

Knowledge, Attitudes and Practices Concerning HPV Infection, Cervical Cancer and HPV Vaccination among Healthcare Providers in Plateau State, Nigeria: A Cross-Sectional Study

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ABSTRACT

Background: Healthcare providers (HCPs) play a significant role in Human Papillomavirus (HPV) vaccine delivery, particularly regarding knowledge, confidence, and counselling quality, which affect caregiver acceptance and uptake during the routine immunization programme. Nigeria included HPV vaccination in its national immunization schedule in 2023, but still lacks awareness and readiness to deliver HPV vaccination services, especially in Plateau State. This paper investigates knowledge, attitude and practice concerning HPV infection, cervical cancer and HPV vaccination among Healthcare providers in Plateau State, Nigeria.

Methods: A cross-sectional survey was conducted among 152 healthcare workers in primary healthcare facilities in Mangu, Riyom, and Qua'anpan who were present and on duty during the study, using a structured questionnaire to obtain information on HPV knowledge, attitudes, practices, training, and campaign engagement. The data were analyzed using IBM SPSS version 27.0, with descriptive statistics and Chi-square tests, odds ratios (ORs), and multivariate logistic regression, based on data collected from healthcare providers.

Results: About 19.7% knew HPV, with a favourable attitude of 79.6% and HPV-related practices of 84.2% of health providers. 88.2% had been trained and had previously been involved in HPV vaccination. The demographic characteristics were not significant at the 0.05 level in association with knowledge or attitude; practice was associated with age, sex, training, and campaign involvement regarding HPV. Campaign involvement independently predicted good practice/readiness among participants in multivariable analysis (AOR=13.44; 95% CI: 3.08-58.62; p<0.001).

Conclusion: Most of the healthcare providers had inadequate knowledge of HPV infection, cervical cancer and vaccination but had positive attitudes and practices. This suggests the need for continuous training for providers, regular refresher courses, and updates through sustained engagement in HPV vaccination campaigns to increase knowledge, build confidence, and consequently improve the delivery of HPV vaccination services in Plateau State.

Keywords: HPV vaccine; cervical cancer; healthcare providers; knowledge attitude practice; Plateau State; Nigeria

INTRODUCTION

Human Papilloma Virus (HPV) is responsible for nearly all cervical cancers and plays a role in other anogenital and oropharyngeal cancers worldwide with persistent infection (de Martel et al., 2017; Sung et al., 2021). The virus drives cancer development through an intricate interplay between viral oncoproteins and host cellular machinery, leading to unregulated cell proliferation and genomic instability (Abdul-Kadhum & Ahmed, 2024). Cervical cancer is one of the most preventable cancers through HPV vaccination, screening and treatment. According to the World Health Organization (WHO), the Global elimination strategy roadmap scaled up prevention with three interventions guided by the 90-70-90 targets by 2030: 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 with precancer or cancer treated appropriately by 2030 (WHO, 2020). Clinical trials and programmatic evidence indicate HPV prophylactic vaccines offer high-certainty protection against cervical precancer and result in markedly decreased HPV 16/18 infections and high-grade cervical disease among vaccinated populations (Arbyn et al., 2018; Drolet et al., 2019). However, uptake of HPV vaccination remains suboptimal, particularly in low- and middle-income countries (Bruni et al., 2016; Tsu et al., 2021; Guillaune et al., 2024). Global HPV vaccine coverage analyses have demonstrated wide regional and economic variations, with many countries in Africa failing to achieve the coverage levels needed to eliminate cervical cancer (Adeyanju et al., 2024; Kailemia & Mukami, 2025). Nigeria introduced the HPV vaccine into its routine immunization programme for girls aged 9–14 years in October 2023, using schools-based programmes, community outreaches, and healthcare facilities as entry points (WHO, 2023). Scaling up the programme to achieve national coverage will require adequate vaccine supply, as well as providers who can recommend the vaccine to parents/caregivers, educate them on the importance of the HPV vaccine, dispel misinformation, and reassure them to trust in routine health services.

