3 times stronger compared to older adolescents and adults. Due to this robust immune response, a two-dose schedule (at 0 and 6–12 months) is sufficient.

f. Immune Mechanism Highlights

The vaccine elicits strong humoral immunity, generating primarily type-specific neutralizing antibodies. It also activates CD4+ T-helper cells, which support B-cell responses. Protective antibodies are present both in the bloodstream and cervical mucosa.

Factors that influence immune response to HPV vaccination

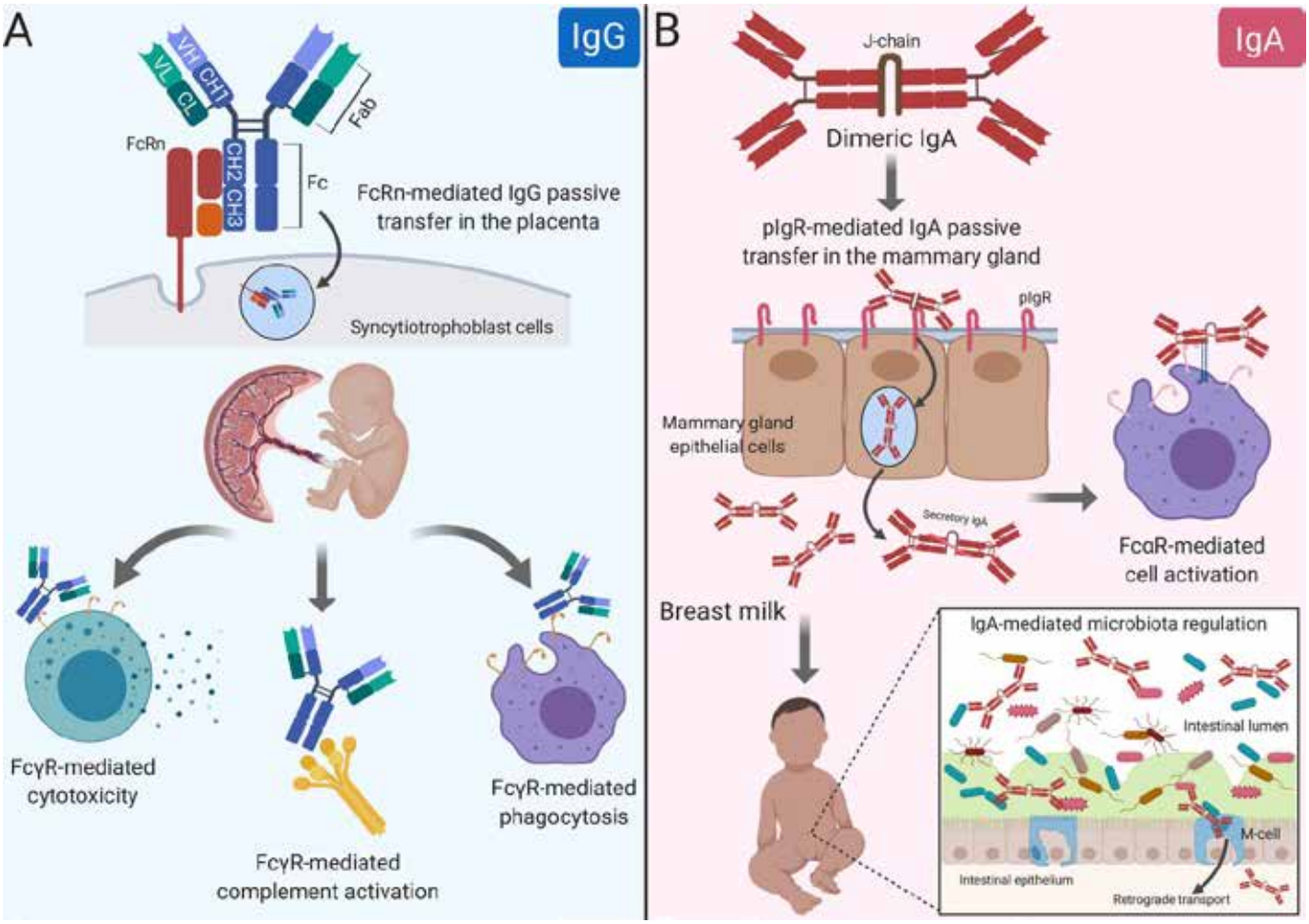
Fig-1: Adaptive immune response induced by HPV vaccination



SOURCE: Reduced dose human papillomavirus vaccination: An update of the current state-of-the-art: Z.Q. Toh et al. / Vaccine 33 (2015) 5042–5050 5047- http://dx.doi.org/10.1016/j.vaccine.2015.07.1020264-410X /© 2015 Elsevier Ltd.

