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Reducing Parental Perceived Barriers to HPV Vaccine Uptake Through a Community-Based Nurse-Led Educational Intervention in Kaduna North Senatorial District, Nigeria

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Abstract

Background: Parental perceived barriers remain a major obstacle to human papillomavirus (HPV) vaccine uptake among adolescents in Nigeria. Community-based nurse-led educational interventions may help address these barriers, but evidence from rural and semi-urban settings is limited. This study aims to assess the effect of a community-based nurse-led educational intervention on parental perceived barriers to HPV vaccine uptake in Kaduna North Senatorial District, Nigeria. **Methods:** A quasi-experimental pre-test and post-test design with intervention and control groups was conducted among 208 parents of adolescents aged 9–14 years, with 204 completing the study (102 per group). Data were collected using a structured interviewer-administered questionnaire assessing socio-demographic characteristics and perceived barriers. The intervention group received a structured nurse-led educational programme, while the control group received no intervention. Data were analysed using chi-square tests, McNemar's test, and t-tests, with significance set at $p < 0.05$. **Results:** At baseline, there was no significant difference in mean barrier scores between groups ($p = 0.652$). After the intervention, the study group showed significant reductions in key barriers, including difficulty accessing accurate information, long waiting times, and limited opportunity to discuss concerns ($p < 0.001$). The mean barrier score decreased significantly in the study group from 5.40 ± 2.03 to 2.07 ± 1.55 ($p < 0.001$), while no significant change occurred in the control group. **Conclusion:** The community-based nurse-led educational intervention significantly reduced parental perceived barriers to HPV vaccine uptake, supporting the integration of structured health education into primary healthcare to improve adolescent vaccination outcomes.

Keywords: Human papillomavirus vaccine; health education; parents

Introduction

Cervical cancer remains a major public health concern globally, accounting for over 600,000 new cases and 342,000 deaths annually, with a disproportionate burden borne by low- and middle-income countries (Okolie et al., 2023; GLOBOCAN/IARC, 2024). Persistent infection with high-risk human papillomavirus (HPV) is the primary cause of cervical cancer, and vaccination has been established as a safe and effective preventive strategy (Agha et al., 2024; Bruni et al., 2021). Recognising this, the World Health Organization (WHO) has prioritised routine HPV vaccination for girls aged 9–14 years as part of the global strategy to eliminate cervical cancer as a public health problem (World Health Organization, 2022). Despite these efforts, HPV vaccine coverage remains suboptimal in many settings, particularly in sub-Saharan Africa, where structural, informational, and sociocultural barriers continue to limit uptake (Kutz et al., 2023; Wang et al., 2022).

Across sub-Saharan Africa, studies have consistently reported gaps between vaccine availability and actual utilisation. Factors such as misinformation, limited awareness, financial constraints, cultural beliefs, and weak

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health system infrastructure contribute to low vaccination coverage (Kutz et al., 2023; Philemon et al., 2025; Talabi et al., 2023). Persistent myths and misconceptions regarding vaccine safety, fertility concerns, and inadequate opportunities for caregivers to discuss vaccination with health professionals further exacerbate hesitancy (Tuhebwe and Kaggwa, 2024; Puckett et al., 2021). Language and cultural barriers, as well as variations in health literacy, have also been shown to influence vaccine acceptance across different communities (Marfo et al., 2022; Masamba et al., 2025).

Nigeria bears a substantial burden of cervical cancer, with thousands of new cases and deaths reported annually (Okolie et al., 2023; GLOBOCAN/IARC, 2024). Although HPV vaccination initiatives have been introduced, uptake remains low, with studies reporting gaps in awareness, knowledge, and access to services among parents and caregivers (Adeyemi et al., 2021; Idowu et al., 2023; Sadiq et al., 2025). National evidence also highlights policy, programmatic, and implementation challenges affecting HPV prevention efforts, underscoring the need for context-specific strategies to improve vaccination coverage (John-Akinola et al., 2022; John-Akinola et al., 2024). Parental concerns related to vaccine safety, cultural beliefs, and financial barriers continue to influence vaccination decisions in many Nigerian communities (Yusuf et al., 2024; Oluwole et al., 2022).