One of the most influential factors in vaccine acceptance and rejection is caregivers' perception of primary care providers as credible sources of vaccine information and motivators for vaccination (Czajka et al., 2020; Lin et al., 2021; Thacker & Uttekar, 2022; Akinsola et al., 2024). SAGE defines vaccine hesitancy as a delay in acceptance or refusal of vaccines despite availability, citing confidence, complacency and convenience as conceptual drivers of vaccine hesitancy (MacDonald, 2015). An extension of this framework is known as the 5C's: confidence, complacency, constraints, calculation, and collective responsibility (Betsch et al., 2018). The 5Cs apply to HPV vaccine distribution, as providers can improve confidence by communicating effectively about vaccine safety, address complacency by discussing the risk of cervical cancer, and reduce constraints by advising caregivers on where they can access the vaccine in the community.

Studies across different countries continue to demonstrate that provider recommendation is one of the strongest predictors of HPV vaccine initiation (Czajka et al., 2020; Lin et al., 2021; Thacker & Uttekar, 2022; Akinsola et al., 2024; Bruni et al., 2016; Tsu et al., 2021; Guillaune et al., 2024). HPV vaccine recommendation practices among healthcare workers showed mixed results regarding their confidence, recommendations, and implementation, including fears about vaccine safety, parental refusal, financial costs, and perceived health system barriers (Bakare et al., 2024; Fu et al., 2025). The Providers' communication patterns around HPV vaccination indicate that delayed, weak, or inconsistent provider recommendations during healthcare encounters impede vaccine initiation, whereas strong, routine, and high-quality provider recommendations during healthcare visits increase vaccine uptake (Gilkey & McRee, 2016; Jacobson et al., 2020; Poland & Poland, 2025; Zavaleta-Monestel et al., 2026). Gilkey et al. (2016) found that strong recommendation quality was significantly associated with HPV vaccine initiation and completion among parents who received a recommendation, yet only a small fraction of parents have received recommendations (Gilkey et al., 2016). Research on healthcare providers' knowledge, attitudes, and practices in Nigeria and sub-Saharan Africa has yielded inconsistent results. There are gaps in healthcare providers' knowledge about cervical cancer prevention and the HPV vaccine, and there is an uneven distribution of providers with knowledge of cervical cancer prevention education and policies that drive implementation within the different states (John-Akinola et al., 2022). Other studies conducted among health care providers in Lagos and Ebonyi revealed poor knowledge of the HPV vaccine despite favourable attitudes (Makwe & Anorlu, 2011; Adekunle et al., 2022; Anyanwu et al., 2024; Balogun & Omotade, 2022). Similar to parental knowledge and acceptability factors, healthcare workers' HPV vaccine recommendation practices have been reported to vary by their knowledge and skills about the vaccine, perceived professional identity to provide the vaccine, perceived outcomes beliefs about HPV vaccination, resource availability and

self-confidence in their ability to recommend the HPV vaccine to caregivers (Balogun & Omotade, 2022; Ayres et al., 2021; Nishioka et al., 2022; Abdelhadi et al., 2025). Other studies have shown that awareness-raising, school-based delivery, and subsidies have improved HPV vaccine uptake among girls; poorly communicated policies create mistrust and affect vaccine acceptance in the Nigerian implementation (Ogundele et al., 2020; Adigwe et al., 2022; Talabi et al., 2023; Mohammed et al., 2024). There is a need to assess providers who routinely administer adolescent vaccines in different rural and semi-urban communities in Nigeria. Plateau State HPV vaccine delivery for adolescents relies heavily on primary healthcare providers, including Community Health Extension Workers, nurses, health educators, and staff responsible for routine immunization. The gaps in HPV vaccination focus on providers show limited information in tertiary health facilities in Plateau State. This necessitated investigating providers' current knowledge, attitudes and practices towards HPV infection, cervical cancer and HPV vaccination. It is important to note that the outcome of the research will help tailor provider training and the HPV vaccine counselling system, inform the programmatic implementation of the HPV vaccine campaign, and improve routine immunization.

METHODS

Study design

A cross-sectional approach was used to capture provider knowledge, attitudes, and practice after the initial phase of Nigeria's HPV vaccination program rollout. This design is suitable for describing KAP patterns and exploring associations between provider characteristics, training, awareness of campaign involvement and good. This manuscript details findings from the quantitative healthcare-provider component of a mixed-methods study examining HPV vaccine hesitancy in Plateau State, Nigeria, from October to January 2026, focusing on practice/readiness.