Maternal gatekeepers: How maternal antibody Fc characteristics influence passive transfer and infant protection –

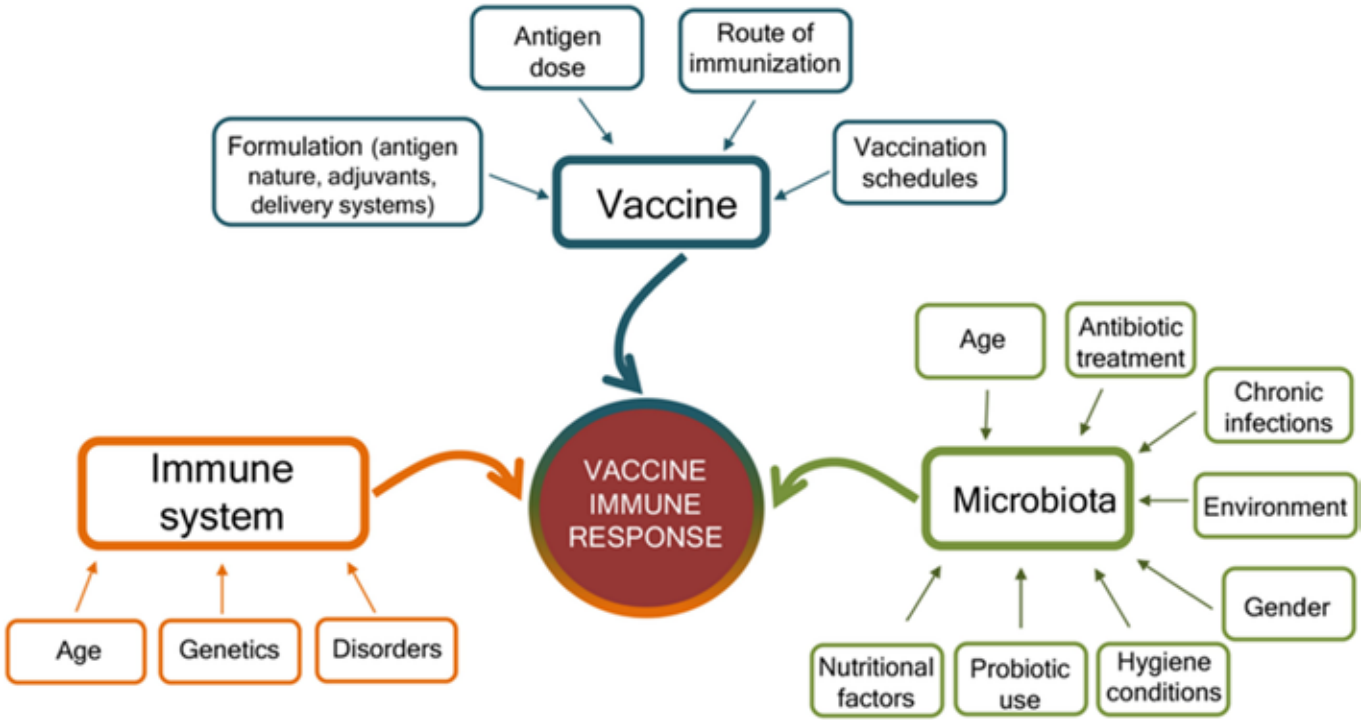
Fig-2: Maternal antibody passive transfer and functional activity in the neonate.



SOURCE: Maternal gatekeepers: How maternal antibody Fc characteristics influence passive transfer and infant protection- Langel SN, Otero CE, Martinez DR, Permar SR (2020). PLoS Pathog 16(3): e1008303. https://doi.org/10.1371/journal.ppat.1008303

Factors that influence immune response to vaccination

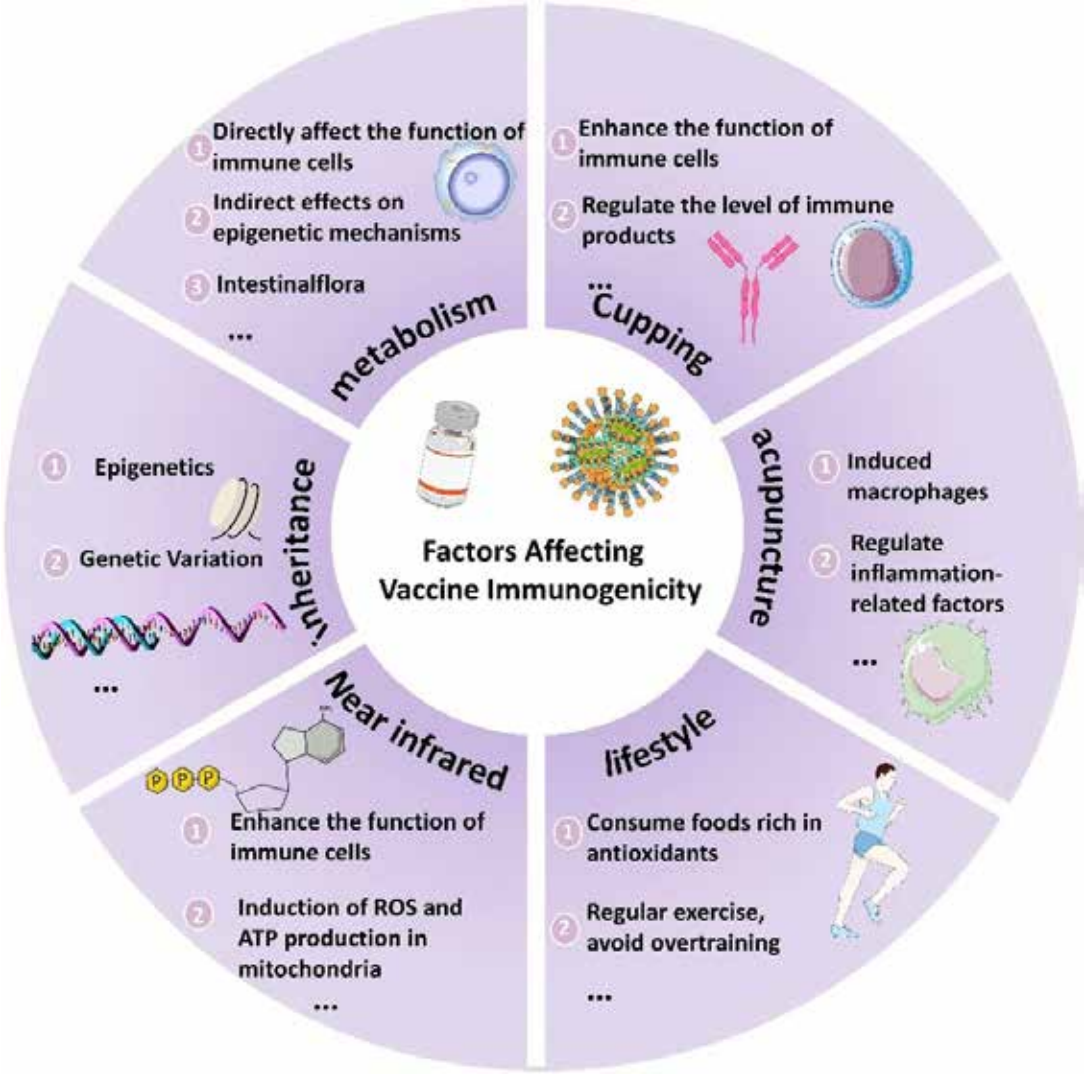
Fig-3: Immune responses to vaccination are affected by factors related to the vaccine, the host immune system, and the microbiota.



