HPV VACCINATION IN NIGERIA: LESSONS AND RECOMMENDATIONS FROM THE SUCCESSES OF HPV VACCINATION IN THE UNITED STATES

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ABSTRACT

Human Papilloma Virus (HPV) is one of the most common sexually transmitted infections (STIs) and has been implicated in many cancers, including cervical cancer. Cervical cancer is primarily caused by persistent infection of various high-risk HPV types, and HPV vaccination is a vital and cost-effective tool in preventing HPV infections, thereby reducing the burden of cervical cancer. The HPV vaccine was first introduced in the United States in 2006, and since the introduction of HPV vaccines in the US, there has been a significant impact on HPV infections and related conditions. In October of 2023, Nigeria rolled out a national HPV vaccination campaign. Before the Nigerian government's HPV vaccination rollout, the knowledge, uptake, and awareness of HPV vaccines were poor. Although the routine HPV vaccination program has increased awareness, this does not automatically translate to increased uptake. In this paper, we explore the history of HPV vaccination in the United States (U.S.), its effects on cervical cancer incidence and mortality, and barriers to the uptake of the vaccine in the U.S. We also identify barriers to HPV vaccine uptake in Nigeria and make recommendations based on the success of the U.S. campaign to maximize the effectiveness of the current vaccine campaign.

INTRODUCTION

man Papilloma Virus (HPV), one of the most common sexually transmitted infections (STIs) transmitted via oral, anal, or vaginal sex, can lead to various cancers, with cervical cancer being the most common.[1] HPV infections are so common that nearly all men and women will get at least one type of HPV at some point in their lives.[2] Cervical cancer is primarily caused by persistent infection of various high-risk HPV types, such as HPV-16 and HPV-18.[3] Cervical cancer is a significant public health issue, particularly in low-resource settings like Nigeria, where screening and vaccination rates are low.[4] Cervical cancer is one of the leading gynaecological cancers affecting women worldwide, with 80% of global cases occurring in low- and middle-income countries.[5] Nigeria ranks as the 5th highest nation in cervical cancer mortality, behind India, China, Brazil, and Bangladesh,[6] and

cervical cancer is the second most common cancer among women in Nigeria.[4] Nigeria reported 12,075 new cases of cervical cancer and 7,968 related deaths in 2020.[7]

Cervical cancer prevention programs in Nigeria have traditionally centred on screening,[8] which has proved ineffective, with an estimated 80% of cases diagnosed at stage III.[9] Common methods of cervical cancer screening in Nigeria include Visual Inspection with Acetic Acid (VIA), HPV DNA testing, and Papanicolaou smear testing.[10,11] Cervical screening rates are low in Nigeria, contributing to the high mortality rates, with studies reporting cervical cancer screening rates < 6%.[12,13] This low screening rate is attributed to several factors, including opportunistic screening, socio-cultural barriers, economic challenges, and poor health-seeking behaviors.[12,14,15]

In October 2023, the HPV vaccine was incorporated into the routine immunisation schedule to aid national efforts against cervical cancer.[16] This inclusion aims to increase herd immunity over time, enhancing the region's overall cervical cancer prevention strategy. HPV vaccines are designed to be prophylactic, meaning they prevent infection and subsequent disease rather than treating existing conditions.[17] Consequently, they are targeted at females aged between 9 and 26. In Nigeria's routine immunisation schedule, the current HPV vaccination initiative focuses on girls aged 9 to 14, an age range that is crucial for maximising the vaccine's effectiveness, as it is administered before potential exposure to HPV.[16]

Despite the current burden of cervical cancer, various studies indicate that many women in Nigeria have limited awareness about cervical cancer and its prevention options.[6,17,18,19] Government support for cervical cancer prevention programs in Nigeria is also limited,[6] leading to a heavy reliance on donor and non-governmental organisations to fill the gaps.