Study setting

The study took place in Plateau State, Nigeria. Nigeria is divided into geopolitical zones and Plateau State lies within the North-Central geopolitical zone. Jos is the capital city of Plateau State and the state has 17 Local Government Areas (LGAs) that cover an estimated land area of 27,000 km². Plateau state is ethnically diverse, populated by different religious and indigenous groups. Communities located within Plateau state can be classified as urban, semi-urban or rural settlements. Parts of Plateau state experiences a mild climate because of its high altitude when compared to some other states in Nigeria. The three LGAs of Mangu, Riyom, and Qua'anpan were selected for data collection, serving as representatives for Plateau State's senatorial zones. Each of these LGAs was chosen because they included communities with different settlement patterns and varying primary healthcare system contexts. Primary healthcare system services play an important role in reaching populations with routine immunization services and providing maternal and child health services, health education, outreach and vaccination counselling services.

Study population and eligibility criteria

The focus of this survey was on healthcare workers operating within immunization programs, adolescent health clinics, and HPV vaccination settings. Inclusion criteria for providers stipulated that they must be present at the selected primary healthcare facilities/LGA health structures during data collection, have the capacity and authority to consent, and be willing to participate. Providers who did not routinely provide vaccination advice/deliver vaccines were excluded. These excluded providers lacked decisional authority over vaccinations and were not involved in vaccination counselling sessions or vaccine delivery.

Sample size and sampling technique

All eligible providers at selected facilities were asked to participate in the survey; a random sampling technique was used to sample healthcare providers for this study. This was appropriate because the population of eligible providers at each selected facility was finite, programmatically defined, and accessible at the time of data collection. The final healthcare-provider sample included 152 respondents.

Data collection instrument, technique, and procedure

We used a structured healthcare provider questionnaire derived for the study to collect data for analysis. The instrument captured socio-demographic and professional profiles, knowledge scores on HPV infection, cervical cancer, and HPV vaccination, attitudes towards HPV vaccination, and scored practice/readiness items addressing the willingness to educate and counsel caregivers about HPV/HPV vaccine, the healthcare provider's training and specific exposure to HPV or HPV vaccine, participation in HPV campaign, awareness of HPV vaccination in schools, and knowledge of AEFI reporting. Three (3) Trained research assistants administered the survey in person to healthcare providers, ensuring full completion and reducing missed questions.

Validity, reliability and data quality measures

Experts in primary healthcare provided feedback on the data collection tools to ensure content validity. Prior to the main study, the healthcare provider questionnaire was pilot tested with 10 providers in health facilities outside the study communities. The pilot test led to modifications to the questionnaire to improve term clarity: terms related to sexual debut were adjusted, question flow was improved, response options were corrected, and questions were shortened to reduce survey time. Data quality was ensured by training the research assistants in the administration of the survey instrument, extensive supervision during data collection, completeness checks, data cleaning, consistency checks, and verification of outliers prior to analysis.

Measurement of outcomes

Healthcare providers were asked knowledge questions about HPV infection, cervical cancer and HPV vaccination. Twenty knowledge items were asked, but one duplicate booster-dose item was dropped during analysis. Scores ranged from 0 to 17, with higher scores indicating greater knowledge of HPV. Based on total knowledge scores, respondents were categorized as having poor knowledge (scores <60%), fair knowledge (scores 60-79%), or good knowledge (scores ≥80%). Providers were also asked questions about their attitudes towards HPV vaccination using Likert-scale questions. Attitude was measured by asking providers about their willingness to encourage caregivers to get HPV vaccination, their support for HPV vaccination policy in schools, and whether they felt they could influence clients' perceptions of vaccines. Healthcare providers were asked five binary practice/readiness questions: whether they had educated their patients about HPV/HPV vaccine before, if there was an active HPV vaccination clinic or program at their facility, awareness of HPV vaccination being given in schools, knowledge of how to report AEFIs and if they felt ready to counsel caregivers about HPV vaccination. Practice scores ranged from 0 to 5, with higher scores indicating greater practice/readiness regarding HPV vaccination. Based on total practice scores, respondents were categorized as having poor practice/readiness (scored <60%), fair practice (scored 60-79%) or good practice (scored ≥80%).