SOURCE: Role of the Microbiota in the Modulation of Vaccine Immune Responses / Ciabattini A, Olivieri R, Lazzeri E and Medaglini D (2019) Role of the Microbiota in the Modulation of Vaccine Immune Responses. Front. Microbiol. 10: 1305.doi: 10.3389/fmicb.2019.01305

Factors Affecting Immunogenicity of Vaccines

Fig – 4: Multidimensional influences on vaccine immunogenicity



SOURCE: REVIEW article - Personalized immunization to optimize vaccine immunogenicity: exploring the multidimensional effects of host intrinsic factors, external intervention strategies, and the external environment / © 2025 Chen, Gu, Li, Xu, Wang, Zhang and Li. / Front. Immunol., 27 August 2025.Sec. Vaccines and Molecular Therapeutics; Volume 16 - 2025 | https://doi.org/10.3389/fimmu.2025.1655819

g. Catch-Up Vaccination (Ages 15-45) *:

*Different countries have different age group approvals from their respective drug controllers. Local PI to be referred before use)

Immunological and Programmatic Considerations-

The immune response in this group is lower compared to HPV-naïve girls, particularly if there has been prior HPV exposure. A three-dose schedule (at 0, 1–2, and 6 months) is recommended to optimize protection. While the vaccine offers partial protection against new HPV infections, it does not treat existing infections or lesions.

Maternal HPV Immunization During Pregnancy: Feasibility and Challenges

a. Current Status

- HPV vaccination is not recommended during pregnancy. Although the vaccine, is non-live, it is typically deferred until the postpartum period due to:
  - Insufficient safety and immunogenicity data in pregnant women
  - Ethical and legal challenges associated with conducting vaccine trials during pregnancy

b. Potential Rationale for Maternal Immunization

- Protecting older women from HPV-related diseases
- Exploring transplacental transfer of IgG antibodies to provide passive immunity to the fetus
- Potential to reduce perinatal HPV transmission, which is linked to juvenile-onset respiratory papillomatosis

c. Immunologic Considerations

- Some maternal-fetal IgG transfer is expected, similar to vaccines for tetanus and influenza
- However, HPV-specific mucosal immunity may be inadequate to fully prevent vertical or perinatal transmission
- There is currently no definitive evidence of placental transfer of protective HPV-specific antibodies

Current and Emerging Research

a. Observational Safety Studies

The ongoing PREG-HPV observational studies monitor cases of unintentional HPV vaccine exposure during pregnancy. Preliminary findings indicate no increase in adverse pregnancy outcomes such as miscarriage or stillbirth. However, current evidence remains insufficient to recommend maternal HPV immunization programs.

b. Neonatal Outcomes

Some research is exploring whether maternal antibodies provide protection to newborns, particularly those exposed to HIV but uninfected. Most of these investigations are in early stages or rely on animal models.

c. Barriers to Conducting Maternal HPV Vaccine Trials - Scientific and Ethical Challenges

- Ethical issues arise from enrolling pregnant women in randomized vaccine trials.
- The benefit-risk balance for protecting the fetus or infant is not clearly established.
- The effect on vertical transmission is uncertain, especially considering differences between mucosal and systemic immunity.

d. Programmatic Challenges in Low- and Middle-Income Countries (LMICs)

- Existing maternal vaccination priorities (e.g., tetanus, pertussis) compete for resources.
- Limited cold-chain infrastructure restricts the addition of new vaccines.
- Cancer prevention vaccines are not yet integrated into antenatal care services.
- Cultural factors and consent processes complicate maternal vaccine research.

e. Conclusion

Although the immunological characteristics of HPV vaccines demonstrate strong efficacy in HPV-naïve girls (ages 9–14) and effectiveness in catch-up groups, maternal HPV vaccination is still in the experimental stage. Additional research is required to evaluate antibody transfer to the fetus, the potential to reduce vertical transmission, and safety during pregnancy before establishing formal maternal immunization programs.

