Adejimi *et al.,* Babcock Univ. Med. J.2026 9(2):335-348
https://doi.org/10.38029/babcockuniv.med.j..v9i2.1448
eISSN: 2756-4657

RESEARCH ARTICLE OPEN ACCESS

Sociodemographic correlates of knowledge, attitudes, and perceptions of HPV infection and vaccination among fathers in an urban area of Lagos State, Nigeria: A cross-sectional study

Fathers and HPV vaccination of adolescents

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Submitted: 3rd March 2026
Accepted: 9th April 2026
Published: 30th June 2026

ID: Orcid ID

Abstract

Objective: Human papillomavirus (HPV) is a common sexually transmitted infection linked to several preventable cancers in both males and females. Fathers play key roles in family health decisions, including HPV vaccination uptake. This study assessed sociodemographic factors associated with knowledge, attitudes, and perceptions regarding HPV infection and vaccination among fathers in Eti-Osa LGA, Lagos State, Nigeria.

Method: A cross-sectional study was conducted among 338 fathers of adolescents selected using a multistage sampling. Data were collected using interviewer-administered questionnaires and analysed using SPSS version 23. Knowledge, attitudes, and perceptions scores were graded as percentages and categorised as good or poor, with 50% as the cut-off. Descriptive statistics, chi-square tests, and multivariable logistic regression were used at 5% significance level.

Results: The mean age was 51.7 ± 7.9 years. Less than half (46.8%) had good knowledge, while the majority had poor attitudes (78%) and poor perceptions (82%) regarding the HPV vaccine. Multivariable analysis showed that fathers aged 61–70 years had higher odds of good knowledge (aOR=5.49; p=0.021), while those aged 41–50 years had better perception (aOR=22.05; p=0.007). Secondary education predicted good knowledge (aOR=3.56; p=0.004) and good attitude (aOR=11.89; p<0.001). Unmarried fathers had lower odds of a good attitude (aOR=0.24; p=0.019) and perception (aOR=0.06; p=0.012). Manual workers were more likely to have good attitudes (aOR=23.43; p<0.001).

Conclusion: Fathers demonstrated poor knowledge and attitudes toward HPV vaccination, influenced by age, education, and marital status. Targeted educational interventions are needed to address misconceptions and improve vaccine acceptance.

Keywords: Adolescent Health, Fathers, Health Knowledge, HPV Vaccination, Human Papillomavirus

Plain English Summary

Human papillomavirus (HPV) is a common infection that can cause several cancers in both men and women, including cervical cancer, penile cancer, and oral cavity cancers. Vaccination can prevent most HPV-related cancers, but parents' understanding and beliefs strongly influence whether children

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receive the vaccine. In many families, fathers play an important role in healthcare decisions. This study surveyed 338 fathers of adolescents in Eti-Osa Local Government Area of Lagos State, Nigeria, to understand the sociodemographic factors associated with their knowledge, attitudes, and perceptions about HPV infection and the HPV vaccine. Fewer than half had good knowledge about HPV and its vaccine, while over half had limited knowledge. Most fathers showed poor attitudes toward HPV vaccination. Most of the fathers had poor perceptions of the HPV infection and vaccines. Education level, occupation, and marital status were linked to differences in knowledge and attitudes, while religion, ethnicity, and income were not.
Overall, the findings show important knowledge gaps and misconceptions among fathers. Providing clear, father-focused health education may help improve understanding, address concerns about safety and cost, and support informed decisions about HPV vaccination.

Background

Human papillomavirus (HPV) infection is the most common sexually transmitted infection (STI) globally and is the most important risk factor for cervical cancer (1). HPV infects epithelial cells of the skin and mucosa and can induce cellular transformation that may result in cancers of the cervix, vulva, vagina, anus, oropharynx, and penis (2). More than 150 HPV types have been identified, of which approximately 40 infect the anogenital and oropharyngeal regions. High-risk oncogenic strains, particularly types 16 and 18, are responsible for most cervical cancer cases, while low-risk types 6 and 11 cause most genital warts (2). The highest incidence and mortality rates from cervical cancer occur in low- and middle-income countries, with Nigeria accounting for approximately 10% of the global cervical cancer burden (3). In 2020, 604,127 new cases and 341,831 deaths from cervical cancer were recorded worldwide, making it the fourth most common cancer and cause of cancer-related deaths among women (3, 4). In Nigeria, cervical cancer is the third most common cancer and the second leading cause of cancer-related deaths among women aged 15–44 years, with approximately 12,075 new cases and 7,968 deaths reported in 2020 (5).

HPV is highly transmissible, and most sexually active individuals will acquire the infection at some point in their lifetime in the absence of vaccination. The introduction of prophylactic HPV vaccines has substantially advanced global prevention efforts by reducing infection rates and HPV-related diseases. Accordingly, the World Health Organisation (WHO) recommends routine HPV vaccination for girls before sexual debut as a cornerstone strategy for the primary prevention of cervical cancer (6). The quadrivalent vaccine was licensed in 2006, followed by the bivalent vaccine in 2009, and the nonavalent vaccine in 2014 (7). However, data from global analyses indicate that HPV vaccination coverage remains well below the World Health Organisation's target of 90%, with first-dose coverage estimates around 27% and full-dose coverage near 20% globally (8).