Statistical analysis

Statistical analysis was done using IBM SPSS Statistics version 27. Frequencies and percentages were used to summarize categorical variables. Means and standard deviations were used to summarize continuous variables. Pearson's Chi-square test was used to determine associations between categorical predictors and three outcome variables (good knowledge, favourable attitude, and good practice). Fisher's exact test was performed where some cells had expected counts less than 5. Crude odds ratios (ORs) and 95% confidence intervals (CI) were reported. Multivariable logistic regression was used to identify independent predictors of good practice/readiness, adjusting for confounders (age group, sex, HPV training, and campaign involvement). Statistical significance was set at $p < 0.05$.

Ethical considerations

Ethical approval for this study was sought from the relevant health research ethics authority before commencement of data collection. Administrative permission was sought from the appropriate health authorities and facility heads. Participation was voluntary and written informed consent was obtained from all respondents. Completed questionnaires were anonymized using unique study codes. Confidentiality of the data was maintained by restricting access to the research team. Data are presented in collective form.

RESULTS

Socio-demographic and professional characteristics

The findings from the study reveal that the mean age and healthcare service experience of respondents were 40.80 ± 10.89 years and 13.31 ± 9.12 years, respectively. The majority of respondents were females (65.1%), married (73.7%) and working in PHC facilities (95.4%). Nurses/Midwives constituted the smallest proportion of study participants (3.9%), while Community Health Extension Workers (CHEWs) formed the largest professional group (71.7%). Other healthcare providers who participated in the study were Environmental Health Officers (EHOs), Laboratory workers and other cadres of healthcare professionals. The largest proportion of respondents were from Mangu (42.8%), Riyom (30.9%) and Qua'anpan (26.3%) Local Government Areas, respectively.

Table 1: Socio-demographic and professional characteristics of healthcare providers (N=152)

Characteristic	Category	Frequency (n)	Percentage (%)
Age group (years)	20-29	31	20.4
	30-39	37	24.3
	40-49	46	30.3
	50-59	35	23.0
	≥ 60	3	2.0
Sex	Female	99	65.1
	Male	53	34.9
Marital status	Married	112	73.7
	Single	33	21.7
	Divorced	1	0.7
	Widowed	6	3.9
Professional cadre	Community Health Extension Worker	109	71.7
	Nurse/Midwife	10	6.6
	Environmental Health Officer	9	5.9
	Medical Laboratory Scientist	8	5.3
	Laboratory technician/assistant	7	4.6
	Records staff	4	2.6
	Dental staff	2	1.3
	Pharmacist/technician	2	1.3

	Doctor	1	0.7
Facility type	Primary health facility	145	95.4
	Private facility	5	3.3
	NGO facility	2	1.3
LGA of workplace	Mangu	65	42.8
	Riyom	47	30.9
	Qua'anpan	40	26.3
Years of experience	1-5	42	27.6
	6-10	30	19.7
	11-15	23	15.1
	16-20	22	14.5
	>20	35	23.0

Knowledge of HPV infection, cervical cancer and HPV vaccination

General HPV knowledge reveals a mean knowledge score of 11.95 out of 17 items (70.3%). 30 providers (19.7%) had good knowledge; 89 (58.6%) had fair knowledge; and 33 (21.7%) had poor knowledge. Providers were most knowledgeable about the HPV vaccine preventing cervical and genital cancers, as 87.5% knew that HPV vaccination decreases the risk of these cancers. However, several technical knowledge gaps were noted. Only 20.4% of providers correctly identified that HPV is not typically symptomatic at onset, 24.3% knew that boys can receive the HPV vaccine, 28.3% knew that a booster dose is not needed for HPV vaccination, and 35.5% correctly recognized that vaccination is not most effective after one becomes sexually active.