Health system factors such as limited-service availability, long waiting times, inconsistent vaccine supply, and inadequate communication with healthcare providers further constrain uptake (Egbon et al., 2022; Ohaeri and Olagunju, 2020). Understanding perceived barriers is therefore critical, as they shape health behaviours and influence decisions regarding preventive interventions such as vaccination (Nguyen et al., 2020). Evidence suggests that improving knowledge and addressing misconceptions can enhance acceptance and intention to vaccinate (Holman et al., 2014; Santa Maria et al., 2021).

Nurse-led educational interventions have emerged as effective strategies for improving vaccination outcomes, particularly in low-resource settings where nurses play key roles in community engagement and health promotion. Studies have demonstrated that structured educational programmes delivered by nurses can improve knowledge, build trust, and increase vaccine uptake by addressing concerns directly and providing culturally appropriate information (Okunade et al., 2024; Oladele et al., 2025). Community-based approaches are especially valuable because they allow tailored communication, facilitate dialogue, and address local barriers within familiar environments.

Despite growing evidence on HPV vaccination, limited research has specifically examined the effect of community-based nurse-led educational interventions on parental perceived barriers in Kaduna North Senatorial District. Understanding how such interventions influence perceived barriers is essential for informing public health strategies. This study therefore assessed the effect of a community-based nurse-led educational intervention on parental perceived barriers to HPV vaccine uptake among parents of adolescents in Kaduna North Senatorial District, Nigeria.

Methods

A quasi-experimental pre-test and post-test design with intervention and control groups was employed to evaluate the effect of a community-based nurse-led educational intervention on parental perceived barriers to HPV vaccine uptake. The study was considered quasi-experimental rather than a randomized controlled trial because individual participants were not randomly assigned to intervention and control groups. However, the Local Government Areas (LGAs) included in the study were randomly selected using a simple random sampling technique by balloting from the eight LGAs in Kaduna North Senatorial District. Two LGAs (Zaria and Sabon Gari) served as the intervention group, while two LGAs (Makarfi and Soba) served as the control group. This approach minimized contamination between groups while allowing comparison of outcomes between communities exposed to the intervention and those that were not.

Study setting and Population

The study was conducted in selected communities within Kaduna North Senatorial District, Kaduna State, Nigeria. The district comprises predominantly Hausa/Fulani populations and includes both semi-urban and rural communities with varying access to primary healthcare services.

The study population consisted of primary caregivers (biological parents or legal guardians) of adolescents aged 9–14 years residing in the selected communities. Eligibility criteria included residence in the community

for at least 12 months and willingness to provide informed consent. Parents who were severely ill or unlikely to be present throughout the study period were excluded.

Sample size determination

The sample size was calculated using the formula for comparing two proportions as described by Robert (1997). The calculation was based on a baseline HPV vaccine uptake rate of 11% (Iwu et al., 2023) and an anticipated post-intervention uptake of 26.6%. The minimum required sample size was 189 participants. After adjusting for a 10% attrition rate, a total of 208 participants were recruited. Of these, 204 participants completed the study (102 in the intervention group and 102 in the control group) and were included in the final analysis.

Sampling technique

A multistage sampling technique was employed. Four Local Government Areas (LGAs)—Zaria, Sabon Gari, Makarfi and Soba—were randomly selected from the eight LGAs within Kaduna North Senatorial District. Thirty percent of wards and communities within the selected LGAs were subsequently chosen through simple random sampling. Systematic random sampling was then used to select households with eligible adolescents. In households with more than one eligible parent, one parent was selected through simple random sampling.