Consideration of Herd Immunity and the Role of Male Immunization in HPV Catch-Up Programs

Herd immunity, or indirect protection, occurs when a large enough portion of a population becomes immune to an infectious agent—through vaccination or natural infection—thereby lowering the chance of transmission, including to those who are not immunized. In the case of HPV, herd immunity is especially important due to the virus's high transmissibility and often asymptomatic nature. High vaccination rates among adolescent girls have been shown to provide indirect protection to males and unvaccinated females by decreasing the overall circulation of oncogenic HPV types within the community.

Incorporating herd immunity into HPV vaccination strategies has led to substantial public health gains. Countries with high female vaccination coverage have reported declines in HPV prevalence and related conditions (such as genital warts and cervical intraepithelial neoplasia) not only among vaccinated individuals but also among unvaccinated groups. For instance, a meta-analysis by Drolet et al. (2015)[49] found that population-level benefits, including herd protection, became apparent within a few years of starting female-only HPV vaccination programs, particularly when coverage surpassed 50–60%.

Nonetheless, vaccinating males is essential in catch-up programs and in populations where vaccination coverage is low or where gender disparities limit healthcare access. Immunizing boys and men directly lower their risk of acquiring and spreading HPV, thereby strengthening herd immunity. It also helps reduce the burden of HPV-related diseases in males, such as oropharyngeal, anal, and penile cancers. Male vaccination is especially critical in communities where men who have sex with men (MSM) may not benefit from herd immunity due to limited female-to-male transmission.

In catch-up initiatives targeting older adolescents and young adults who missed early vaccination, including boys helps close immunity gaps, particularly when administered before sexual debut. Research shows that gender-neutral catch-up programs lead to quicker declines in HPV prevalence and related disease incidence. A modeling study by Brisson et al. (2016)[50] demonstrated that gender-neutral vaccination can accelerate the elimination of vaccine-type HPV, even in settings with moderate female vaccination coverage.

a. HPV Vaccination in the Catch-Up Age Group (27–45 Years)*: Required Screening and Emerging Evidence51-55

*Different countries have different age group approvals from their respective drug controllers. Local PI to be referred before use)

As HPV vaccination efforts extend to older age groups, particularly adults aged 27–45 years, it becomes essential to maximize clinical benefits and unlike routine vaccination in adolescents (9–14 years), catch-up vaccination in older adults—who may have already been exposed to HPV—demands careful evaluation through regular scheduled screening.

Routine Scheduled Screening (27–45 Years) Pointers:

1	Cervical Cancer Screening (for women)	**HPV DNA testing** and/or **Pap smear** (cytology) to assess current infection or cervical dysplasia. Individuals with active high-risk HPV infection or precancerous lesions may require **management and treatment** rather than vaccination alone. Co-testing (HPV DNA + cytology) is recommended especially in women aged 30 years and above.
2	History of HPV-Related Diseases	Clinical history of **genital warts**, **abnormal Pap results**, or **previous HPV-related cancers** should be documented, although these do not preclude vaccination
3	Sexual and Immunization History	Determine prior exposure risk, number of sexual partners, and previous HPV vaccination status

Vaccination is not a substitute for cervical cancer screening in this age group but can offer extra protection against new HPV infections, particularly for individuals with new or multiple sexual partners.

Findings from Research and Emerging Evidence:

Recent research, including randomized controlled trials, has demonstrated that HPV vaccination in women aged 27–45 is safe, generates a strong immune response, and is moderately effective in preventing persistent HPV infections and related diseases. Although the vaccine's efficacy is lower compared to younger, HPV-naive populations, significant protection can still be achieved, especially in those who have not been exposed to all HPV types covered by the vaccine.

- The **VIVIANE study,** which included women aged 26–45, showed an 88.7% vaccine efficacy against persistent HPV 16/18 infection in HPV-naive women, along with a 34.5% reduction in overall persistent infections across the entire vaccinated group.
- The **FUTURE III trial** reported that the quadrivalent vaccine lowered rates of persistent infection and genital warts in women aged 24–45, particularly among those without prior HPV exposure.
- In 2018, **the FDA approved the nonavalent HPV vaccine (Gardasil 9)** for use in individuals **up to age 45,** based on cumulative trial **evidence supporting its ongoing effectiveness in disease prevention**.

Catch-up vaccination may be offered on a shared clinical decision-making basis, particularly for individuals at ongoing risk of HPV exposure, such as those with new sexual partners or immunocompromised status.

b. Catch-Up HPV Vaccination: Types, Dosing, Special Considerations for Immunocompromised Populations, and Ongoing Research

1. Currently, three HPV vaccines are licensed and used worldwide:

- Bivalent vaccine (Cervarix) – protects against HPV types 16 and 18
- Quadrivalent vaccine (Gardasil) – protects against HPV types 6, 11, 16, and 18
- Nonavalent vaccine (Gardasil 9) – protects against HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58

Gardasil 9 is now the most widely recommended vaccine due to its broad protection and is the vaccine of choice in catch-up programs across many countries.