Table 2: HPV knowledge indicators among healthcare providers

Knowledge item	Correct response	Correct n (%)
HPV vaccination reduces the risk of cervical and genital cancers	Yes	133 (87.5)
HPV infection is usually symptomatic at onset	No	31 (20.4)
Boys can receive HPV vaccine	Yes	37 (24.3)
Routine booster doses are required after HPV vaccination	No	43 (28.3)
HPV vaccine is most effective after a girl becomes sexually active	No	54 (35.5)
There are more than 100 HPV types	Yes	66 (43.4)

Attitudes toward HPV vaccination

Most providers had favourable attitudes towards HPV vaccination. Providers agreed or strongly agreed that they would recommend caregivers vaccinate their children (n = 119, 78.3%). Providers also agreed or strongly agreed that HPV vaccination should be required for school enrollment (n = 120, 78.9%). Finally, providers agreed or

strongly agreed that their profession made them more favourable towards the HPV vaccine (n = 124, 81.6%). Based on the merged attitude classification, most providers had favourable attitudes (n = 121, 79.6%), 4 (2.6%) were neutral, and 27 (17.8%) had unfavourable attitudes.

Table 3: Attitudes toward HPV vaccination among healthcare providers

Attitude indicator	Positive response n (%)	Summary classification
Would encourage caregivers to vaccinate their children	119 (78.3)	Favourable attitude: 121 (79.6%)
Supports HPV vaccination as a requirement for school enrolment	120 (78.9)	Neutral attitude: 4 (2.6%)
Professional background positively influences view of HPV vaccine	124 (81.6)	Unfavourable attitude: 27 (17.8%)

Practice, HPV training and campaign involvement

It reveals that practice indicators were moderately high; a substantial number of providers reported educating patients on HPV or the vaccine (96.7%), stated that an HPV vaccination program was active in their area (94.1%), and indicated they were prepared to counsel caregivers (91.4%). Overall, 85.5% of providers reported knowing how to report HPV vaccine-related AEFI. Fewer providers reported knowing where students would receive the HPV vaccine if a school-based vaccination program were implemented (57.9%). When classified by practice/readiness, 128 providers (84.2%) had good practice, 16 providers (10.5%) had fair practice, and 8 providers (5.3%) had poor practice. Most providers had received HPV-related training (86.8%) and had participated in HPV vaccination/campaign activities (88.2%). Of those who had received HPV-related training, 95.5% had participated in vaccination/campaign activities compared to 40.0% of providers who had not received HPV-related training.

Table 4: Practice, training and campaign involvement among healthcare providers

Variable	Yes (n) (%)	No/Do not know (n) (%)
Educated a patient about HPV/HPV vaccine	147 (96.7)	5 (3.3)
HPV vaccination programme active in facility/LGA	143 (94.1)	9 (5.9)
Aware of school-based HPV vaccination programme	88 (57.9)	64 (42.1)
Knows how to report HPV vaccine-related AEFI	130 (85.5)	22 (14.5)
Feels equipped to counsel caregivers	139 (91.4)	13 (8.6)
Received HPV training	132 (86.8)	20 (13.2)
Involved in HPV vaccination/campaign	134 (88.2)	18 (11.8)
Good practice ($\geq 80\%$)	128 (84.2)	24 (15.8)

Factors associated with knowledge, attitude and practice

Neither the socio-demographic nor the professional characteristics were significantly associated with good HPV knowledge. Age group, sex, marital status, cadre, facility level, LGA of workplace, years of experience, HPV training and campaign involvement were not associated with good knowledge. Neither the socio-demographic

nor the professional characteristics were significantly associated with a favourable attitude. Bivariate analysis revealed that age group, sex, HPV training and campaign involvement were associated with good practice/readiness. Compared to providers aged 20–29 years, providers in the age group 30–39 years had higher odds of good practice/readiness (OR=3.93; 95% CI: 1.09-14.16) and providers in the age group 40–49 years were more likely to have good practice/readiness (OR=6.83; $p=0.005$). Female providers had higher odds than male providers (OR=2.60; 95% CI: 1.07-6.30; $p=0.03$). Those who had received HPV training had higher crude odds of good practice/readiness (OR=8.43; 95% CI: 2.99-23.77; $p<0.001$), and providers who had been involved in HPV vaccination/campaign activities had higher crude odds of good practice/readiness (OR=20.33; 95% CI: 6.47-63.92; $p<0.001$). The multivariable logistic regression model was statistically significant (Chi-square = 36.75, $p < 0.001$). HPV campaign involvement was the only factor independently associated with good practice/readiness after adjusting for the others (AOR=13.44; 95% CI: 3.08-58.62; $p<0.001$). Age group, sex and HPV training were not statistically significant after adjusting for other factors.

