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| RESEARCH ARTICLE

Effect of a Community-Based Nursing Educational Intervention on Parental Acceptance of HPV Vaccination in Kaduna North Senatorial District, Nigeria: A Quasi-Experimental Study

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| ABSTRACT

Limited parental acceptance contributes to the low uptake of the human papillomavirus (HPV) vaccine in many African settings. Nurse-led educational strategies may improve parental acceptance and increase vaccine uptake in communities. The study aimed to determine the effect of a nurse-led educational intervention on parental acceptance of the HPV vaccine among parents of adolescents in Kaduna North Senatorial District, Nigeria. The study was conducted in selected communities within Kaduna North Senatorial District. A quasi-experimental study was conducted among 208 parents, of whom 204 completed the study (retention rate: 98.1%). The final sample comprised 102 participants in both the intervention and control groups. Parental acceptance of the HPV vaccine was measured using a validated questionnaire before and after a structured educational intervention delivered only to the intervention group. Data were analysed using Pearson chi-square tests, McNemar tests, and paired and independent t-tests. Effect sizes were calculated using Cohen's d, with statistical significance set at $p < 0.05$. The results indicated that baseline acceptance was similar between groups ($\chi^2 = 0.083$; $p = 0.773$). Post-intervention, high acceptance increased significantly in the intervention group (62.7% to 85.3%; McNemar $\chi^2 = 15.613$; $p < 0.001$) compared to controls (60.8% to 66.7%). Mean acceptance scores increased significantly in the intervention group from 5.86 ± 3.89 to 8.35 ± 2.82 ($t = -6.015$; $p < 0.001$; Cohen's $d = 0.68$) and were significantly higher than the control group post-intervention ($t = 3.806$; $p < 0.001$; Cohen's $d = 0.57$). Nurse-led education significantly improved parental acceptance of the HPV vaccine. Findings support integrating nurse-led health education into primary health care strategies to improve HPV vaccine uptake and cervical cancer prevention in similar settings.

| KEYWORDS

HPV vaccine, parental acceptance, nurse-led education, community-based intervention.

| ARTICLE INFORMATION

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1. Introduction

Limited parental acceptance of the human papillomavirus (HPV) vaccine contributes significantly to the low uptake of this preventive intervention in many African countries, including Nigeria. Human papillomavirus (HPV) infection is the primary cause of cervical cancer, a largely preventable disease that remains a major public health challenge globally, particularly in low- and middle-income countries (World Health Organization, 2023). Cervical cancer disproportionately affects women in sub-Saharan Africa, where incidence and mortality rates are among the highest

worldwide (International Agency for Research on Cancer, 2021b). In Nigeria, cervical cancer constitutes a substantial public health burden, with an estimated 12 075 new cases and 7 968 deaths in 2020, ranking as the second most common cancer among women (International Agency for Research on Cancer, 2021b). Despite the availability of safe and effective HPV vaccines, uptake remains suboptimal in many settings (International Agency for Research on Cancer, 2021a).

Parental acceptance plays a pivotal role in determining vaccine uptake among adolescents, as parents are the primary decision-makers regarding their children's health. Limited parental acceptance, often driven by inadequate knowledge, misconceptions about vaccine safety, and insufficient engagement with healthcare providers, continues to hinder optimal vaccination coverage (International Agency for Research on Cancer, 2021a). Nigerian research reveals similarly complex patterns: in Lagos, parental acceptance was high only when vaccines were offered free, with knowledge strongly associated with willingness to vaccinate (Rabiu et al., 2020); in Jos, even with low awareness of HPV and cervical cancer, most parents expressed willingness to have their children vaccinated when informed (Anyaka et al., 2024); and in Ibadan, parental intention to vaccinate adolescents was very high and linked to attitudes, norms, and perceived control (Balogun & Omotade, 2022). A cross-sectional study in Owerri found that about 77.5 % of caregivers intended to vaccinate their children, though knowledge gaps persisted, indicating room for educational interventions (Ezeogu et al., 2024).

Global evidence demonstrates wide variability in parental acceptance of HPV vaccination. A recent systematic review and meta-analysis reported acceptance rates ranging from 12.0 % to 97.5 %, with a pooled estimate for Africa of 79.6 % (95 % CI: 73.5–85.2) (Heyde et al., 2024). Systematic reviews have found that structured educational strategies consistently improve parental knowledge and acceptance, typically increasing acceptance by 10-20 percentage points (Lott et al., 2020).