2. Recommended Doses for Catch-Up HPV Vaccination

- For individuals aged 15–45 years (catch-up group):
  - A 3-dose schedule is recommended, administered at 0, 1–2 months, and 6 months.
  - This applies to all women, who have not been previously vaccinated or who have an incomplete vaccination series.
- For individuals aged 9–14 years (including catch-up within this age range):
  - A 2-dose schedule is recommended, given at 0 and 6–12 months, with a minimum interval of 5 months between doses.

3. Vaccination in Immunocompromised Individuals

Individuals with immunocompromising conditions—such as HIV infection, cancer survivors, or those receiving immunosuppressive therapy—tend to have weaker immune responses to vaccination and face a higher risk of persistent HPV infection and HPV-related cancers. Therefore:

- A 3-dose vaccination schedule (at 0, 1–2, and 6 months) is strongly recommended for these individuals, regardless of age or sex.
- Ideally, vaccination should occur before sexual debut, but catch-up vaccination remains beneficial even after potential HPV exposure.

Key Points to Consider:

- Although immunocompromised individuals may not achieve full immunity, partial protection is preferable to none.
- HPV vaccination does not treat existing HPV-related conditions but helps prevent new infections from the HPV types covered by the vaccine.

CONSIDERATIONS IN POPULATION WITH HIGH RISK OF HIV INFECTIONS

HIV acquisition during pregnancy represents a considerable risk, particularly in high-prevalence areas such as sub-Saharan Africa. According to a meta-analysis by Drake et al. (2014), the incidence rate is 4.7 per 100 person-years, while Moodley et al. (2009) reported an incidence of 3.8 per 100 woman-years in South Africa. This indicates that acute maternal HIV infection elevates the risk of mother-to-child transmission due to increased viral loads during seroconversion.

Some mothers may acquire HIV during pregnancy despite initially testing negative, a process called seroconversion. This is critical because acute HIV infection involves high viral loads, greatly increasing the risk of mother-to-child transmission. Studies, especially in high-prevalence areas like sub-Saharan Africa, show that new maternal HIV infections during pregnancy disproportionately contribute to infant transmission due to delayed diagnosis and treatment. Biological and behavioral factors heighten women's vulnerability during this period.

Therefore, special consideration should be for women who have higher risk of acquisition of HIV during pregnancy and to undertake HPV testing prior to vaccination.

4. Research and Evidence on Catch-Up HPV Vaccination

- Recent and ongoing research underscores the benefits and safety of extending HPV vaccination into adulthood and among high-risk populations:
- The VIVIANE Study confirmed the safety and efficacy of the bivalent vaccine in women aged 26–45, showing a significant reduction in persistent HPV infection, particularly in those who were HPV-naive at the start (Castellsagué et al., Lancet, 2014)[56].
- The FUTURE III trial demonstrated that the quadrivalent vaccine provides protection against persistent HPV infection and related diseases in women aged 24–45 (Munoz et al.2009) [57].
- A large observational study in the U.S. found that extending HPV vaccination up to age 45 can decrease the incidence of HPV-related diseases, especially in individuals with new sexual partners or those who are immunocompromised (Meites et al., MMWR, 2019) [58].
- Ongoing research is investigating HPV vaccine immunogenicity and durability in people living with HIV, with trials such as the IMPACT study and the HIV Vaccine Trials Network (HVTN) assessing vaccine effectiveness in HIV-positive populations.
- Modeling studies (Brisson et al., Lancet, 2020) [59] highlight that gender-neutral vaccination and extending vaccination to older age groups, combined with screening programs, are essential strategies for eliminating cervical cancer as a public health issue by 2100.

c. Integration of Catch-Up HPV Vaccination with Family Planning (FP) in the Postpartum Period: A Strategic Approach for Vulnerable Women Populations[60–62]

I. Introduction and Rationale:

The postpartum period offers a crucial opportunity for catch-up HPV vaccination, particularly for women who missed vaccination during adolescence. In many resource-limited settings, this timeframe is often the only occasion when women access healthcare services, such as postnatal check-ups, immunization visits, and family planning (FP) counseling. By integrating HPV vaccination into postpartum and FP services, healthcare providers can effectively reach vulnerable and high-risk groups, including:

- Women living with HIV or who are immunocompromised
- Sex workers
- Women with multiple sexual partners
- Discordant couples (HIV-positive/negative)
- Marginalized, low-income, or displaced women

II. Programmatic Integration with FP Services

1. Postpartum and Family Planning Service Points

Catch-up HPV vaccination can be provided at:

- Postnatal care (PNC) clinics

- FP counseling and contraceptive initiation
- Infant immunization clinics (e.g., 6-week or 10-week visits)
- HIV/ART (Antiretroviral Therapy) and STI (Sexually Transmitted Infections) clinics

2. Benefits of Integration

- Reduces missed opportunities for vaccination.
- Promotes continuity of care across reproductive health services.
- Allows for risk-based targeting (e.g., women with high HPV exposure risk).
- Improves coverage among vulnerable groups who often do not access routine adolescent immunization.