Table 5: Predictors of good HPV-related practice/readiness among healthcare providers

Predictor	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age 30-49 vs 20-29	3.93-6.83	0.02	3.37 (0.94-12.12)	0.06
Female vs Male	2.60 (1.07-6.30)	0.03	2.51 (0.85-7.38)	0.09
HPV training: Yes vs No	8.43 (2.99-23.77)	<0.001	1.70 (0.38-7.59)	0.48
HPV campaign involvement: Yes vs No	20.33 (6.47-63.92)	<0.001	13.44 (3.08-58.62)	<0.001

Note: The adjusted model included age group, sex, HPV training and HPV campaign involvement. AEFI = adverse events following immunization; OR = odds ratio; AOR = adjusted odds ratio; CI = confidence interval.

DISCUSSION

This study sought to measure healthcare provider knowledge, attitudes, and practices regarding HPV infection, cervical cancer prevention, and HPV vaccination in Plateau State, Nigeria. The study highlighted that, in Plateau State, healthcare providers displayed positive attitudes and good practices but lacked thorough knowledge. Despite prior training and exposure to HPV vaccine implementation activities, only 19.7% of providers had good knowledge. While the majority of providers expressed confidence in their ability to motivate caregivers, provide counselling and discuss both HPV vaccination and AEFI reporting steps, gaps in knowledge about HPV vaccination persisted. Specifically, knowledge gaps were evident regarding the natural course of HPV, male vaccine eligibility, the necessity of booster doses, and optimal vaccination timing. Taking part in campaigns, more so than just training, emerged as the most significant individual factor influencing good practices. The fair level of understanding aligns with other Nigerian studies indicating that awareness of HPV vaccination does not necessarily translate to robust technical knowledge. Some studies have demonstrated low HPV vaccine knowledge among nursing staff, despite positive attitudes toward vaccination (Makwe & Anorlu, 2011; Adekunle et al., 2022; Sagtas & Gursoy, 2023). This aligns with findings from other studies that observed a lack of consistent provider knowledge and prevention education in Nigeria, encompassing healthcare workers and other segments of the population [26,39,40,41]. Moreover, other research has found that some healthcare practitioners must first acquire adequate knowledge before they feel sure about recommending HPV (Abdelhadi et al., 2025 & Gokcay et al., 2024), and that a combination of their knowledge and skills, along with their provider identity, beliefs about consequences, and environmental factors, plays a role (Sobalik et al., 2025; Balogun & Omotade, 2022). This study contributes to the literature by demonstrating that knowledge gaps persisted in a primary healthcare-focused Plateau sample even after most providers had received formal training.

The finding that most providers had positive attitudes towards cervical cancer prevention and HPV vaccination is encouraging. Provider attitudes are important because HPV vaccination requires effective provider

communication about sensitive topics: an STI, adolescent health, and cancer prevention. In this study, nearly 80% of providers reported they would encourage caregivers and promote school-HPV vaccination linkages. In line with research from Nigeria and globally, this suggests that healthcare professionals, while often recognizing the value of HPV vaccination, encounter other influences that affect their consistent application of positive attitudes in recommendation practices (Ayre et al., 2021; Balogun & Omotade, 2022; Burton, 2020; Olubodun et al., 2024; Herig et al., 2025). In line with other studies, nurses appear to hold positive beliefs regarding cervical cancer and HPV prevention, but their knowledge limitations can diminish their confidence in recommending such interventions (Berenson et al., 2021; Swain et al., 2022; Murciano-Gamborino et al., 2025).

The high level of practice/readiness reported in this study has immediate relevance for implementation. More than 90% of providers agreed that they had previously educated patients about HPV vaccination, that HPV programs were present in their facility, and that they were ready to counsel caregivers about vaccination. As such, these findings are likely reflective of Nigeria's recent national HPV vaccine introduction and campaign efforts. Nigeria's 2023 vaccine introduction activities included the mobilization of social and religious influencers, integration into routine immunization systems, and active engagement of health workers. Many frontline providers have had repeated opportunities to join school or community vaccination campaigns directly (Tsu et al., 2021). The observation that participation in the campaign, rather than training alone was the strongest predictor of good practice aligns with principles of implementation science, which suggest that hands-on experience in real-world settings is necessary to enhance providers' competence and readiness.