Data collection instrument

Data were collected using a structured interviewer-administered questionnaire developed from relevant literature on HPV vaccination barriers. The instrument comprised two sections: socio-demographic characteristics and perceived barriers to HPV vaccine uptake. Perceived barrier items were scored as Yes = 1 (barrier present) and No = 0 (barrier absent). A composite barrier score was calculated by summing all barrier items, with higher scores indicating greater perceived barriers.

Validity and reliability

Content and face validity of the instrument were established through expert review by professionals in statistics, community medicine, public and community health nursing, and obstetrics and gynaecology. The instrument was pre-tested among 10% of the calculated sample in communities outside the study area. Internal consistency reliability was assessed using Cronbach's alpha, which yielded a coefficient of 0.874, indicating good reliability.

Intervention Procedure

Data collection was conducted in three phases: pre-intervention, intervention and post-intervention. Baseline (pre-intervention) data were collected from both study and control groups using the structured questionnaire. The intervention group received a structured community-based nurse-led educational programme delivered through face-to-face sessions at participants' homes. Each session lasted approximately 40 minutes and included interactive discussions, visual aids, and educational flyers. The educational content focused on addressing perceived barriers to HPV vaccination, including: Accessing accurate information about HPV and the HPV vaccine, availability of HPV vaccination services in local health facilities, addressing myths and misconceptions about HPV vaccination, managing financial and logistical challenges and overcoming language and communication barriers.

A question-and-answer session was incorporated to clarify concerns and reinforce key messages. The control group received no structured educational intervention during the study period. Post-intervention data were collected three months after the intervention to assess changes in perceived barriers.

Data analysis

Data were analysed using IBM SPSS Statistics version 25. Descriptive statistics (frequencies, percentages, means and standard deviations) were used to summarise participant characteristics and perceived barriers. Pearson's chi-square test was used to compare categorical variables between the intervention and control groups. McNemar's test was used to assess changes in perceived barriers within the intervention group before and after the educational intervention. Paired t-tests were conducted to compare mean barrier scores within groups, while independent t-tests were used to compare mean scores between groups. Statistical significance was set at $p < 0.05$.

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Ethical considerations

Ethical approval was obtained from the Ahmadu Bello University Teaching Hospital Health Research Ethics Committee (ABUTH-HREC/ABUTHZ/HREC/C47/2025). Permission was also obtained from relevant Local Government authorities and community leaders. Written informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity were maintained throughout the study, and participation was voluntary, with respondents free to withdraw at any stage without consequence. The study was not registered in a clinical trial registry because it was conducted as a community-based quasi-experimental educational intervention rather than a randomized controlled trial.

Table 1. Distribution of Study and Control Groups According to their Socio-Demographic Data

Variable	Category	Intervention n (%)	Control n (%)	p-value
Age group (years)	20–24	1 (1.0)	3 (2.9)	
	25–29	10 (9.8)	13 (12.7)	
	30–34	48 (47.1)	57 (55.9)	0.180
	≥35	43 (42.2)	29 (28.4)	
Sex	Male	12 (11.8)	11 (10.8)	0.825
	Female	90 (88.2)	91 (89.2)	
Religion	Islam	90 (88.2)	98 (96.1)	**0.037**
	Christianity	12 (11.8)	4 (3.9)	
Education	No formal	12 (11.8)	26 (25.5)	
	Primary	15 (14.7)	18 (17.6)	
	Qur'anic	36 (35.3)	38 (37.3)	**0.016**
	Secondary	17 (16.7)	11 (10.8)	
	Tertiary	22 (21.6)	9 (8.8)	
Occupation	Housewife	53 (52.0)	51 (50.0)	
	Petty trader	23 (22.5)	13 (12.7)	
	Civil servant	15 (14.7)	7 (6.9)	**0.036**
	Farmer	3 (2.9)	9 (8.8)	
	Student	8 (7.8)	2 (2.0)	
Marital status	Married	99 (97.1)	98 (96.1)	0.903
	Divorced	1 (1.0)	1 (1.0)	
	Widowed	2 (2.0)	3 (2.9)	
Family type	Monogamous	35 (34.3)	39 (38.2)	0.560
	Polygamous	67 (65.7)	63 (61.8)	
No. of female adolescents	1	77 (75.5)	66 (64.7)	
(9–14 years)	2	15 (14.7)	23 (22.5)	
	3	6 (5.9)	10 (9.8)	0.425
	4	2 (2.0)	2 (2.0)	
	≥5	2 (2.0)	1 (1.0)	
Ethnicity	Hausa/Fulani	68 (66.7)	95 (93.1)	
	Yoruba	18 (17.6)	2 (2.0)	
	Igbo	1 (1.0)	0 (0.0)	**0.001**
	Others	15 (14.7)	5 (4.9)	
Length of stay	1–2 years	10 (9.8)	5 (4.9)	
in community	3–4 years	21 (20.6)	18 (17.6)	0.313
	≥5 years	71 (69.6)	79 (77.5)	