III. Medical Eligibility and Breastfeeding Considerations

1. WHO Medical Eligibility Criteria (MEC) for HPV Vaccination

- HPV vaccines are safe during breastfeeding.
- Postpartum women, including those up to 45 years, are eligible for HPV vaccination if previously unvaccinated or partially vaccinated.
- No pregnancy test is required before vaccination; however, vaccination during known pregnancy is not recommended, but not contraindicated—defer until postpartum if needed.

2. Breastfeeding

- HPV vaccines do not affect milk production or composition.
- They are non-live vaccines, making them safe during lactation.
- Women can continue exclusive breastfeeding while receiving all three doses.
- Contraception in the postpartum period should be methods that do not influence negatively breast-feeding practice

IV. Tailored Strategies for Vulnerable Populations

1. Women Living with HIV/Immunocompromised

- 3-dose schedule (0, 1–2, and 6 months) is mandatory.
- Should be integrated with ART adherence counseling, cervical cancer screening (e.g., VIA/HPV DNA testing), and STI treatment.

2. Female Sex Workers (FSWs)

- High prevalence of HPV infection and low access to adolescent vaccination.
- Vaccination should be part of integrated SRHR and HIV prevention packages, including condom distribution, PrEP, and regular Pap/HPV testing.

3. Women with Multiple Partners

- Considered high-risk and eligible for catch-up HPV vaccination.
- FP settings are ideal for counseling and linking to vaccination.

4. Discordant Couples

- Provide vaccination to HIV-negative female partners to reduce HPV transmission risk and prevent cervical dysplasia.
- HPV vaccination complements HIV prevention strategies (e.g., PrEP, ART adherence, condoms).

V. Implementation Considerations

- Training of FP and MNH providers to assess eligibility and administer HPV vaccines.
- Use mHealth tools and FP registers to track doses and improve adherence.
- Community engagement to overcome vaccine hesitancy and stigma, especially among sex workers and HIV-positive women.
- Include HPV vaccination in postpartum contraception counseling, with emphasis on dual protection (contraceptives + STI/HIV prevention + HPV vaccine).

VI. Monitoring and Evaluation

- Record HPV vaccination as part of maternal postnatal care registers.
- Integrate into District Health Information Software (DHIS2) or other digital tools.
- Monitor coverage among key groups (e.g., HIV-positive women, FSWs).

MATERNAL ACCEPTANCE
- Perception of risk / severity of infection
- Access to vaccine provider
- Cost / health insurance

HEALTHCARE WORKER ACCEPTANCE
- Knowledge of recommendations
- Vaccine access and storage
- Reimbursement

MATERNAL IMMUNE RESPONSE TO VACCINATION

TRANSPLACENTAL TRANSFER OF VACCINE-SPECIFIC ANTIBODIES AND THEIR FUNCTION

INTERFERENCE WITH SUBSEQUENT INFANT IMMUNE RESPONSE TO VACCINATION

MATERNAL CLINICAL CONDITIONS
- Malaria, HIV infection, gestational hypertension, smoking

VACCINE SAFETY / ADVERSE EVENTS

TIMING OF IMMUNIZATION
- To achieve optimal immunity in mother and /or infant

GEOGRAPHICAL LOCATION
- Different circulating pathogen strains
- Different responses to vaccination
- Different local recommendations

SEASONALITY OF PATHOGENS TARGETED BY IMMUNIZATION
- Influenza, RSV

INDUCTION OF VACCINE-SPECIFIC ANTIBODIES IN BREAST MILK

SOURCE: Abu-Raya B, Maertens K, et:al (2020) Global Perspectives on Immunization During Pregnancy and Priorities for Future Research and Development: An International Consensus Statement. Front. Immunol. 11: 1282.doi: 10.3389/fimmu.2020.01282

VII. Research and Evidence

- A study in South Africa (Bekker et al., 2022)63 showed feasibility and high acceptance of postpartum HPV vaccination in HIV clinics.
- Research in Thailand and Kenya confirmed positive attitudes toward integrating HPV vaccines in postpartum and FP settings among sex workers and HIV-positive women.
- WHO's Global Strategy to Eliminate Cervical Cancer (2020)64 recommends integration of HPV vaccination with postpartum and SRHR services, especially in high-burden, low-access settings.

d. Research Priorities for Catch-Up HPV Vaccination in Low- and Middle-Income Countries (LMICs): Evidence Gaps and Strategic Areas of Focus[65-70]

Although HPV vaccination is a crucial component in the worldwide initiative to eradicate cervical cancer, there are still significant evidence gaps regarding the effective implementation of catch-up HPV vaccination programs in low- and middle-income countries (LMICs). These gaps pose challenges to policy formulation, health system integration, and equitable access for vulnerable groups. The following are priority research areas designed to address these gaps and support the WHO's strategy for cervical cancer elimination.

1. Effectiveness and Immunogenicity in Older Age Groups (15–45 years) in LMIC Context

Research Questions	**Evidence Gap**
• What is the real-world effectiveness of HPV vaccination in catch-up populations (especially 20–45 years) in LMIC settings? • How durable is the immune response in HPV-exposed individuals in these settings?	Most immunogenicity data are derived from high-income countries. Limited data exist on vaccine efficacy among **women with high HPV exposure**, HIV infection, or poor nutritional status common in LMICs.