Before the Nigerian government's HPV vaccination rollout in October 2023, the uptake and awareness of HPV vaccines were poor, and knowledge of the vaccine was limited primarily to women of middle or higher socioeconomic status.[19] Before this rollout, HPV vaccination services were primarily available in private facilities at an average cost of ₦15,000 to ₦20,000 (approximately $20 to $25) per dose.[20] With multiple doses recommended, the total cost often exceeds the financial capacity of low-income households. Although the routine HPV vaccination program has increased awareness and availability, this does not automatically translate to increased uptake. In low and middle-income countries like Nigeria, uptake remains low due to vaccine hesitancy and limited coverage.[21]

This paper explores the successful implementation of routine HPV vaccination in the United States of America (U.S.) and its impact on the incidence of cervical cancer. This success can serve as a model for enhancing vaccination efforts in Nigeria. This paper aims to apply lessons learned from the U.S. to improve the effectiveness and acceptance of the HPV vaccine in Nigeria. Additionally, it offers actionable recommendations to optimise the vaccination campaign, considering Nigeria's unique cultural, social, and healthcare challenges.

MATERIALS AND METHODS

A systematic search was conducted across PubMed, Google Scholar, and Medline to identify studies related to HPV vaccination and cervical cancer in Nigeria and the U.S. The search employed a combination of the key words "cervical cancer", "HPV vaccine", "vaccine uptake", "barriers", "Nigeria", "United States" and "vaccine uptake" in both countries. The search included peer-reviewed studies, surveillance reports and public health reviews published between 2000 and 2024. Inclusion criteria were studies, reports or reviews that focused on HPV vaccination programs, cervical cancer incidence, discussed barriers to vaccine uptake, implementation strategies and public health outcomes associated with HPV vaccination. Exclusion criteria were studies not geographically relevant, and publications unrelated to HPV, cervical cancer or vaccination efforts. Following screening to ensure relevance, a total of 84 studies and reports were selected and synthesised to inform this narrative review.

HPV Vaccination and Cervical Cancer in the United States

The HPV vaccine was first introduced in the U.S. for girls in 2006, and boys in 2009.[22,23] The Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunisation Practices (ACIP) recommends routine vaccination for individuals aged 9 to 26. Catch-up HPV vaccinations for adults aged 27 to 45 through shared clinical decision-making are also recommended.[24] The vaccine was initially recommended for females aged 11-12, with catch-up vaccination for females aged 13-26.[25] Historically, three HPV vaccines (Gardasil 4vHPV, Cervarix 2vHPV, and Gardasil 9vHPV) that offer protection from HPV 16 and 18 have been licensed by the U.S. Food and Drug Administration (FDA).[26] Gardasil 9 is the only vaccine distributed in the U.S. since 2016.[24] It protects against nine HPV types that cause most HPV cancers.[27] In 2022, the CDC reported over 60% of adolescents had received at least one dose of the HPV vaccine, and this rate increased from 2020 to 2022[28] although this rate dropped amongst adolescents covered by Medicaid from 2021 to 2022.[29]

Since the introduction of HPV vaccines in the U.S., there has been a significant impact on HPV infections and related conditions.[27,30-34] HPV vaccination has led to declining HPV infections in vaccinated populations.[33] Among teen girls, infections with HPV types that cause most HPV-related cancers and genital warts have dropped by 88 percent, and among young adult women, infections have dropped by 81 percent.[30] The percentage of cervical precancers caused by the HPV types covered by the vaccine has also decreased.[32] These changes are also demonstrated as early as 4 to 6 years after the vaccine introduction, with declines observed in early outcome studies of HPV infections.[33] Between 1999 and 2015, cervical cancer rates decreased by 1.6% per year.[31]

In the U.S., in females aged 15 to 29, data from population-based cancer registries demonstrate a yearly reduction in the incidence of cervical cancer from 1999 to 2017.[2] The HPV Vaccine Impact Monitoring Project (HPV-IMPACT) plays an important role in tracking the occurrence of cervical cancer. [35] This project utilises a population-based, active surveillance system and

examines archived diagnostic specimens from women aged 18 and older with abnormal cervical lesions. From 2008 to 2016, in women aged 20-24 years old with abnormal cervical lesions, there were statistically significant reductions in precancerous lesions caused by vaccine-targeted and non-vaccine-targeted HPV strains, suggesting some cross-protection.[35] Furthermore, compared to 2008-2009, in 2014-2015, there was a 50% reduction in cervical pre-cancer cases among 18–20-year-olds and a 36% reduction among 21–24-year-olds,[35] highlighting the importance of early vaccination to maximise its protective effects. By 2014, the rates of abnormal cervical lesions due to vaccine-targeted HPV strains had dropped by 40%.[35]

From January 2001 to December 2017, the incidence and mortality of cervical cancer in females aged 15 to 39 decreased, with the largest reductions in the age group 15 to 24.[34] From 1973 to 2007, the incidence of invasive cervical cancer decreased by over 50%, albeit largely due to increased screening rates.[36] In 2024, approximately 14,000 new cases of cervical cancer will be diagnosed, with a result of approximately 4,000 deaths in the U.S.[37]

Barriers to HPV Vaccination in the U.S.