Mean age (SD): Intervention 34.78 ± 4.78; Control 33.34 ± 4.77

Results

Table 1 presents the distribution of intervention and control groups according to their socio-demographic data. A total of 204 participants completed the study, with equal representation in the intervention and control groups. The mean age of respondents was similar between groups. Most respondents were female, married, and of Hausa/Fulani ethnicity. Significant differences were observed in religion ($p = 0.037$), educational level ($p = 0.016$), occupation ($p = 0.036$), and ethnicity ($p = 0.001$). No significant differences were found in age distribution, sex, marital status, family type, number of female adolescents, or length of residence in the community.

Table 2 presents the distribution of intervention and control groups according to perceived barriers to HPV Vaccine uptake before and after intervention. At baseline, perceived barriers were compared between the intervention and control groups using Pearson chi-square test. Most barriers were comparable between groups,

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although significant differences were observed for long waiting times, limited opportunity to discuss concerns, financial difficulty, and myths or misconceptions. Following the intervention, changes in perceived barriers were assessed using McNemar chi-square test. The intervention group demonstrated significant reductions in most barriers, including difficulty accessing accurate information, vaccine unavailability, long waiting times, limited discussion opportunities, financial difficulty, myths or misconceptions, limited internet access, conflicting information, and language barriers. No significant change was observed for misinformation about the HPV vaccine.

Table 2. Distribution of both studied groups according to perceived barriers to HPV Vaccine Uptake before and after intervention.

Barrier item	Intervention Before (n)	Control Before (n)	Pearson χ^2	p-value	Intervention After (n)	Control After (n)	McNemar χ^2	p-value
Difficulty accessing accurate information	50	50	0.000	1.000	13	53	35.837	0.001
Vaccine unavailable at local facility	41	48	0.977	0.323	15	51	29.028	0.001
Long waiting times	75	45	18.214	0.001	23	48	13.502	0.001
Limited opportunity to discuss concerns	69	45	11.453	0.001	10	45	30.494	0.001
Financial difficulty	35	55	7.953	0.005	9	54	46.505	0.001
Misinformation about vaccine	67	65	0.086	0.770	55	67	2.936	0.087
Myths or misconceptions	40	63	10.374	0.001	10	57	49.094	0.001
Limited internet access	75	62	3.756	0.053	46	61	4.422	0.035
Conflicting information	67	61	0.755	0.385	29	66	26.970	0.001
Language barriers	32	37	0.548	0.459	1	41	47.972	0.001

Pearson χ^2 test was used to compare perceived barriers between intervention and control groups *at baseline. McNemar χ^2 test was used to assess changes after intervention. Statistical significance was set at $p < 0.05$.*