2. Integration with Postpartum and Family Planning Services

Research Questions	Evidence Gap
• What models best support integration of HPV vaccination into postnatal, FP, and immunization programs in LMICs? • What is the uptake and adherence when HPV vaccines are co-delivered with contraceptives or child immunization?	Operational and effectiveness data on **co-delivery models** are scarce in LMICs, especially among women of reproductive age

3. Cost-Effectiveness of Catch-Up Programs Beyond Adolescents

Research Questions	Evidence Gap
• What are the incremental cost-effectiveness ratios (ICERs) for vaccinating women aged 20–45 years in LMICs? • How does catch-up vaccination compare to investments in screening or adolescent vaccine scale-up?	Cost-effectiveness analyses are under-represented for **gender-neutral and extended-age vaccination** in LMICs, where financial resources are limited.

4. HPV Vaccine Acceptance, Demand Creation, and Hesitancy in Adult Women

Research Questions	Evidence Gap
• What socio-cultural, religious, and gender-based factors influence HPV vaccine acceptability in women aged 18–45 in LMICs? • How can vaccine literacy and demand be effectively built among postpartum and FP clients?	Most community engagement studies focus on **adolescents and caregivers**, not adult women or those in marginalized groups (e.g., sex workers, refugees, HIV-positive women).

5. Delivery and Completion Strategies in Mobile and Vulnerable Populations

Research Questions	Evidence Gap
• How effective are community-based or outreach strategies for vaccinating hard-to-reach adult women (e.g., in informal settlements, rural areas)? • What mechanisms improve dose **completion** in transient or marginalized populations?	Lack of longitudinal studies on **completion rates and follow-up** for multi-dose HPV vaccination in high-risk women outside the school-based model.

6. Immunization of High-Risk Populations (e.g., WLHIV, FSWs, Discordant Couples)

Research Questions	Evidence Gap
• What are the immunogenicity and long-term outcomes of HPV vaccination in women living with HIV (WLHIV) or female sex workers in LMICs? • Can catch-up vaccination reduce high HPV-related disease burden in **discordant couples**?	Few large-scale studies evaluate **HPV vaccine performance in immunocompromised or key populations** under routine LMIC conditions.

7. Gender-Neutral Catch-Up Programs in LMICs

Research Questions	Evidence Gap
• What is the feasibility and impact of including **boys and young men** in catch-up programs in LMICs? • How does male inclusion influence **herd immunity**, uptake by females, and HPV transmission dynamics?	Sparse data from LMICs on **gender-neutral vaccination models**, especially beyond adolescence.

8. Surveillance, Monitoring, and Data Systems for Adult HPV Vaccination

Research Questions	Evidence Gap
• How can existing health information systems (e.g., DHIS2) track adult HPV vaccination across sectors (MCH, FP, HIV)? • What indicators best measure the success of **catch-up campaigns** in adult women?	Weak infrastructure for **vaccine coverage tracking, adverse events monitoring**, and follow-up in older age groups.

9. Implementation Science for Multi-Sectoral Collaboration

Research Questions	Evidence Gap
• What policy and health system enablers or barriers exist for scaling catch-up HPV vaccination? • How can **HIV, reproductive health, and immunization sectors** be coordinated in LMIC settings?	Limited implementation science and **inter-sectoral program models** for HPV vaccine integration in national health programs.

GENDER NEUTRAL VACCINATION – TARGETING VACCINATION OF MALE POPULATION

Integration of Male Immunization into the HPV Vaccination Program: Public Health Rationale and Outcomes

Vaccinating males of eligible age cohort provides direct protection against HPV-related conditions such as genital warts and cancers of the anus, penis, and oropharynx. Additionally, it boosts herd immunity, indirectly safeguarding unvaccinated individuals, including girls. Including males of the eligible age groups in vaccination efforts enhances the equity and reach of HPV prevention, particularly in communities where social norms restrict girls' access to healthcare or where gender disparities are prevalent.

Expanding HPV vaccination programs to include males of eligible age group creates a more inclusive and effective approach to achieving widespread population immunity, lowering HPV transmission, and preventing HPV-associated diseases in both males and females. While the World Health Organization (WHO) currently prioritizes vaccinating girls aged 9–14 as the most cost-effective strategy to prevent cervical cancer, it also recommends gender-neutral vaccination when resources allow or when coverage among girls is insufficient[46].

Evidence from countries implementing gender-neutral HPV vaccination policies support this integrated approach. For example, Australia, which incorporated boys into its national HPV vaccination program in 2013, has seen significant declines in HPV prevalence and genital warts among both males and females. A study by Ali et al. (2013) reported a 90% reduction in genital warts among vaccinated males, along with notable decreases in heterosexual unvaccinated males due to herd immunity[47]. Likewise, a Swedish registry study by Lei et al. (2020) found that gender-neutral vaccination significantly lowered the incidence of invasive cervical cancer in females, highlighting the long-term advantages of including boys in early adolescent vaccination programs[48].

Including males of eligible age cohorts also helps mitigate the impact of variable vaccine uptake among females, offers protection to men who have sex with men (MSM), and speeds up efforts to eliminate vaccine-type HPV infections and related diseases.