Quasi-experimental studies further support the effectiveness of structured educational interventions. A school-based intervention in Indonesia significantly increased parental acceptability (from 74.3 % to 87.4 %) (Sitaresmi et al., 2020). In Nepal, a structured education programme improved acceptance from 40.3 % to 87.9 % (Dhakal et al., 2025), and in India, repeated health education sessions increased acceptance substantially (Dhinu et al., 2024). Culturally tailored educational interventions in Europe also resulted in improvements in parental vaccination intention (Ganczak et al., 2025). Collectively, these studies highlight the effectiveness of structured education in improving parental acceptance of HPV vaccination across diverse settings.

However, there remains limited community-based experimental evidence from Nigeria, particularly within primary health care contexts where nurses serve as frontline health educators and immunisation providers. Although HPV vaccination is a cost-effective strategy to prevent cervical cancer, Nigeria has yet to achieve optimal vaccine coverage among adolescents (Ngoma et al., 2021). Limited parental acceptance, particularly in rural and semi-urban communities, remains a major barrier. Many existing studies either lack control groups or are conducted in school-based environments that may not reflect routine community health service delivery. Given the central role of nurses in health promotion and preventive services, evaluating the effectiveness of nurse-led educational interventions within community settings is critical for informing scalable strategies to improve HPV vaccine uptake.

To the best of our knowledge, empirical evidence assessing the effect of structured nurse-led education on parental acceptance of the HPV vaccine within Kaduna North Senatorial District remains scarce. Without targeted, evidence-based interventions, suboptimal parental acceptance may continue to limit vaccine uptake and sustain preventable cervical cancer burden among future generations.

Therefore, this study aimed to evaluate the effect of a structured, nurse-led educational intervention on parental acceptance of the HPV vaccine in Kaduna North Senatorial District, Nigeria. Specifically, the study objectives were to: assess the level of parental acceptance of the HPV vaccine before and after the educational intervention, determine the effectiveness of the nurse-led intervention in improving parental acceptance, and compare post-

intervention acceptance between intervention and control groups. Evidence from this study will provide critical insights into the role of community-based nurse-led education in enhancing HPV vaccine acceptance in Nigeria and may guide strategies to improve vaccination coverage, contributing to cervical cancer prevention in African settings.

2. Literature Review

Evidence from low- and middle-income countries consistently demonstrates that structured educational interventions improve parental acceptance of HPV vaccination, although contextual and methodological variations influence outcomes.

In Indonesia, Sitaresmi et al. (2020) conducted a study among 504 parents of female primary school students, examining improvement of parents' awareness, knowledge, perception, and acceptability of HPV vaccination following a structured educational intervention. Their study demonstrated that HPV vaccine acceptability increased significantly from 74.3 % to 87.4 % ($p < 0.001$). A moderate positive correlation was observed between increased acceptability and improvements in awareness, knowledge, and perception ($r = 0.32–0.53$, $p < 0.001$). While the large sample size strengthens the generalisability of findings, the school-based setting may limit applicability to community primary healthcare contexts.

Dhakal et al. (2025) conducted a quasi-experimental one-group pre-test/post-test study in Bharatpur Metropolitan City, Nepal, among parents of adolescent girls aged 9–12 years. The structured educational intervention significantly improved parental acceptance from 40.3 % to 87.9 %. Although the magnitude of improvement was substantial, the absence of a control group limits causal inference, as external influences could not be fully excluded.

A broader perspective is provided by Heyde et al. (2024), whose systematic review and meta-analysis of 86 global studies reported wide variability in parental acceptance (12.0 %–97.5 %), with a pooled African estimate of 79.6 % (95 % CI 73.5–85.2). Education and healthcare provider engagement emerged as key predictors of high acceptance. However, most included studies were cross-sectional, limiting the ability to determine intervention effectiveness over time.

Ramezankhani and Bahrambeygi (2024), through a systematic review of thirteen quantitative, qualitative, and mixed-method studies, reported that educational interventions significantly increased HPV vaccine acceptability among adolescents and their parents. Interestingly, they observed that mothers' intention to vaccinate may be more responsive to educational interventions than fathers', suggesting potential gender-related differences in decision-making. While informative, the review highlighted heterogeneity in intervention design and outcome measurement, indicating the need for standardised, context-specific intervention models.