A key finding from this research highlighted the distinction between formal training and campaign participation. Good practice and readiness were significantly associated with HPV training in bivariate tests, but this association was no longer evident in the multivariable model that adjusted for campaign engagement which proposes that while training is important, it may not be sufficient to promote best practices. Through their involvement in campaigns, providers can consistently guide caregivers, respond to their questions, manage consent issues, arrange for delivery in schools and the community, and monitor vaccine safety in real-world settings. Recent studies from other countries have reported similar findings; Abdelhadi et al. (2025) observed that while a provider's knowledge, attitudes, and practices concerning HPV vaccination correlated with their self-reported willingness to recommend it, their attitudes and practical clinical engagement emerged as more robust predictors among the participants. Research by Afolabi & Toivanen, Mehra & Mishra, and Bakare et al. indicated that healthcare providers' confidence, the general environment of their workplace, concerns about vaccine safety, parents' reluctance, and obstacles within the healthcare system were all strong predictors of whether they recommended the HPV vaccine, irrespective of their own understanding of the virus (Afolabi & Toivanen, 2020; Mehra & Mehra, 2021; Bakare et al., 2024). Gilkey & McRee (2016) showed that the quality and effectiveness of healthcare provider communication are major drivers of HPV vaccine uptake. Gilkey et al. (2016) and other studies found out that strong provider recommendations were independently associated with HPV vaccine initiation and series completion; however, only about one-third of parents reported receiving a strong recommendation from their child's provider (Gilkey et al., 2016; Cunningham-Erves et al., 2019; Kong et al., 2021; Sonawane et al., 2021). Training in Plateau State ought to include more than just technical information on HPV types, vaccines, and catch-up schedules. Emphasis should be placed on uniform recommendation scripts, simulated counselling sessions, AEFI conversations, myth correction, and pair training with mentorship during school and community vaccination efforts.

Another gap in provider knowledge that requires attention concerns AEFI reporting. While 85.5% of providers knew how to report suspected HPV vaccination-related AEFI, 14.5% either did not know or were unsure. Given caregivers already express concern about infertility, side effects, and general vaccine safety, hesitant willingness to vaccinate and provider ambivalence about AEFI reporting processes can undermine confidence. Studies across sub-Saharan Africa have identified many sources of HPV vaccination-related fear, including limited health-system capacity, lack of information, fear, and negative vaccination experiences (Talabi et al., 2022; Kagina et al., 2023; Kutz et al., 2023; Omayo et al., 2023). Therefore, to build broader vaccine confidence at the health-system level, AEFI preparedness ought to be a core component, not just an add-on or a routine duty. Ensuring providers can confidently articulate expected mild vaccine reactions, recognize warning signs, and guide people on reporting safety matters is key to strengthening the program's reliability.

The analysis did not reveal any robust socio-demographic predictors of either good knowledge or favourable attitudes. In other words, knowledge gaps and attitudes did not significantly differ by cadre, LGA, age group, or other professional characteristics examined. Although Community Health Extension Workers were the most numerous participants, the close balance among the different professional groups suggests that continuous education ought to be extended to all cadres offering immunization or adolescent health services. This aligns with findings from other sub-Saharan African studies, which have highlighted significant variations in healthcare providers' knowledge, attitudes, and practices concerning cervical cancer prevention. To improve understanding, programs might need to conduct regular knowledge checks and focused training for various professional groups (Ababaw et al., 2022; Kaushal, 2023; Delie et al., 2024; Casey et al., 2022). Results from Plateau offer a point of comparison to the qualitative and quantitative evidence gathered during HPV vaccine initiatives in other parts of West Africa. Successful national rollouts were observed in some countries, driven by top-down leadership and the involvement of partners outside the health sector (Casey et al., 2022). Across the implementation sites, key informants consistently raised provider strikes, prevalent rumours, vaccine hesitancy, and a lack of information on stakeholders' views of the vaccine. A recent cross-sectional study conducted among Senegalese healthcare workers found high rates of self-reported vaccine recommendation practices, supporting the idea that provider recommendations can improve when program systems bolster health workers' confidence (Mengistie, Demeke & Setegen, 2025). In line with this, the findings in Plateau suggest that providers are willing and ready to implement practices. However, ongoing program assistance may be necessary to ensure sustained, high-quality recommendation behaviours.