In Nigeria, the HPV vaccine has recently been introduced into the National Programme on Immunisation (NPI), targeting approximately 7.7 million girls (9). This represents one of the largest single-round HPV vaccination efforts in the African region, aimed at preventing infections caused by high-risk HPV strains implicated in nearly all cases of cervical cancer (9). Knowledge and awareness of HPV infection and vaccination vary globally, including among fathers. In Italy, fathers demonstrated relatively high awareness: 76.9% had heard of HPV, 88% considered it dangerous, 99.4% knew it was sexually transmitted, and 86.7% understood that vaccination prevents cervical cancer; however, only 12% recognized its role in preventing sexually transmitted infections (10). In contrast, a study in Jakarta reported that only 32.4% of men had good knowledge of HPV, cervical cancer, and HPV vaccination, although 75.2% expressed good attitudes toward vaccination (11). Another study in Nigeria found that only 45.9% of fathers had knowledge of HPV and HPV vaccines, and education level significantly influenced attitudes toward vaccination (12). HPV vaccination initiatives have faced opposition in several countries. Cultural and religious beliefs have contributed to misconceptions, including the belief that abstinence before marriage eliminates the need for vaccination. Misconceptions, such as the belief that vaccination promotes promiscuity or sexual risk-taking among adolescents, and concerns about vaccine safety, have also contributed to hesitancy. Parental knowledge, therefore, plays a critical role in vaccine uptake, and parents of adolescents require an adequate understanding of HPV transmission, prevention, and vaccine efficacy to make informed decisions (13, 14, 15, 16). This study, therefore, aimed to assess the correlates of fathers' knowledge, attitudes, and perceptions regarding HPV infection and their willingness to vaccinate their adolescent children.

Materials and Methods

Study Design and Setting

A descriptive cross-sectional study was conducted among fathers of adolescent children

in Eti-Osa Local Government Area (LGA), Lagos State, from March 2023 to August 2023. Eti-Osa LGA is one of the 20 LGAs in Lagos State and is known for its ethnically diverse population, with residents representing various Nigerian ethnic groups. According to the National Population Commission of Nigeria, the estimated population of Eti-Osa LGA in 2021 was approximately 460,000 (17). The area features a mix of high-density urban settlements and affluent residential zones, served by a network of public primary health centres and private facilities. Notably, the study coincided with Nigeria's 2023 phased national introduction of the 1-dose Human Papillomavirus (HPV) vaccine into the Routine Immunisation schedule. Within Lagos State, this government-led effort involved large-scale school-based outreaches and community-level mobilisation (18).

Study Population, Sample Size Calculation, and Sampling Technique

The study population comprised fathers of adolescents residing in Eti-Osa LGA, Lagos State. Inclusion criteria were fathers who had at least one adolescent child aged 10–17 years and who had resided in Eti-Osa LGA for at least six months. Fathers who were temporary residents, mentally incapable of providing reliable information, or who had previously participated in similar studies were excluded to prevent duplication of data.

The minimum sample size for the study was determined using Cochran's formula for estimating a single population proportion:

$$n_0 = \frac{Z^2 p(1-p)}{d^2}$$

where n_0 is the minimum sample size, Z is the standard normal deviate corresponding to a 95% confidence level (1.96), p is the estimated prevalence from previous literature, and d is the margin of error. An estimated prevalence (p) of 73.4% (19) was used based on a prior Nigerian study on fathers' willingness to vaccinate their children, and a precision (d) of 5% was used. Substituting into the formula:

$$n_0 = \frac{(1.96)^2 \times 0.734 \times 0.266}{(0.05)^2} \approx 300$$

To account for a potential 10% non-response rate, the sample size was adjusted using:

$$n = \frac{n_0}{1 - 0.10}$$

$$n = \frac{300}{0.90} \approx 330$$

The minimum sample size calculated was 330 respondents after rounding off to the nearest whole number; however, 338 fathers were finally included in the study.

A multistage sampling technique was employed to select participants. In Stage 1, four of the ten administrative wards in Eti-Osa LGA were selected using simple random sampling by balloting (Ilado/Eti-Osa, Ado/Langbasa/Badore, Ilasan Housing Estate, and Ajah/Sangotedo). In Stage 2, five streets were selected from each ward using simple random sampling. In Stage 3, 15 houses were selected per street using systematic sampling. With an average of 50 houses per street, a sampling interval of three was calculated (50/15 ≈ 3), and every third house was selected after determining a random starting point by balloting. In Stage 4, where multiple households were present within a house, one household was selected by simple random sampling. One eligible father was recruited per selected household until the required sample size per street was achieved.

Data Collection

Data were collected using a structured, five-section interviewer-administered questionnaire. The questionnaire covered socio-demographic characteristics and assessed knowledge, attitudes, perceptions, and willingness regarding HPV infection and HPV vaccination. A pre-test of the questionnaire was conducted among 10% of the calculated sample size in Ibeju-Lekki, a Local Government Area with similar demographic characteristics to the study setting. The pre-test was used to assess the clarity, relevance, and reliability of the instrument, and necessary adjustments were made before the main study.