In India, Dhinu et al. (2024) conducted a quasi-experimental study among 70 parents in Bishnupur, Manipur, demonstrating that health education sessions significantly increased vaccine acceptance from 61.4 % at baseline to 81.4 % after the first session and 88.6 % after the third session ($p = 0.001$). The repeated-session design suggests that sustained engagement may produce cumulative improvements in acceptance. However, the relatively small sample size may limit external validity.

Within Nigeria, Rabiu et al. (2020) conducted a descriptive cross-sectional survey among 318 parents in Lagos and found that HPV vaccination was acceptable to most parents only if offered free of charge. Poor knowledge of cervical cancer, HPV infection, and the vaccine was identified as a barrier. However, as a cross-sectional study, it did not evaluate the effect of structured educational intervention on acceptance.

Furthermore, Lott et al. (2020), in a systematic review examining multi-component interventions globally, reported that educational components improved knowledge and acceptance by approximately 10–20 percentage points. Greater increases in uptake were observed when education was combined with reminders or healthcare provider recommendations, underscoring the importance of integrating education within healthcare delivery systems.

Collectively, existing literature demonstrates that structured educational interventions are effective in improving parental acceptance of HPV vaccination across diverse settings. However, several limitations are evident:

Many studies employed cross-sectional designs, limiting causal inference, several quasi-experimental studies lacked control groups, reducing internal validity. most interventions were conducted in school-based settings, rather than community and primary healthcare context. There is limited evidence evaluating nurse-led educational interventions within community-based primary health care systems in Nigeria, particularly using a quasi-experimental design with comparison groups. Despite Nigeria's high cervical cancer burden, empirical evidence assessing structured nurse-led interventions in rural and semi-urban communities remains scarce. Given the central role of nurses in immunisation services and health promotion within primary healthcare systems, evaluating the effectiveness of nurse-led community-based education is essential to inform scalable strategies for improving HPV vaccine uptake. Therefore, this study addresses an important gap by employing a quasi-experimental design with intervention and control groups to evaluate the effect of a structured nurse-led educational intervention on parental acceptance of HPV vaccination within Kaduna North Senatorial District, Nigeria.

3. Methods

3.1 Study Design

This study adopted quasi-experimental research using a pre-test and post-test control group design. The aim of using the pre-test and post-test control group design is to compare parents of adolescents exposed to a nurse-led educational intervention in the study group with those not exposed to the intervention (control group), to examine the effect of the intervention on the acceptance of the Human Papillomavirus (HPV) vaccine among parents of adolescents in communities within Kaduna North Senatorial District.

3.2 Study Setting

The study was conducted in selected communities within Kaduna North Senatorial District, Kaduna State, northwestern Nigeria. The district comprises eight Local Government Areas (LGAs), of which four were included in this study: Zaria and Sabon Gari (intervention group), and Makarfi and Soba (control group). Zaria and Sabon Gari are predominantly urban and semi-urban LGAs with diverse populations and established primary health care services. Makarfi and Soba are largely rural and agrarian communities. Based on 2025 projections, the combined population of the four LGAs exceeds 1.6 million residents. Each LGA has functional primary health care centres and health posts providing routine immunisation and maternal and child health services. The mix of urban and rural communities with operational primary health care structures provided an appropriate setting to evaluate the effect of a nurse-led educational intervention on parental acceptance of the HPV vaccine.

3.3 Study Population

The study population comprised parents of adolescents aged 9–14 years, in line with WHO recommendations for HPV vaccination, residing in communities within Zaria and Sabon Gari Local Government Areas (intervention LGAs) and Makarfi and Soba Local Government Areas (control LGAs) for at least one year. Based on national demographic patterns, the study population represents households with adolescents eligible for HPV vaccination within these four LGAs.

3.4 Sample size

The study population consisted of parents of adolescents in Kaduna North Senatorial District, Nigeria. The sample size was calculated using the formula for comparing two proportions to detect differences between the intervention and control groups. The calculation assumed a baseline (P_0) of 11% and an expected post-intervention improvement (P_1) of 26.6%, with a 95% confidence level, 80% statistical power, and a design effect of 2. An additional 10% was included to account for possible attrition. Based on these assumptions, a total sample size of 208 participants was obtained and included in the study.