Including male HPV vaccination of the eligible age group, helps stabilize overall vaccine coverage despite variations in girls' uptake, offers direct protection to men who have sex with men (MSM), and speeds up the elimination of vaccine-type HPV infections and associated diseases.

KEY FINDINGS FROM THE LITERATURE REVIEW

- HPV is the most common sexually transmitted infection, that can lead to the development of anogenital warts, precancers, cervical cancer, and other anogenital cancers in women.
- Postpartum women can be susceptible to HPV infection. Multiple studies show persistence of HPV infection in pregnant women - Latent HPV infection is prone to reactivation, leading to disease recurrence
- 40% prevalence of genital HPV infection is seen during pregnancy – The high prevalence in pregnancy can be attributed to changed hormonal milieu and decreased immunity
- A High Number of PREGNANT AND POSTPARTUM Women Are at Risk for HPV Infection due to Innate & adaptive immune response in pregnancy and at Post partum phases. The intricate interplay between innate and adaptive immune responses orchestrates the clearance of HPV infection, albeit to a limited extent, as HPV adroitly employs evasion tactics against immune defenses.
- Most women see a gynecologist during their pregnancy, providing an excellent touch point for counseling on cervical cancer prevention
- Postpartum period is a critical opportunity to offer HPV vaccines
- Strengthening health education tailored to cultural and literacy needs, involving family support, and addressing vaccine hesitancy are essential to improve HPV vaccine uptake during this period.
- Findings reveal that pregnancy is a time when women think about themselves and their own needs, rather than exclusively focusing on those of their unborn child (Hodgkinson et al., Citation2014; Stockton & Nield, Citation2020).
- Studies show that health education significantly increases awareness and acceptance of HPV vaccination among postpartum women, with high completion rates of the vaccine series and strong patient satisfaction.
- Incorporating catch-up HPV vaccination into postpartum discharge protocols is mandatory, as we gynecologists commit to creating a world free of HPV-related diseases and cancers.

IAHR INFERENCES FROM KEY FINDINGS

- The International Association of Human Reproduction (IAHR) emphasizes the critical importance of HPV vaccination as a key strategy to prevent HPV-related diseases and cancers.
- Given the substantial global burden of HPV-associated cancers, particularly cervical cancer, IAHR supports vaccination programs targeting vulnerable multi-cohort eligible population, aligned to WHO revised policy recommendation.
- The postpartum period is identified as a unique and valuable opportunity for catch-up HPV vaccination, as physiological and hormonal changes during pregnancy and delivery may increase susceptibility to the infection, and women are more likely to engage with healthcare providers during this time, with increased frequency.
- Marked by profound physical, hormonal, emotional, and social changes, that is associated with psychological changes, pregnancy is a unique confluence of factors that contributes to women being more receptive to counseling during this time. This period is therefore often referred to as a "teachable moment" in health behavior change (Phelan, Citation2010). McBride et al. (Citation2003).
- Unlike other "teachable moments" in acute healthcare settings, pregnancy typically provides a window of opportunity spanning up to 40 weeks, involving multiple contacts between women and healthcare professionals (National Institute for Health and Care Excellence, Citation2008).
- Much improved HPV vaccine completion rates were observed when counselling, strict monitoring and follow-up of postpartum HPV vaccinations in women were ensured according to a postpartum HPV vaccination program.
- Evidence demonstrates that postpartum vaccination is safe, well-tolerated, and associated with high patient satisfaction
- Endorsements from leading medical societies, including ACOG, EBCOG, WHO, and FOGSI, reinforce the safety and efficacy of global HPV Vaccine in lactating women.

IAHR CONSENSUS RECOMMENDATIONS

- IAHR recommends incorporating HPV vaccination from DAY-I of Antenatal Checkup into pregnancy care protocols globally, supported by tailored health education addressing cultural and literacy barriers, involvement of family members, and counseling over these 40 weeks of window pregnancy offers, so as to overcome vaccine hesitancy during antenatal care itself so as to help being receptive to HPV Vaccination, at Post Partum phase.
- IAHR calls for the adoption of hospital-based vaccination programs, integrated maternal-child health services, community outreach, and electronic health record reminders to enhance vaccine coverage.
- IAHR recommends "Integrating Mandatory Catch-up HPV Vaccination into Global Postpartum Discharge Protocols" as a vital step toward eliminating HPV-related diseases and cancers and improving women's reproductive health worldwide.
- IAHR urges gynecologists and healthcare providers to prioritize HPV vaccination during the postpartum period and offer the **FIRST DOSE AT POST DELIVERY DISCHARGE as a part of the mandatory discharge protocol, with subsequent doses in accordance with the post-partum follow up schedule**.
- Integration of Male Immunization into the HPV Vaccination Program boosts herd immunity, indirectly safeguarding unvaccinated individuals, including women and enhances reach of HPV prevention, particularly in communities where social norms restrict girls' access to healthcare or where gender disparities are prevalent. This also speeds up the elimination of vaccine-type HPV infections and associated diseases.
- Emerging evidence on HPV TYPE attribution to various Cancer & lesion types and also their distribution varying across Geographic Regions - choosing the Broad-Spectrum Nonavalent alternative of HPV Vaccine for Comprehensive Coverage for long term safety, is globally recommended by IAHR.

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Notes

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