Data Analysis

Data were entered and analysed using the Statistical Package for the Social Sciences (SPSS) version 23 (20). All information was handled confidentially. Socio-demographic characteristics and responses were summarised using frequencies and percentages. Associations between independent variables (socio-demographic characteristics) and dependent variables (knowledge, attitude, perception, and willingness to vaccinate) were assessed using Chi-square tests or Fisher's exact tests, as appropriate. A p-value of <0.05 was considered statistically significant.

Scoring of Study Variables

Knowledge was assessed using 22 questions. A raw scoring system was applied, with one (1) point awarded for each correct response and zero (0) for each incorrect response. Participants who answered 50% or more of the questions correctly were categorised as having good knowledge, while those scoring below 50% were classified as having poor knowledge. Attitude was assessed using 15 items on a five-point Likert scale: Strongly Agree (5), Agree (4), Neither Agree nor Disagree (3), Disagree (2), and

Strongly Disagree (1). There were 11 positively worded items and 4 negatively worded items. Negative items were reverse-scored so that a score of 5 consistently represented the most favourable attitude toward HPV vaccination across items. The total obtainable score ranged from 15 to 75 points. Participants scoring 37.5 points or above (≥50%) were categorised as having a good attitude, while those scoring below 37.5 were categorised as having a poor attitude. Perception was assessed using 11 items on a five-point Likert scale with the same scoring structure as the attitude section. Seven items were positively worded, and four were negatively worded, with reverse scoring applied to negative items. The total obtainable score ranged from 11 to 55 points. Participants scoring 27.5 points or above (≥50%) were categorised as having good perception, while those scoring below 27.5 were categorised as having poor perception.

Results

A total of 338 fathers participated in the study, with a mean age of 51.73±7.86 years. The majority was predominantly middle-aged (82.2% were between 41 and 60 years), married (90.8%), and Christian (83.4%). Regarding ethnicity, nearly half were Yoruba (48.5%), followed by Igbo (29.0%). Notably, the study population was highly educated, with 78.7% of respondents and 76.6% of their wives having attained tertiary-level education. Occupationally, the largest groups were categorised as professionals (40.5%) or manual-skilled workers (32.0%). (Table 1)

Table 1: Socio-Demographic Characteristics of Respondents

Variables	Frequency (n=338)	Percentage (%)
Age(years)		
≤40	22	6.5
41-50	136	40.2
51-60	142	42.0
61-70	33	9.8
≥71	5	1.5
Mean age ± SD (51.73 ±7.86)		
Marital Status		
Single	15	4.4
Married	307	90.8
Separated	8	2.4
Divorced	5	1.5
Widowed	3	0.9
Religion		
Christianity	282	83.4
Islam	51	15.1
Traditional	5	1.5
Ethnicity		
Yoruba	164	48.5
Hausa	12	3.6
Igbo	98	29.0
Others	64	18.9
Educational status		
No formal education	7	2.0
Primary	9	2.7
Secondary	56	16.6
Tertiary	266	78.7
Occupational Status		
Intermediate	70	20.7
Manual-skilled	108	32.0
Non-manual skilled	23	6.8
Professional	137	40.5
Wife's educational status		
No formal education	3	0.9
Primary	7	2.1
Secondary	69	20.4
Tertiary	259	76.6

Less than half of the respondents (46.8%) demonstrated good knowledge of HPV infection and its vaccines, while the majority (53.2%) had poor knowledge. Most respondents (78%) exhibited poor attitudes toward HPV infection and vaccination, while only 22% demonstrated good attitudes. The majority (82%) of the respondents also demonstrated poor perceptions of HPV infections and the vaccine, while only 18% of them had good perceptions. (Figure 1).

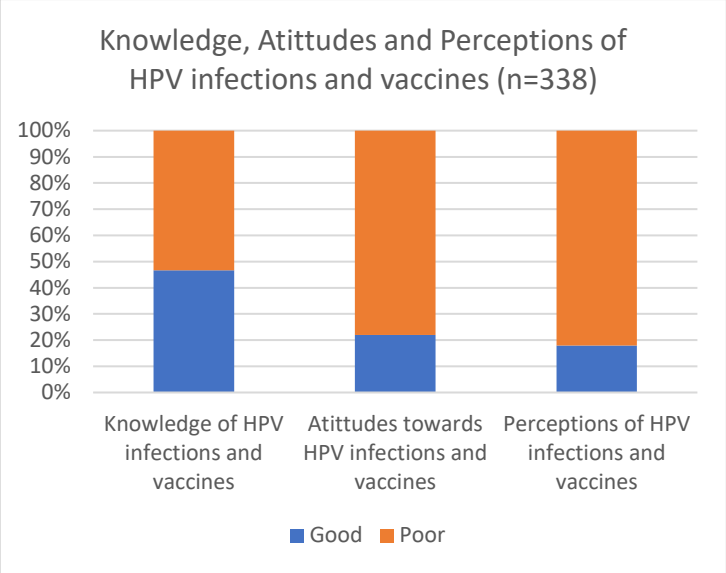


Figure 1: Knowledge, attitudes, and perceptions of HPV infection and vaccines among the respondents

Statistically significant associations were observed between specific sociodemographic characteristics and the primary outcome variables (Table 2). Knowledge of HPV was significantly associated with marital status (χ 2=12.323, p=0.015), with a higher proportion of respondents with good knowledge among single (100%) and divorced (66.7%) respondents compared to their married or widowed counterparts.