Despite this remarkable success, HPV vaccination in the U.S. has not been without its challenges, and some barriers persist to date. The uptake of HPV vaccination in the U.S. among young adolescents remains modest, and actual rates of HPV vaccine uptake vary across racial/ethnic groups,[38] insurance coverage (lower rates for the uninsured),[29] socioeconomic status,[39,40] and geography.[41] Minority groups have been found to have higher HPV vaccine initiation rates but lower follow-through rates than Caucasians.[40] Furthermore, the Healthy People 2020 goal of an HPV vaccine completion rate of 80% among females aged 13- to 15 is behind the target.[41]

Several barriers contribute to the gap between the current and the target coverage. Declining awareness and knowledge about HPV have slowed the uptake of HPV,[41,42] in different demographic groups, including racial minorities,[43] individuals with lower education,[44] and low socioeconomic status.[41] Despite relatively higher education levels among immigrant parents, knowledge about the HPV vaccine remains low.[45] Lower parental knowledge correlates with decreased vaccination uptake, as informed parents are more likely to vaccinate their children.[46] Misconceptions about healthcare providers, HPV infection, vaccine safety and effectiveness, and side effects contribute to HPV vaccine hesitancy.[47] Fatalistic beliefs and cultural views present additional challenges.[48] Cultural and language barriers, particularly among immigrants, also hinder vaccine understanding and acceptance.[46,49]

Limited access to healthcare services, including lack of a medical home, insufficient insurance coverage, and other barriers, also hinders HPV vaccination.[46,49] The cost of vaccination can also be prohibitive for families without adequate insurance coverage or access to subsidised programs.[46,49] Additionally, challenges such as scheduling appointments, transportation to healthcare facilities, and clinic hours are barriers, especially in rural settings.[49] Healthcare providers play crucial roles in HPV vaccination decisions,[50] yet there are disparities in HPV vaccine recommendations

from healthcare providers, contributing to low vaccine uptake.[51] Policy and systemic issues further hinder vaccination uptake. Vaccination programs are managed at the state level in the U.S., leading to policy inconsistency across states.[46,49] This decentralised approach complicates vaccine distribution and education efforts nationwide.

In the U.S., several strategies have been employed successfully to overcome barriers to HPV vaccination. Over a decade ago, Downs Jr. et. al. highlighted several strategies to increase HPV vaccinations in high-risk populations with disparities using a comprehensive approach to address complex barrier factors. This approach includes developing culturally sensitive educational campaigns, improving the availability of vaccination services in underserved communities, ensuring affordability through insurance coverage or subsidised programs, standardised guidelines at national and state levels, community-level interventions that engage local leaders and organisations, and continuously monitoring vaccination rates and evaluating the effectiveness of interventions.[52] Public education campaigns, especially if messaging is delivered by trusted authoritative sources and includes parents, have increased HPV vaccination rates in adolescents and young adults.[53]

Healthcare worker recommendations and clinician-patient communication training also play a vital role in increasing HPV vaccination.[54,55] Parents are more likely to vaccinate their children if a healthcare worker recommends the vaccine. At the healthcare worker level, using language that assumes the parent is ready to vaccinate their children, including the HPV vaccine with other vaccines, and repeated recommendations have increased the uptake of the HPV vaccine.[56] Increasing availability of the vaccine outside of a medical home has also increased the uptake of the HPV Vaccine. Making the vaccine available in settings such as schools has proven to be an effective strategy.[57] State-level policies also play a significant role in the uptake of the HPV vaccine. Vaccination rates in states with a HPV requirement for school entry have higher HPV vaccination rates, with rates as high as 88.9% for receiving at least 1 dose of the vaccine in adolescents aged 13-17 years.[58]