3.5 Sampling Technique

A multistage sampling technique was employed to select study participants. Four Local Government Areas (LGAs): Zaria and Sabon Gari (intervention) and Makarfi and Soba (control) were randomly selected from the eight LGAs in Kaduna North Senatorial District. Within each selected LGA, approximately 30% of political wards and 30% of communities were randomly chosen. Systematic random sampling was then used to select households within these communities, with one parent of an adolescent aged 9–14 years recruited per household. The total sample of 208 participants was equally distributed across the four LGAs (52 per LGA), with sampling intervals calculated based on the estimated number of eligible households.

3.6 Instrument of Data Collection

The instrument for data collection was a structured questionnaire developed by the researchers for this study to obtain information from respondents on awareness. Section A consisted of items on the socio-demographic characteristics of the respondents. Section B consisted of ten (10) items designed to assess parental acceptance of the HPV vaccine. Responses were scored as Yes = 1 and No = 0. The total acceptance score was converted to percentages and categorized as ≤59% indicating low acceptance and ≥60% indicating high acceptance.

3.7 Validity of the instrument

The questionnaire was drafted by the researcher and reviewed by the supervisory team for content and face validity. It was further vetted by four experts in Statistics, Community Medicine, Public and Community Health Nursing, and Obstetrics & Gynaecology. The jurors evaluated content relevance, clarity, and alignment with study objectives. Their feedback was incorporated into the final version. Items were written in simple, clear language to ensure ease of understanding by respondents.

3.8 Reliability of Instrument

The questionnaire was pre-tested on 10% of the sample, among participants with characteristics similar to the study population but not included in the main study. Based on the pre-test findings, minor modifications were made to improve clarity and consistency. The internal consistency of the instrument was assessed using Cronbach's Alpha, which yielded a reliability coefficient of 0.822, indicating a high reliability. A Cronbach's Alpha of 0.70 or higher is considered acceptable for research instruments (Stevens, 2006).

3.9 Method of data collection

The data were collected between May to August 2025. The process was conducted in three phases: pre-intervention, intervention, and post-intervention.

Pre-Intervention Phase: Ethical approval was obtained from Ahmadu Bello University Teaching Hospital Health Research Ethics Committee (approval number ABUTHZ/HREC/C47/2025). Permission was also sought from the relevant Local Government Authorities and community leaders in the selected LGAs. Eight research assistants from primary healthcare centres were trained for two days to ensure understanding of the study objectives, methodology, and data collection procedures. Written informed consent was obtained from all participants, and confidentiality and anonymity were assured.

Intervention Phase: The intervention consisted of a structured, nurse-led health education programme delivered to parents of adolescents aged 9–14 years in their homes. The programme used lectures, visual aids, and interactive discussions to provide accurate information on HPV infection, HPV-related diseases, HPV vaccination (benefits, safety, eligibility), barriers to vaccination, and strategies to improve vaccine uptake. Sessions lasted approximately 40 minutes and included a question-and-answer segment to clarify misconceptions and address participant concerns. Educational materials and flyers were distributed to reinforce learning.

Post-Intervention Phase: Three months after the intervention, the same questionnaire used in the pre-test was administered to participants in both the intervention and control groups to assess changes in parental acceptance of the HPV vaccine. Reminder flyers were also distributed to encourage vaccination. Data from pre- and post-

intervention assessments were collated and analyzed to evaluate the effect of the nurse-led educational intervention.

3.10 Data analysis

Data collected were cleaned, coded, and entered into Microsoft Excel to ensure accuracy, completeness, and consistency. The cleaned dataset was then exported to the Statistical Package for the Social Sciences (SPSS) version 29 for statistical analysis. Both descriptive and inferential statistics were employed. Hypotheses was tested at a 5% level of significance. A p-value ≤ 0.05 was considered statistically significant and led to rejection of the null hypothesis, whereas a p-value > 0.05 indicated no statistically significant difference.