Table 2: Association between socio-demographic characteristics and knowledge of HPV infection and Vaccines

Variables	Knowledge of HPV infection and vaccines			Statistic	
	Good n (%) n=158	Poor n (%) n=180	Total n (%) n=338	Chi-square (χ^2)	p-value
Age (years)					
≤40	10(45.5)	12(54.5)	22(100.0)	3.172**	0.530
41-50	64(47.1)	72(52.9)	136(100.0)		
51-60	64(45.1)	78(54.9)	142(100.0)		
61-70	19(57.6)	14(42.4)	33(100.0)		
≥71	1(20.0)	4(80.0)	5(100.0)		
Marital Status					
Single	5(100.0)	00.0) (	5(100.0)	12.323**	0.015*
Married	141(45.9)	166(54.1)	307(100.0)		
Divorced	10(66.7)	5(33.3)	15(100.0)		
Separated	2(25.0)	6(75.0)	8(100.0)		
Widowed	0(0.0)	3(100.0)	3(100.0)		
Religion					
Christianity	130(46.1)	152(53.9)	282(100.0)	2.270**	0.321
Islam	27(52.9)	24(47.1)	51(100.0)		
Traditional	1(20.0)	4(80.0)	5(100.0)		
Ethnicity					
Yoruba	77(47.0)	87(53.0)	164(100.0)	.343	0.952
Igbo	47(48.0)	51(52.0)	98(100.0)		
Hausa	6(50.0)	6(50.0)	12(100.0)		
Others	28(43.8)	36(56.3)	64(100.0)		

Educational status					
None	1(14.3)	6(85.7)	7(100.0)	5.583	0.134
Primary	4(44.4)	5(55.6)	9(100.0)		
Secondary	32(57.1)	24(42.9)	56(100.0)		
Tertiary	121(45.5)	145(54.5)	266(100.0)		
Average monthly income (₦)					
≤100,000	25(43.1)	33(56.9)	58(100.0)	1.285	0.733
100,001-500,000	92(48.4)	98(51.6)	190(100.0)		
500,001-1,000,000	27(49.1)	28(50.9)	55(100.0)		
>1000000	14(40.0)	21(60.0)	35(100.0)		
Number of children					
1—3	77(44.3)	97(55.7)	174(100.0)	2.254	0.324
4—6	74(51.0)	71(49.0))	145(100.0)		
≥7	7(36.8)	12(63.2	19(100.0)		

**Statistically significant association (p≤0.05); **Fischer's Exact Test*

Regarding attitudes, educational attainment showed a significant association (χ2=22.097, p=0.001), where respondents with primary (55.6%) and secondary (41.1%) education unexpectedly exhibited better attitudes than those with tertiary education (16.9%). Occupational status was also significantly associated with attitude (χ2 =21.048, p=0.001), with manual-skilled and intermediate workers demonstrating higher levels of positivity than professionals (10.2%) (Table 3).

Table 3: Association between socio-demographic characteristics and attitude towards HPV infection and vaccines

Variables	Attitudes towards HPV infection and vaccines			Statistic	
	Good n (%) n=74	Poor n (%) n=264	Total n (%) n=338	Chi-square (χ^2)	p-value
Age (years)					
≤40	2(9.1)	20(90.9)	22(100.0)	3.257**	0.516
41-50	28(20.6)	108(79.4)	136(100.0)		
51-60	36(25.4)	106(74.6)	142(100.0)		
61-70	7(21.2)	26(78.8)	33(100.0)		
≥71	1(20.0)	4(80.0)	5(100.0)		
Marital Status					
Single	3(20.0)	12(80.0)	15(100.0)	7.372**	0.117
Married	68(22.1)	239(77.9)	307(100.0)		
Divorces	0(0.0)	8(100.0)	8(100.0)		
Separated	3(60.0)	2(40.0)	5(100.0)		
Widowed	0(0.0)	3(100.0)	3(100.0)		
Religion					
Christianity	59(20.9)	223(79.1)	282(100.0)	3.243**	0.198
Islam	15(29.4)	36(70.6)	51(100.0)		
Traditional	0(0.0)	5(100.0)	5(100.0)		
Tribe					
Yoruba	37(22.6)	127(77.4)	164(100.0)	0.247	0.970
Hausa	2(16.7)	10(83.3)	12(100.0)		
Igbo	21(21.4)	77(78.6)	98(100.0)		
Others	14(21.9)	50(78.1)	64(100.0)		
Educational Status					
None	1(14.3)	6(85.7)	7(100.0)	22.097	0.001*
Primary	5(55.6)	4(44.4)	9(100.0)		
Secondary	23(41.1)	33(58.9)	56(100.0)		
Tertiary	45(16.9)	221(83.1)	266(100.0)		
Occupational Status					
Intermediate	17(24.3)	53(75.7)	70(100.0)	21.048	0.001
manual-skilled	37(34.3)	71(65.7)	108(100.0)		
non-manual skilled	6(26.1)	17(73.9)	23(100.0)		
Professional	14(10.2)	123(89.8)	137(100.0)		

**Statistically significant (p≤0.05): **Fischer's Exact Test*

Perception of HPV was significantly influenced by marital status (χ2=9.742, p=0.045) and educational status (χ2=13.148, p=0.004), following similar trends where single respondents (60.0%) and those with lower formal education levels reported higher proportions of good perception. Additionally, age demonstrated a borderline significant association with perception (χ2 =9.283, p=0.054), peaking among respondents aged 41–50 years (24.3%) (Table 4).