Barriers to HPV Vaccination in Nigeria

The implementation and acceptance of the HPV vaccine in Nigeria are influenced by a complex interplay of socio-political factors. These factors include public awareness, government policies, healthcare infrastructure, cultural beliefs, economic conditions, vaccine confidence, and the role of support from non-governmental organisations. Understanding these factors is crucial for developing effective strategies to increase HPV vaccination rates and reduce the incidence of cervical cancer in Nigeria.[59]

There is a pervasive misunderstanding and limited awareness of HPV, its transmission and connection to cervical cancer, and prevention measures, including the HPV vaccine, in the general population. This limited awareness has been widely documented across multiple studies.[6,60-62] In 2014, a systematic review of the knowledge and uptake of the HPV vaccine in sub-Saharan African countries, including Nigeria, showed misinformation and a lack of awareness were major barriers to HPV vaccine acceptance.[63] A 2022 systematic

review revealed poor knowledge of HPV and cervical cancer across all Nigerian geopolitical zones.[6] This deficit is seen in females from adolescents to mothers,[60,61,64] and is more evident in rural versus urban areas.[6] Similarly, a 2023 study identified cultural beliefs, misconceptions, myths, and social norms as significant factors affecting vaccine uptake in the region.[65] In their study, they showed that myths such as the vaccine causing infertility or being unnecessary for women who are not sexually active contribute to low vaccination rates. Even when there is knowledge and awareness of HPV, and the vaccine is accessible, fear, mistrust, and concerns about the safety of the vaccine can hinder uptake.[62,66] Accessibility, including cost and availability of the vaccine, has also been demonstrated to significantly impact the uptake of the HPV vaccine.[6,62,64,66,67]

The state of healthcare infrastructure significantly impacts the delivery of vaccination programs. In many parts of Nigeria, healthcare facilities are inadequate, and access to healthcare services is limited. Like many other low-and-middle-income countries, Nigeria's healthcare system suffers from a lack of adequate healthcare resources (including personnel, facilities, and equipment).[68] This infrastructural challenge makes it difficult to implement widespread vaccination programs. There is also low and insufficient funding for health and health care by the Nigerian government.[69,70] Immunisations in Nigeria are further impacted by inadequate cold chain equipment to maintain vaccine efficacy during transportation, political problems, and shortage of vaccine and immunisation supplies.[71] Frequent changes in leadership and policies disrupt the consistency and effectiveness of public health initiatives.[71]

Gavi, the Vaccine Alliance, is a global public-private partnership that aims to increase access to vaccines in low- and middle-income countries by negotiating affordable prices and providing financial and technical assistance.[59] Gavi, along with other international partners such as the World Health Organisation and the United Nations Children's Fund, has recently partnered with the Nigerian Government through the National Primary Health Care Development Agency in their campaign to introduce a single dose of the HPV vaccine into the national immunisation program.[16] This historical partnership has the potential to have a significant impact on the fight against cervical cancer in Nigeria. An assessment of the impact of vaccines from health, economic, and social perspectives underscores the importance of considering economic barriers in vaccination programs.[72] Providing the HPV vaccine at no cost or subsidised rates through this current partnership could significantly improve vaccination rates. To maximise the effectiveness of this campaign, further action is needed.

Lessons Learned from the U.S. & Recommendations to Maximise the Effectiveness of the Nigerian National HPV Campaign

There are valuable lessons to glean from the success of the U.S. HPV vaccination strategy. The introduction of this vaccine has led to a decline in HPV-related infections, including cervical cancer and precancer rates. Similar to Nigeria, the U.S. has a diverse landscape that includes many groups of ethnicities, socioeconomic status, and races, living in different geographies with vaccination

policies that vary across state lines, and the reduction in cervical cancer incidence has occurred despite these differences. This is encouraging, especially as Nigeria's government begins the second phase of its HPV vaccination program, which is expected to increase awareness and vaccination uptake.

Challenges still exist in achieving high rates of HPV vaccination in the U.S. Disparities exist in vaccination rates based on race, ethnicity, socioeconomic status, and geography in the U.S. Barriers such as a lack of awareness, misconceptions about vaccine safety, limited access to healthcare, and inconsistent policies at the state level continue to hinder vaccine coverage. Similar barriers are also present in Nigeria.