The pooled HPV vaccine uptake in Africa was reported as 41.38% in a 2025 review by Mengistie et al. Furthermore, they highlighted how knowledge and attitudes were significant predictors of vaccination status. Even though the study primarily examined uptake among women instead of healthcare providers, it nevertheless advocates for facility-based education as a means to enhance vaccination (Mengistie et al., 2025). Ongoing efforts through campaign counselling and mass-media communication are crucial for boosting awareness and clarifying misunderstandings about HPV vaccination. In Plateau State, healthcare providers serve as channels for these interventions because they interact with caregivers during routine immunization, school-based outreach, antenatal care, and community mobilization events.

This research contributes to the literature by providing quantitative analysis of healthcare provider KAP in Nigeria's Plateau State during the early years of the country's HPV vaccine introduction. Unlike previous studies conducted among Nigerian caregivers or parents, this research focused on supply-side actors who have ethical responsibilities to provide vaccination counselling, recommendations, or delivery services. Campaign participation was the most robust independent predictor of good practice and readiness, suggesting a modifiable programme delivery opportunity. Therefore, the most effective provider training would integrate technical knowledge with hands-on campaign experience, peer support, and ongoing involvement in standard immunization services. This kind of strategy could boost providers' assurance and their ability to counsel patients on HPV vaccination.

This study has some limitations, as a cross-sectional analysis, causal inference is limited, and all outcome measures were self-reported, which invites potential social desirability bias. We recruited participants from a few health facilities in Plateau State, primarily primary healthcare providers. Therefore, results may not be generalizable to providers in tertiary hospitals, private-sector facilities, or all health workers across the state. Sampling all providers on duty at participating facilities may have missed those not present during data collection. Lastly, some categories had small sample sizes, limiting our ability to detect differences between statistical subgroups. Despite these limitations, this study offers important programmatic takeaways as it is among the first to directly survey providers who may counsel, recommend, or provide HPV vaccination in selected Nigerian LGAs.

CONCLUSION

Findings on HPV knowledge and attitudes in Plateau State health care providers revealed excellent readiness for HPV vaccine delivery despite existing gaps in technical knowledge. While most providers had received HPV training and had vaccination experience through participating in vaccination drives or national campaigns, only

one-fifth had good knowledge of HPV. Participation in campaigns remained the only independent predictor of good practice and readiness scores, highlighting that hands-on field experiences are much more influential than didactic training alone at preparing health care providers for HPV vaccine delivery. As such, HPV vaccination programs in Plateau State should not only continue to provide refresher training for health care providers but also place additional emphasis on providing ongoing mentorship in counselling, AEFI communication, the use of standardized recommendation tools, and active school/community outreach.

RECOMMENDATIONS

Plateau State immunization managers are advised to provide refresher training for all HPV vaccination providers, covering topics such as HPV's natural history, vaccination schedules, and the prevention of cervical cancer. Training should also include practical exercises, counselling scripts, and safe communication about HPV without stigmatizing adolescent sexuality. Experienced providers should mentor newer staff, especially in facilities with limited school-based HPV vaccinations. Simplifying AEFI reporting is recommended to enhance safety communication with caregivers. Additionally, future research should investigate the impact of provider recommendations on vaccination uptake and whether improving providers' knowledge and counselling quality correlates with higher HPV vaccination rates among eligible girls.

Declarations

Conflict of Interest

The author has no conflict of interest to disclose.

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Ethical Approval and Consent to Participate

Ethical approval was granted by the Health Research Ethics Committee of the Ministry of Health, Plateau State (MOH/MIS/202/VOL1/ 2095) prior to study data collection. The relevant health authorities and facility administration granted administrative approval. Written informed consent was obtained from each participating health care provider.

Authors contribution

AJN and HA did the statistical analysis of the study. AIA and OON revised the draft and provided methodological guidance. All authors reviewed and approved the final manuscript.

Availability of data and materials

Data sets used and analyzed during the current study are available from the corresponding author on reasonable request. Access to confidential data may be subject to ethical restrictions.

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