3.11 Ethics Consideration

Ethical approval was obtained from Ahmadu Bello University Teaching Hospital Health Research Ethics Committee (approval number ABUTHZ/HREC/C47/2025). The approval covered the larger study titled "Effect of Nurse-Led Educational Intervention Among Parents of Adolescents on Uptake of HPV Vaccine in Kaduna North, Nigeria." This manuscript reports findings specifically on parental acceptance. The study was conducted in accordance with the Declaration of Helsinki and the National Health Research Ethics Code of Nigeria. All participants were informed about the study, privacy, anonymity, and confidentiality was maintained and written informed consent was obtained after explaining the study objectives, procedures, potential benefits, and possible risks. Participation was voluntary, and participants were assured of their right to withdraw at any stage without penalty, and the study was conducted in accordance with the principles of the Declaration of Helsinki. All data collected were used solely for the purpose of this study and were securely stored and backed up on an encrypted computer with no internet access.

3.12 AI Statement

Generative AI tools were used for language editing and clarity enhancement. No AI tools were used in data generation, data analysis, or interpretation of results.

4. Results

Table 1: Distribution of both Studied Groups According to their Socio-Demographic Data.

Variable	Category	Intervention Group n (%)	Control Group n (%)	χ^2	p-value
Age (years)	20–24	1 (1.0%)	3 (2.9%)	4.885	0.180
	25–29	10 (9.8%)	13 (12.7%)		
	30–34	48 (47.1%)	57 (55.9%)		
	35 and above	43 (42.2%)	29 (28.4%)		
	Mean ± SD	**34.78 ± 4.784**	**33.34 ± 4.769**		
Sex of Parent	Male	12 (11.8%)	11 (10.8%)	0.049	0.825
	Female	90 (88.2%)	91 (89.2%)		
Religion	Islam	90 (88.2%)	98 (96.1%)	4.340	**0.037**
	Christianity	12 (11.8%)	4 (3.9%)		
Level of Education	No formal	12 (11.8%)	26 (25.5%)	12.222	**0.016**
	Primary	15 (14.7%)	18 (17.6%)		
	Quaranic	36 (35.3%)	38 (37.3%)		
	Secondary	17 (16.7%)	11 (10.8%)		
	Tertiary	22 (21.6%)	9 (8.8%)		
Occupation	Housewife	53 (52.0%)	51 (62.2%)	10.273	**0.036**
	Petty trader	23 (22.5%)	13 (15.9%)		
	Civil servant	15 (14.7%)	7 (8.5%)		
	Farmer	3 (2.9%)	9 (11.0%)		
	Student	8 (7.8%)	2 (2.4%)		
Marital Status	Married	99 (97.1%)	98 (96.1%)	0.205	0.903
	Divorced	1 (1.0%)	1 (1.0%)		
	Widowed	2 (2.0%)	3 (2.9%)		
Type of Family	Monogamous	35 (34.3%)	39 (38.2%)	0.339	0.560
	Polygamous	67 (51.5%)	63 (48.5%)		
No. of Female Adolescents (9–14 yrs)	1	77 (75.5%)	66 (64.7%)	3.864	0.425
	2	15 (14.7%)	23 (22.5%)		
	3	6 (5.9%)	10 (9.8%)		
	4	2 (2.0%)	2 (2.0%)		
	≥5	2 (2.0%)	1 (1.0%)		
Ethnicity	Hausa/Fulani	68 (66.7%)	95 (93.1%)	23.272	**0.001**
	Yoruba	18 (17.6%)	2 (2.0%)		
	Igbo	1 (1.0%)	0 (0%)		
	Others	15 (14.7%)	5 (4.9%)		
Length of Stay in Community	1–2 years	10 (9.8%)	5 (4.9%)	2.324	0.313
	3–4 years	21 (20.6%)	18 (17.6%)		
	≥5 years	71 (69.6%)	79 (77.5%)		

Table 1 shows the sociodemographic characteristics of respondents in the intervention and control groups. The mean age of respondents in the intervention group was 34.78 ± 4.784 years, while that of the control group was 33.78 ± 4.769 years. Most respondents were in the 30–34 years age group (47.1% study and 55.9% control). The difference in age distribution between the two groups was not statistically significant (χ^2 = 4.885, p= 0.180 > 0.05).

In terms of sex, the majority of respondents in both groups were females (88.2% study and 89.2% control), while males constituted 11.8% and 10.8% in the intervention and control groups, respectively. This difference was not statistically significant (χ^2 = 0.049, p 0.825 > 0.05).

With respect to religion, Islam was the predominant religion in both groups (88.2% intervention and 96.1% control), while Christianity accounted for 11.8% and 3.9% of respondents in the intervention and control groups, respectively. The difference was statistically significant (χ^2 = 4.340, p 0.0037 < 0.05).