Ongoing strategies that have proven effective in increasing vaccine uptake include culturally sensitive educational campaigns, improving accessibility to the vaccine, especially in hard-to-reach areas, increasing access to healthcare via creating pathways to increase health insurance coverage, making the vaccine available in settings outside of a medical home, localized specific and targeted interventions at the community level, and increasing healthcare providers' vaccine promotion. By leveraging the lessons learned from these strategies, Nigeria can enhance its efforts to meet vaccination targets.

There is a lack of awareness, poor knowledge, and misinformation (including cultural and social norms) about HPV, and the link between cervical cancer and the HPV vaccine as a preventive measure. Educating the public on the link between cervical cancer, HPV, and the HPV vaccine, including its safety, is vital to increase uptake and overcome vaccine hesitancy.[6] Once education and awareness are addressed, the willingness to vaccinate is high,[7,66,73,74] especially if the vaccine is accessible. Community-based educational programs and target-oriented vaccine campaigns have been used effectively in increasing awareness and dispelling myths about the HPV vaccine.[65,75] Engaging with communities using local languages and culturally appropriate messages also helps improve vaccine confidence.[76,77]

Interventions using peer educators have proven successful, especially in adolescent girls.[78] Providing education may also have an impact beyond the direct interactions between the educator and the student. Women who know about the vaccine are more willing to vaccinate their daughters and are more willing to recommend it to other women,[64] who are then more likely to get the vaccine or vaccinate their daughters.[62]

Once knowledge and awareness are addressed, the possibility of mistrust in the vaccine may still exist. Trust in the effectiveness and safety of vaccines is crucial for successful vaccination campaigns. A large-scale study by De Figeurora et al. on vaccine confidence highlighted that misinformation, mistrust in the healthcare system, and past negative experiences can erode vaccine confidence.[79] Building trust through transparent communication and reliable healthcare services is essential for improving HPV vaccine acceptance. Efforts to enhance vaccine confidence should focus on clear, consistent communication from trusted sources, addressing misinformation and fears, and demonstrating the vaccine's safety and efficacy through evidence-based practices. Social media has also been used as a medium

to address vaccine misinformation and overcome hesitancy,[76,77] and should not be ignored.

Healthcare workers play a vital role in the uptake of vaccines. Women are more likely to get the HPV vaccine or vaccinate their daughters if recommended by a healthcare worker.[62] While the knowledge of the vaccine is higher amongst healthcare workers, knowledge about the vaccine protocol is limited, which affects their practice and recommendations to patients.[73,80,81] Thus, education about the vaccine, indications, the vaccine protocol, and potential side effects should be provided to healthcare workers to facilitate uptake.

School-based vaccine administration can improve access and is a generally acceptable mode of vaccination.[7,66] Non-HPV and HPV vaccine mandates for school attendance have also been shown to have a positive effect on increasing uptake and demand for the vaccine.[82] Integrating the HPV vaccination with other healthcare services and vaccines can reduce the overall cost burden on families and also improve access to the vaccine.[83] While any of these strategies can be employed independently, we recommend a multilevel strategy as this has proved to be effective.[84]

This list is not exhaustive but provides a feasible starting point for strategic interventions to increase the uptake of the HPV vaccine in Nigeria.

CONCLUSION

The success of HPV vaccination in the US and its impact on cervical cancer incidence and mortality provide a strong foundation for recommending its implementation in Nigeria. Nigeria faces significant challenges in cervical cancer prevention due to limited access to HPV vaccination, cervical screening, and treatment services, as well as social and economic determinants. Cervical cancer is largely preventable.

The incidence and mortality rates from cervical cancer in Nigeria highlight the urgent need for a larger focus on preventive measures, like the current integration of the vaccine into the national immunisation program. The implementation and acceptance of the HPV vaccine in Nigeria are influenced by a complex interplay of social, cultural, health system, and political factors. Addressing these factors requires a multifaceted multilevel approach, including improving public awareness, addressing cultural beliefs and misconceptions, and building vaccine confidence using an array of available tools and approaches. With the integration of the HPV vaccine into the national immunisation program, the cost and access barrier, although not eliminated, is mitigated, and in this paper, we focused on feasible, implementable solutions to complement the current campaign. Collaborative efforts between the government, healthcare providers, and communities are essential to overcoming challenges and ensuring the success of the HPV vaccination program in Nigeria.

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