Table 4: Association between socio-demographic characteristics and perception of HPV infection and vaccines

Variables	Perceptions of HPV infection and vaccines			Statistic	
	Good n (%) n=61	Poor n (%) n=277	Total n (%) n=338	Chi-square (χ^2)	p-value
Age (years)					
≤40	1(4.5)	21(95.5)	22(100.0)	9.283**	0.054*
41-50	33(24.3)	103(75.7)	136(100.0)		
51-60	24(16.9)	118(83.1)	142(100.0)		
61-70	3(9.1)	30(90.9)	33(100.0)		
≥71	0(0.0)	5(100.0)	5(100.0)		
Marital Status					
Single	3(60.0)	2(40.0)	5(100.0)	9.742**	0.045*
Married	57(18.6)	250(81.4)	307(100.0)		
Divorced	1(6.7)	14(93.3)	15(100.0)		
Separated	0(0.0)	8(100.0)	8(100.0)		
Widowed	0(0.0)	3(100.0)	3(100.0)		
Religion					
Christianity	47(16.7)	235(83.3)	282(100.0)	4.514**	0.105
Islam	14(27.5)	37(72.5)	51(100.0)		
Traditional	0(0.0)	5(100.0)	5(100.0)		
Ethnicity					
Yoruba	28(17.1)	136(82.9)	164(100.0)	0.648	0.885
Igbo	19(19.4)	79(80.6)	98(100.0)		
Hausa	3(25.0)	9(75.0)	12(100.0)		
Others	11(17.2)	53(82.8)	64(100.0)		
Educational status					
None	1(14.3)	6(85.7)	7(100.0)	13.148	0.004*
Primary	5(55.6)	4(44.4)	9(100.0)		
Secondary	15(26.8)	41(73.2)	56(100.0)		
Tertiary	40(15.0)	226(85.0)	266(100.0)		
Average monthly income (₦)					
≤100,000	6(10.3)	52(89.7)	58(100.0)	3.612	0.307
100,001-500,000	36(18.9)	154(81.1)	190(100.0)		
500,001-1000000	13(23.6)	42(76.4)	55(100.0)		
>1,000,000	6(17.1)	29(82.9)	35(100.0)		
Number of children					
1—3	33(19.0	141(81.0	174(100.0	0.435**	0.805
4—6	24(16.6	121(83.4	145(100.0		
≥7	4(21.1	15(78.9	19(100.0		

**Statistically significant association (p≤0.05); **Fischer's Exact Test*

Multivariable logistic regression analysis identified several independent predictors across the domains of knowledge, attitude, and perception regarding HPV infection and vaccination (Table 5). Age was a significant factor, as fathers aged 61–70 years had over five times higher odds of good knowledge (aOR=5.49; 95% CI: 1.29–23.44; p=0.021) compared to those under 40, while those aged 41–50 years were significantly more likely to have a good perception (aOR=22.05; 95% CI: 2.31–210.55; p=0.007). Educational status showed a consistent association; respondents with secondary education had higher odds of

good knowledge (aOR=3.56; 95% CI: 1.51–8.37; p=0.004) and good attitude (aOR=11.89; 95% CI: 4.53–31.22; p<0.001) than those with tertiary education, while those with primary or no formal education also demonstrated higher odds of good perception (aOR=6.86; 95% CI: 1.64–28.65; p=0.008). Fathers with 4-6 children had twice the odds of good knowledge (aOR=2.15; 95% CI: 1.18–3.91; p=0.012).

Marital status was a determinant for attitude, with unmarried fathers showing significantly reduced odds of both a good attitude (aOR=0.24; 95% CI: 0.07–0.79; p=0.019) and a good perception (aOR=0.06; 95% CI: 0.01–0.53; p=0.012) compared to their married counterparts. For attitude, respondents with secondary education (aOR=11.89; 95% CI: 4.53–31.22; p<0.001) and those with primary/no formal education (aOR=5.03; 95% CI: 1.43–17.60; p=0.012) had significantly higher odds of good attitudes compared to those with tertiary education. In addition, manual-skilled workers were 23 times more likely to hold good attitudes than professionals (aOR=23.43; 95% CI: 8.33–65.88; p<0.001),

Regarding perception, respondents aged 41–50 years had significantly higher odds of good perception (aOR=22.05; 95% CI: 2.31–210.55; p=0.007), while those with primary or no formal education also showed increased likelihood (aOR=6.86; 95% CI: 1.64–28.65; p=0.008). Non-Yoruba respondents had higher odds of good perception (aOR=5.46; 95% CI: 1.81–16.43; p=0.003).