Concerning education, Qur'anic education was the most common form of schooling reported (35.3% intervention and 37.3% control). However, a higher proportion of respondents in the control group had no formal education (25.5% and 11.8%), while the intervention group had more respondents with tertiary education (21.6% and 8.8%). This difference was statistically significant (χ^2 =12.222, p = 0.016 < 0.05). Regarding occupation, the majority of respondents were housewives (52.0% intervention and 62.2% control). Petty trading was more common in the intervention group (22.5% and 15.9%), while farming was higher in the control group (11.0% and 2.9%). The difference in occupation between the groups was statistically significant (χ^2 = 10.273, p =0.036 < 0.05).

Almost all respondents were married (97.1% intervention and 96.1% control), with very few reporting being divorced or widowed. There was no statistically significant difference between groups (χ^2 = 0.205, p =0.903 > 0.05). Type of family structure was comparable between the two groups, with a predominance of polygamous families (51.5% intervention and 48.5% control). This difference was not statistically significant (χ^2 = 0.339, p =0.560 > 0.05).

The number of female adolescents aged 9–14 years per household was largely one in both intervention (75.5%) and control groups (64.7%). A smaller proportion of households reported having two or more adolescent girls. The difference was not statistically significant (χ^2 = 3.864, p =0.425 > 0.05).

With respect to ethnicity, Hausa/Fulani was the dominant ethnic group in intervention and control groups, though significantly higher in the control group (93.1% and 66.7%). The intervention group was more ethnically diverse, with higher proportions of Yoruba (17.6%) and other minority groups (14.7%). This difference was statistically significant (χ^2 =23.272, p=0.001 < 0.05). Finally, the majority of respondents had resided in their community for at least five years (69.6% intervention and 77.5% control), with no statistically significant difference between groups (χ^2 = 2.324, p =0.313 > 0.05).

Table 2: Distribution of both studied Groups According to Parental Acceptance level of HPV Vaccine Before Intervention

Acceptance	Intervention	Control
Low acceptance (≤59)	38 (37.3%)	40 (39.2%)
High acceptance (≥60)	64 (62.7%)	62 (60.8%)
Pearson χ^2	0.083	
p-value	0.773	

Table 2 shows the distribution of parental acceptance of the HPV vaccine in both the study and control groups before the intervention. In the intervention group, 38 parents (37.3%) had low acceptance (≤59) and 64 parents (62.7%) had high acceptance (≥60), while in the control group, 40 parents (39.2%) had low acceptance and 62 parents (60.8%) had high acceptance. The difference between the groups was not statistically significant (χ^2 = 0.083, p = 0.773), indicating that both groups were comparable in terms of parental acceptance at baseline. The Pearson

chi-square test indicated no statistically significant difference in acceptance levels between the two groups before the intervention (χ^2 = 0.083, p = 0.773).

Table 3: Distribution of intervention group According to Parental Acceptance level of HPV Vaccine Before and After Intervention

Acceptance	Before	After
Low acceptance (≤59)	38 (37.3%)	15 (14.7%)
High acceptance (≥60)	64 (62.7%)	87 (85.3%)
McNemar χ^2	15.613	
p-value	0.000	

Table 3 presents the distribution of parental acceptance of the HPV vaccine in the intervention group before and after the nurse-led educational intervention. Before the intervention, 38 parents (37.3%) had low acceptance (≤59) and 64 parents (62.7%) had high acceptance (≥60). Following the intervention, the number of parents with low acceptance decreased to 15 (14.7%), while those with high acceptance increased to 87 (85.3%). This change was statistically significant (McNemar χ^2 = 15.613, p < 0.001), indicating that the nurse-led educational intervention effectively increased parental acceptance of the HPV vaccine.

Table 4: Distribution of both studied Groups According to Parental Acceptance level of HPV Vaccine After Intervention

Acceptance	Intervention	Control
Low acceptance (≤59)	15 (14.7%)	34 (33.3%)
High acceptance (≥60)	87 (85.3%)	68 (66.7%)
Pearson χ^2	9.696	
p-value	0.002	

Table 4 shows the distribution of parental acceptance of the HPV vaccine in both the intervention and control groups after the nurse-led educational intervention. In the intervention group, only 15 parents (14.7%) had low acceptance (≤59) compared to 34 parents (33.3%) in the control group, while 87 parents (85.3%) in the intervention group had high acceptance (≥60) compared to 68 parents (66.7%) in the control group. The difference between the groups was statistically significant (Pearson χ^2 = 9.696, p = 0.002), indicating that the nurse-led educational intervention effectively increased parental acceptance of the HPV vaccine compared to no intervention.