Table 3 shows the comparison of mean perceived barrier scores before and after the nurse-led educational intervention in the intervention and control groups. In the intervention group, the mean barrier score decreased significantly from 5.40 ± 2.03 before the intervention to 2.07 ± 1.55 after the intervention, with a mean difference of 3.33. This reduction was statistically significant (paired t-test: $t = 15.798$, $df = 101$, $p < 0.001$) and was associated with a very large effect size (Cohen's $d = 1.73$). In contrast, the control group showed no significant change in mean barrier scores, with a pre-intervention mean of 5.21 ± 3.88 and a post-intervention mean of 5.32 ± 3.80. The observed mean difference of −0.12 was not statistically significant (paired t-test: $t = 0.309$, $df = 101$, $p = 0.758$) and demonstrated a negligible effect size (Cohen's $d = 0.03$).

Comparison of the intervention and control groups using the independent t-test revealed no significant difference in mean barrier scores at baseline ($t = 0.452$, $df = 202$, $p = 0.652$). However, after the intervention, the intervention group had a significantly lower mean barrier score than the control group (2.07 ± 1.55 vs 5.32 ± 3.80; $t = -8.011$, $df = 202$, $p < 0.001$), with a large effect size (Cohen's $d = 1.23$).Therefore, the null hypothesis which states there is no significant difference in the perceived barriers to HPV vaccine uptake for the study group was rejected, while for the control group it was not rejected, indicating that the nurse-led health education intervention significantly reduced parental perceived barriers to accessing the HPV vaccine, with no meaningful change in the control group.

Discussion

This study assessed the effect of a community-based nurse-led educational intervention on parental perceived barriers to HPV vaccine uptake among adolescents in Kaduna North Senatorial District, Nigeria. The findings demonstrate that the intervention significantly reduced multiple informational, structural, and socio-cultural

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barriers, highlighting the effectiveness of targeted community education in improving conditions that support vaccination uptake.

Table 3: Distribution of Mean Perceived Barrier Scores Before and After Intervention in Intervention and Control Groups

Comparison	Pre-Intervention Mean ± SD	Post-Intervention Mean ± SD	Mean Difference	*t*-value	df	*p*-value	Cohen's *d*
Paired *t*-test							
Study Group	5.4020 ± 2.03075	2.0686 ± 1.54958	3.33333	15.798	101	0.001	1.73
Control Group	5.2059 ± 3.88278	5.3235 ± 3.79985	−0.1176	0.309	101	0.758	0.03
Independent *t*-test							
Study vs Control (Before)	5.4020 ± 2.03075	5.2059 ± 3.88278	0.19608	0.452	202	0.652	0.06
Study vs Control (After)	2.0686 ± 1.54958	5.3235 ± 3.79985	−3.25490	−8.011	202	0.001	1.23

At baseline, participants reported barriers such as long waiting times, misinformation, limited opportunities for discussion, financial constraints, and difficulty accessing accurate information. These findings align with studies in sub-Saharan Africa identifying structural and informational challenges as major determinants of low HPV vaccination coverage (Kutz et al., 2023; Wang et al., 2022), as well as evidence from Nigeria linking misconceptions and financial barriers to low uptake (Oluwole et al., 2022; Yusuf et al., 2024).

Following the intervention, there was a significant reduction in most perceived barriers among the intervention group, particularly in access to information, communication with health workers, and misconceptions. This supports evidence that nurse-led education can improve knowledge and reduce vaccine hesitancy by addressing information gaps and building trust (Holman et al., 2014; Okunade et al., 2024; Oladele et al., 2025). The improvement suggests that personalised, face-to-face engagement may be especially effective in settings where misinformation is prevalent, consistent with research emphasising the importance of caregiver–provider communication (Zheng et al., 2021).

The reduction in financial concerns may reflect improved awareness of vaccine availability and support mechanisms, consistent with findings that education can influence perceptions of affordability (Santa Maria et al., 2021). However, misinformation did not decline significantly, suggesting that deeply rooted beliefs may require sustained and multi-channel communication strategies, as reported in previous studies (Puckett et al., 2021; Tuhebwe and Kaggwa, 2024).