Table 5: Multivariable logistic regression analysis for predictors of good attitude, good perception, and good knowledge

Predictor Variable	Category	Adjusted Odds Ratio (aOR)	95% Confidence Interval (CI)	p-value
Good attitude				
Age (years)	< 40	1.00 (Ref)	-	-
	41–50	2.44	0.53 – 4.75	0.414
	51–60	0.79	0.12 – 5.22	0.805
	61+	3.24	0.40 – 26.52	0.272
Marital Status	Married	1.00 (Ref)	-	-
	Others†	0.24	0.07 – 0.79	0.019*
Religion	Christianity	1.00 (Ref)	-	-
	Others‡	0.56	0.20 – 1.53	0.255
Tribe	Yoruba	1.00 (Ref)	-	-
	Others	0.37	0.11 – 1.23	0.105
Education	Tertiary	1.00 (Ref)	-	-
	Secondary	11.89	4.53 – 31.22	<0.001*
	Primary/None	5.03	1.43 – 17.60	0.012*
Occupation	Professional	1.00 (Ref)	-	-
	Manual-Skilled	23.43	8.33 – 65.88	<0.001*
	Intermediate	5.30	2.19 – 12.83	<0.001*
Good perception				
Age (years)	< 40	1.00 (Ref)	-	-
	41–50	22.05	2.31 – 210.55	0.007*
	51–60	4.08	0.39 – 42.60	0.241
	61+	3.72	0.33 – 41.48	0.285
Marital Status	Married	1.00 (Ref)	-	-
	Single	4.82	0.70 – 33.06	0.110
	Others†	0.06	0.01 – 0.53	0.012*
Religion	Christianity	1.00 (Ref)	-	-
	Others	1.81	0.51 – 6.46	0.361
Ethnicity	Yoruba	1.00 (Ref)	-	-
	Others	5.46	1.81 – 16.43	0.003*
Education	Tertiary	1.00 (Ref)	-	-
	Secondary	2.17	0.58 – 8.02	0.247
	Primary/None	6.86	1.64 – 28.65	0.008*
Monthly Income (₦)	100,000–500,000	1.00 (Ref)	-	-
	< 100,000	0.48	0.13 – 1.84	0.285
	> 500,000	0.71	0.17 – 2.93	0.632
No. of Children	1–3	1.00 (Ref)	-	-
	4–6	1.02	0.26 – 3.89	0.983

	7+	0.72	0.14 – 3.82	0.701
Good knowledge				
Age (years)	< 40	1.00 (Ref)	-	-
	41–50	1.58	0.53 – 4.75	0.414
	51–60	1.44	0.47 – 4.40	0.524
	61–70	5.49	1.29 – 23.44	0.021*
	≥71	0.99	0.08 – 12.58	0.993
Marital Status	Married	1.00 (Ref)	-	-
	Single**	>999.9	-	0.999
	Divorced	1.85	0.57 – 6.02	0.308
	Separated	0.20	0.03 – 1.29	0.091
	Widowed**	<0.001	-	0.999
Education	Tertiary	1.00 (Ref)	-	-
	None	0.13	0.01 – 1.19	0.071
	Primary	1.98	0.41 – 9.66	0.398
	Secondary	3.56	1.51 – 8.37	0.004*
Monthly Income (₦)	100,000–500,000	1.00 (Ref)	-	-
	< 100,000	0.47	0.20 – 1.10	0.080
	500,000–1,000,000	0.95	0.44 – 2.04	0.896
	> 1,000,000	0.75	0.31 – 1.82	0.528
No. of Children	1–3	1.00 (Ref)	-	-
	4–6	2.15	1.18 – 3.91	0.012*
	7+	1.26	0.41 – 3.86	0.689

*Statistically significant at $p < 0.05$. †Includes Divorced, Separated, and Widowed. ‡Includes Islam and Traditional. **Estimated values due to zero-cell frequency in original data.

Discussion

This study assessed the sociodemographic correlates of knowledge, attitude, and perception among fathers in Eti-Osa LGA regarding HPV infection and vaccination. Our findings reveal significant gaps across all domains regarding knowledge, attitudes, and perceptions of HPV infections and vaccines. Fewer than half (46.8%) had good knowledge, while (22%) had good attitudes, and (18%) had good perceptions, indicating an overwhelming majority with poor attitudes (78%) and poor perceptions (82%) regarding HPV infections and the vaccine. These findings align with reports from several low- and middle-income countries (LMICs), where HPV awareness among men remains limited, and parental awareness of HPV remains suboptimal despite global advocacy (21). Multi-country reviews and studies from Ghana and Kenya similarly report knowledge levels below 50%, particularly among fathers who are less frequently targeted in reproductive health campaigns (21, 22, 23). These gaps are critical, as male involvement has been shown to significantly influence vaccine acceptance and uptake among adolescents (21).