Table 5: Acceptance Score of HPV Vaccine in both intervention and Control Groups Before and After Intervention

Comparison	Mean Acceptance Score ± SD	Mean Difference	*t*-value	Df	*p*-value	Cohen's *d*
Paired *t*-test						
Study Group	Before: 5.86 ± 3.89 After: 8.35 ± 2.82	−2.49	−6.015	101	0.000	0.68
Control Group	Before: 5.50 ± 4.54 After: 6.37 ± 4.44	−0.87	−3.098	101	0.003	0.19
Independent *t*-test						
Before intervention	Study: 5.86 ± 3.89 Control: 5.50 ± 4.54	0.36	1.980	202	0.541	0.09
After intervention	Study: 8.35 ± 2.82 Control: 6.37 ± 4.44	1.98	3.806	202	0.000	0.57

Table 5 presents the comparison of parental mean acceptance score of the HPV vaccine and the hypothesis testing before and after the nurse-led educational intervention. The mean acceptance score of the HPV vaccine increased

significantly in both groups after the study, but the improvement was more pronounced in the intervention group. In the intervention group, the mean score increased from 5.86 ± 3.89 before the intervention to 8.35 ± 2.82 after the intervention, with a mean difference of −2.49, which was statistically significant (paired t = −6.015, df = 101, p < 0.001) and represented a moderate effect size (Cohen's d = 0.68). In the control group, the mean score increased slightly from 5.50 ± 4.54 to 6.37 ± 4.44, with a mean difference of −0.87, which was also statistically significant (paired t = −3.098, df = 101, p = 0.003), but the effect size was small (Cohen's d = 0.19).

Comparison between groups showed no significant difference in mean acceptance scores before the intervention (study: 5.86 ± 3.89 vs. control: 5.50 ± 4.54; t = 1.980, df = 202, p = 0.541, Cohen's d = 0.09), indicating the groups were comparable at baseline. However, after the intervention, the intervention group had a significantly higher mean score than the control group (8.35 ± 2.82 vs. 6.37 ± 4.44; t = 3.806, df = 202, p < 0.001), with a moderate effect size (Cohen's d = 0.57), demonstrating the effectiveness of the nurse-led educational intervention in increasing parental acceptance of the HPV vaccine.

The null hypothesis, which stated that there is no significant difference in the level of acceptance of the HPV vaccine among parents in Kaduna North Senatorial District before and after the health education intervention, was rejected. The significant increase in acceptance scores and the higher levels of parental acceptance in the intervention group after the educational program indicate that the nurse-led educational intervention effectively improved parental acceptance of the HPV vaccine.

5. Discussion

This study investigated parental acceptance of the HPV vaccine before and after the educational intervention. The findings revealed that at baseline (pre-test), 37.3 % of parents in the study group exhibited low acceptance (≤ 59), while 62.7 % demonstrated high acceptance (≥ 60). Following the intervention (post-test), high acceptance increased markedly to 85.3 %, whereas low acceptance declined to 14.7 %. This substantial improvement suggests that the nurse-led educational intervention was effective in enhancing parental acceptance of the HPV vaccine. In contrast, within the control group, low acceptance decreased slightly from 39.2 % at pre-test to 33.3 % post-test, while high acceptance rose modestly from 60.8 % to 66.7 %. The relatively smaller improvement in the control group compared with the study group indicates that the observed change in vaccine acceptance was largely attributable to the educational intervention rather than external factors.

For within-group analysis, a paired t-test was conducted. In the study group, the mean acceptance score increased significantly from 5.86 ± 3.89 (pre-intervention) to 8.35 ± 2.82 (post-intervention), with a mean difference of –2.49. This increase was statistically significant (t = –6.015, df = 101, p < 0.001), confirming that the educational intervention effectively improved parental acceptance of the HPV vaccine. Similarly, in the control group, a statistically significant increase was also observed, with mean acceptance scores rising from 5.50 ± 4.54 (pre-intervention) to 6.37 ± 4.44 (post-intervention), resulting in a mean difference of –0.87 (t = –3.098, df = 101, p = 0.003). Although significant, the magnitude of improvement in the control group was smaller compared to the study group.