In contrast, minimal changes in the control group reinforce the conclusion that routine exposure to health services alone may be insufficient to address barriers. The significant decline in mean barrier scores and large effect size further confirm the intervention's effectiveness, consistent with studies demonstrating the impact of community-based education on vaccination attitudes and behaviours (Holman et al., 2014; Kutz et al., 2023).

The findings of this study are also in consistent with evidence from other low- and middle-income countries where educational interventions have been shown to improve HPV vaccine acceptance by addressing parental misconceptions and knowledge gaps. For example, a study conducted in Indonesia found that parental knowledge and positive attitudes toward HPV vaccination were significant predictors of vaccine acceptance among adolescents (Sitaresmi et al., 2020). Similarly, research in China reported that limited awareness of HPV infection and concerns about vaccine safety were major barriers to vaccination, but improved knowledge was associated with increased willingness to vaccinate (Hu et al., 2019). In Malaysia, Wong et al. (2013) also reported that providing parents with accurate information about HPV and cervical cancer significantly improved acceptance of the HPV vaccine for their daughters. These findings support the present study,

demonstrating that educational interventions delivered by healthcare professionals can effectively address modifiable barriers to HPV vaccination, improving parental knowledge, increasing vaccine acceptance, and strengthening long-term HPV vaccination programmes aimed at reducing cervical cancer burden.

Limitations

This study has some limitations that should be acknowledged. First, the study employed a quasi-experimental design in which participants were not randomly assigned to intervention and control groups. In addition, baseline differences were observed between the intervention and control groups in some socio-demographic variables, including religion, education, occupation, and ethnicity. These differences may have influenced parental perceptions and responses to the intervention, which could affect the comparability of the groups. Second, the study was not registered in a clinical trial registry because it was conducted as a community-based quasi-experimental educational intervention rather than a randomized controlled trial. Finally, the study was conducted in selected communities within Kaduna North Senatorial District, which may limit the generalizability of the findings to other settings. Despite these limitations, the study provides valuable evidence on the effectiveness of nurse-led community education in reducing parental perceived barriers to HPV vaccine uptake.

Conclusion

The findings of this study revealed that a community-based nurse-led educational intervention significantly reduced parental perceived barriers to HPV vaccine uptake among adolescents in Kaduna North Senatorial District, Nigeria. The intervention effectively addressed key obstacles, including difficulty accessing accurate information, limited opportunities for discussion with healthcare providers, financial concerns, and misconceptions about the vaccine, with the intervention group reporting substantial reductions in these barriers. In contrast, no meaningful changes were observed in the control group, emphasizing the importance of structured educational programmes in addressing modifiable barriers to vaccination. These findings revealed the critical role of nurses in community health promotion and support the integration of nurse-led education into routine primary healthcare strategies to improve HPV vaccination uptake. By reducing parental misconceptions and improving access to reliable information, community-based educational initiatives may enhance sustained acceptance of the HPV vaccine and contribute to long-term vaccination coverage, thereby supporting ongoing efforts to reduce the burden of cervical cancer in low-resource settings.

Recommendations

Based on the findings of this study, the following recommendations are proposed. Primary healthcare programmes should integrate nurse-led educational interventions targeting parents to address misconceptions and improve awareness of HPV vaccination. Community engagement strategies involving local leaders, schools and religious institutions should be strengthened to promote accurate information and reduce socio-cultural barriers.

Given that some misinformation persisted after a single intervention, continuous and multi-channel education campaigns are recommended to reinforce key messages and sustain behavioural change. Capacity building for nurses and community health workers should be prioritised to enhance their skills in effective communication and vaccine counselling. Further research involving larger samples, longer follow-up periods and broader geographic coverage is recommended to assess long-term effectiveness and scalability of nurse-led interventions.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this study.

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