This study found limited knowledge despite a high level of education (with about 78.7% having completed tertiary education), which is consistent with existing Nigerian research findings suggesting that formal education does not inherently translate into HPV-related awareness (24, 25). Furthermore, the predominance of poor attitudes in this study (78%) stands in stark contrast to high-income countries, where structured public health messaging has successfully improved parental acceptance of the HPV vaccine (26, 27). The hesitancy observed here reinforces patterns in sub-Saharan Africa, where concerns about safety and morality-related stigma remain significant contributors to vaccine resistance (28, 29, 30). These findings suggest that formal education alone does not necessarily translate into adequate awareness or favourable disposition toward HPV prevention, highlighting a disconnect between general educational attainment and health-specific literacy. The predominance of poor perceptions in this study is also consistent with previous findings suggesting that HPV vaccination is often perceived as a female-specific intervention (13). Cultural norms and limited male-targeted health education may contribute to this perception, thereby reducing men's engagement in HPV prevention strategies. The poor outcomes observed may reflect sociocultural norms that exclude men from reproductive health discussions, as well as misinformation or a lack of targeted health promotion strategies directed at fathers.

Sociodemographic associations revealed some noteworthy patterns. Knowledge was significantly associated with marital status but not with age, religion, education, or income. This differs from findings in many international studies where higher education and income are typically associated with improved HPV knowledge (31). The absence of a significant association with

educational level in this study may reflect limited targeted health communication toward fathers across all educational strata. Attitude and perception were significantly associated with educational and occupational status. Contrary to expectations, respondents with lower levels of education (primary and secondary) demonstrated significantly better attitudes and perceptions compared to those with tertiary education. This contrasts with conventional evidence that higher education correlates with improved health literacy (32). This counterintuitive finding may indicate that highly educated individuals are either less exposed to targeted HPV messaging or more influenced by vaccine hesitancy narratives. A plausible explanation may be the influence of vaccine hesitancy, which has been reported to be higher among educated populations exposed to misinformation, particularly through digital media (15). It can also be due to online misinformation or scepticism, a phenomenon increasingly observed in vaccine discourse globally (31). Occupational differences further support this observation, as professionals were less likely to exhibit good attitudes compared to manual-skilled workers; manual-skilled workers demonstrated more favourable attitudes than professionals. Similar patterns have been reported in studies where professional groups exhibit scepticism toward vaccines due to perceived risks or misinformation (33).

Age and marital status also emerged as important determinants. Older fathers (61–70 years) were more likely to have good knowledge, possibly reflecting accumulated life experience, cumulative exposure to health information over time, as well as increased healthcare engagement and interactions (34). Meanwhile, fathers aged 41–50 years had significantly higher odds of good perception. This age group likely represents fathers actively engaged in adolescent healthcare decision-making. However, willingness to adopt preventive measures may still be influenced by sociocultural norms rather than age alone. Globally, HPV vaccination programs have demonstrated significant reductions in HPV prevalence, genital warts, and cervical precancers in countries with high coverage (35). The World Health Organisation's global strategy to eliminate cervical cancer emphasises achieving 90% vaccination coverage among girls by age 15 years (6). Nigeria, which contributes substantially to the global cervical cancer burden, faces unique challenges related to awareness, cost perception, and sociocultural beliefs (36). Married respondents had better knowledge, attitudes, and perception compared to unmarried counterparts, which may be linked to increased parental responsibility and engagement in child health decisions. This suggests that family structure influences health decision-making, with married individuals more likely to engage in preventive health behaviours.

The multivariable analysis further reinforced the influence of education, occupation, and family size. This analysis revealed a complex relationship between socio-demographic factors and HPV-related knowledge, attitudes, and perceptions, highlighting that formal education and professional status do not linearly translate to vaccine acceptance. The finding that fathers with secondary education or manual-skilled occupations held significantly higher odds of good knowledge and attitudes compared to their tertiary-educated and professional counterparts suggests a potential "knowledge-attitude gap" among highly educated groups, who may be more prone to specific vaccine hesitancy or safety concerns. Furthermore, the significant influence of age (41–70 years) and family size (4–6 children) suggests that increased life experience and more frequent interactions with the healthcare system - likely through their children's routine immunisations—may enhance health literacy and receptivity. Fathers with 4–6 children were more likely to have good knowledge, supporting evidence that increased parental experience enhances exposure to health information and services (37). Conversely, the markedly reduced odds of good attitudes and perceptions among unmarried fathers underscore the role of spousal support and shared household decision-making in fostering favourable views toward the HPV vaccine. Furthermore, ethnic variations in perception highlight the role of sociocultural factors in shaping health beliefs, indicating the potential role of cultural beliefs in shaping HPV-related understanding from diverse populations (38). These findings suggest that public health interventions should not only target less-educated populations, but they must also address the specific barriers or scepticism present among professional and highly educated paternal cohorts to ensure comprehensive vaccine coverage.

Overall, the study demonstrates that knowledge, attitudes, and perceptions of HPV among fathers remain suboptimal, with significant sociodemographic disparities. These findings underscore the need for targeted, context-specific interventions and inclusive public health strategies that engage fathers as key stakeholders in HPV prevention and vaccination programs.