For between-group analysis, an independent t-test was used. At baseline (pre-intervention), there was no significant difference in acceptance scores between the study group (5.86 ± 3.89) and the control group (5.50 ± 4.54) (t = 1.98, df = 202, p = 0.541), suggesting that both groups were comparable prior to the intervention. However, at post-intervention, a statistically significant difference was observed between the study group (8.35 ± 2.82) and the control group (6.37 ± 4.44), with a mean difference of 1.98 (t = 3.806, df = 202, p < 0.001), indicating that parents in the study group demonstrated greater acceptance of the HPV vaccine compared to those in the control group after the intervention.

These results align with findings from other quasi-experimental and cross-sectional studies. For example, in Owerri, Nigeria, mothers' acceptance and intention to vaccinate were high despite gaps in knowledge, suggesting that

educational interventions tailored to local contexts can increase acceptance (Ezeogu et al., 2024). Similarly, acceptance in Lagos was higher when vaccines were free and when parents understood HPV and cervical cancer, underscoring the importance of cost and knowledge in decision-making (Rabiu et al., 2020). In Jos, although knowledge was low, a high proportion of parents were willing to vaccinate when provided basic information, indicating a positive attitude toward preventive health measures (Anyaka et al., 2024). These findings corroborate the present study's demonstration that structured educational interventions can significantly enhance acceptance in community settings.

On a broader scale, global evidence shows that structured educational strategies and healthcare provider recommendations enhance HPV vaccine acceptance and intention (Heyde et al., 2024; Lott et al., 2020). The alignment of the present findings with international research suggests that nurse-led education combining information delivery with interpersonal engagement can be particularly effective in similar socio-cultural contexts.

5.1 Study Limitations

This study had some limitations that should be considered when interpreting the findings. First, the use of a quasi-experimental design without randomization may limit the ability to establish causality between the nurse-led educational intervention and HPV vaccine uptake. Secondly, the study was conducted in selected LGAs of Kaduna North Senatorial District, which may limit the generalizability of the findings to other regions of Nigeria with different cultural, social, or health infrastructure contexts. Finally, although the post-intervention assessment was conducted six months after the pre-intervention survey, the study did not assess long-term vaccine adherence beyond this period, so the sustainability of the observed effects remains unknown.

6. Conclusion

In conclusion, the nurse-led educational intervention significantly improved parental acceptance of the HPV vaccine in Kaduna North Senatorial District. These findings support the incorporation of structured community-based education, particularly delivered by frontline primary health care nurses, into broader immunisation strategies to enhance HPV vaccine uptake and to improve adolescent vaccination coverage in Nigeria. Integrating nurse-led education with community and primary health care outreach services, cost-reducing policies, and provider recommendation efforts may contribute to sustainable improvements in vaccination coverage and cervical cancer prevention in similar resource-limited settings.

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Declarations

Ethics Approval and Consent to Participate: This study was approved by the Ethics Committee of Ahmadu Bello University Teaching Hospital Health Research Ethics Committee (ABUTH-HREC, approval number ABUTHZ/HREC/C47/2025). Written informed consent was obtained from all participants prior to data collection.

Consent for Publication: Not applicable.

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Author Contributions:

Shatu Ishaku (S I): Conceptualization, data collection, analysis, and drafted the manuscript.

Hadiza Mohammed Sani (H M S): Contributed to study design, conceptualized the manuscript title, provided supervision, and critically revised the manuscript.

Hayat Imam Gommaa (H I G): Provided overall supervision, contributed to study methodology, revised the manuscript, and approved the final version.

Mfuh Anita Y. Lukong (M Y L): Provided supervision, contributed to study methodology, revised the manuscript.

Ishaku Hassan (I H): Provided guidance, critical review, and final approval as senior author.

All authors read and approved the final manuscript.

AI Statement: The authors declare that generative artificial intelligence (AI) tools (ChatGPT) were used solely for language editing and improvement of clarity during manuscript preparation. The AI tool was not used for study design, data collection, data analysis, data interpretation, or generation of scientific content. All intellectual content, interpretation of findings, and conclusions are the sole responsibility of the authors.

Disclaimer: The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of their institutions.

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