Strengths and limitations of the study

This study has several strengths and limitations. A key strength is its focus on fathers, a group often underrepresented in HPV-related research despite their important role in adolescent healthcare decision-making, particularly in patriarchal settings. The relatively large sample size, high response rate, and use of multistage sampling enhance the reliability of the findings within the study area. The use of a pre-tested, structured questionnaire and standardised scoring systems for knowledge, attitude, and perception also strengthened internal validity. The use of inferential and multivariable analysis using chi-square tests and multivariable logistic regression strengthens the analytical rigour by identifying independent predictors and controlling for potential confounders. However, despite the strengths of this study, some limitations should be considered when interpreting the findings. The cross-sectional design limits causal inference, and the interviewer-administered format may have introduced social desirability bias, especially given the sensitivity of HPV as one of the sexually transmitted infections. Additionally, the study was conducted in a single urban local government area with a highly educated population, which may limit generalizability to rural or less-educated populations in Nigeria. Small subgroup sizes in some demographic categories may also have affected the robustness of certain statistical comparisons. Overall, while the study provides valuable insights into fathers' roles in HPV prevention, these limitations should be considered when interpreting the findings and in designing future research.

Study implications

Policy

The findings highlight the need for gender-inclusive HPV prevention policies. Current strategies often prioritise women and girls, potentially overlooking the influential role of fathers in vaccination decisions. Policymakers should integrate male-focused education into national HPV vaccination programs and ensure that public health campaigns explicitly target men. Additionally, incorporating HPV education into broader non-communicable disease and reproductive health policies may improve awareness at the population level.

Practice

Healthcare providers should actively involve fathers during clinical encounters, particularly in paediatrics and family health settings. Routine health education sessions should include information on HPV transmission, risks, and the benefits of vaccination for both males and females. Community-based interventions, such as workplace outreach and faith-based programs, may be particularly effective, given the observed occupational and sociocultural variations in attitudes. Tailored communication strategies that address misconceptions and cultural barriers are essential.

Research

Further studies are needed to explore the underlying reasons for poor attitudes and perceptions among highly educated and professional groups. Qualitative research could provide deeper insights into sociocultural beliefs, misinformation, and vaccine hesitancy among men. Longitudinal studies are also recommended to assess changes in knowledge, attitudes and perceptions, following targeted interventions. Additionally, research should evaluate the effectiveness of male-inclusive HPV education programs in improving vaccine uptake.

Conclusion

The study conducted in Eti-Osa LGA demonstrates a significant paradox: while many fathers conceptually support HPV vaccination, substantial knowledge gaps and poor attitudes remain pervasive. This study demonstrates that fathers exhibit inadequate knowledge, poor attitudes, and unfavourable perceptions regarding HPV infection and vaccination, despite high levels of formal education. Sociodemographic factors such as age, marital status, education, occupation, and ethnicity significantly influence these outcomes. The findings emphasise the critical need to engage fathers in HPV prevention efforts, as their role in decision-making can significantly impact vaccine uptake among eligible populations.

Recommendations

To address these barriers, policymakers need to develop and implement gender-inclusive HPV vaccination policies that explicitly target men, particularly fathers. Public health practitioners should conduct health education campaigns which should target reaching fathers and be designed in a culturally appropriate, male-focused educational interventional format to improve HPV awareness and correct misconceptions. They should also do this through community-based interventions in workplaces, religious institutions, and community groups as platforms for disseminating HPV-related information to men. Healthcare providers should be engaged and encouraged to involve fathers in vaccination discussions during routine clinical visits. This should be done using targeted messages and tailored communication strategies for highly educated and professional populations

to address vaccine hesitancy and misinformation. Public health researchers should conduct further qualitative and intervention-based studies to better understand and address barriers to positive attitudes and perceptions among fathers. Health planners should establish monitoring and evaluation mechanisms which will assess the impact of male-inclusive HPV programs on knowledge, attitudes, and vaccine uptake over time. These recommendations aim to strengthen HPV prevention strategies by recognising and leveraging the critical role of fathers in public health interventions.

List of Abbreviations

CDC**:** Centres for Disease Control and Prevention
HPV: Human papillomavirus
HREC: Health Research Ethics Committee
LGA: Local Government Area
LMICs: Low- and middle-income countries
LUTH: Lagos University Teaching Hospital
NPI: National Programme on Immunisation
SPSS: Statistical Package for the Social Sciences
STI: Sexually Transmitted Infection
WHO: World Health Organisation

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Health Research and Ethics Committee of Lagos University Teaching Hospital (LUTH) with reference number ADM/DSCST/HREC/APP/5995. Written informed consent was obtained from all participants before data collection. Participation was voluntary, and confidentiality of information was strictly maintained. Participants were provided with clear information about the study objectives, procedures, potential risks, and benefits, and were informed of their right to withdraw at any time without penalty. All data were anonymised and used solely for research purposes. The study strictly adhered to the ethical principles outlined in the Declaration of Helsinki, including respect for persons, beneficence, non-maleficence, and justice.

Consent for publication

Not applicable. This manuscript does not contain any person's data in any form (including individual details, images, or videos).

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author contributions

AAA conceptualised the study, designed the research protocol, and supervised all stages of the study.
AAA and EO coordinated and conducted data collection.
EO, AAA, OEO and MBA performed data entry, cleaning, and formal data analysis and contributed to the interpretation of the results.
MBA, AAA, and OV drafted the initial manuscript.
AAA, MBA, AKS and OKS provided critical revisions for important intellectual content.
All authors reviewed and approved the final version of the manuscript.

Acknowledgements

The authors would like to thank all the fathers who participated in this study.

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