

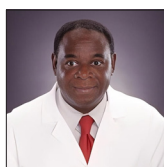


## ORIGINAL ARTICLE ADOLESCENT HEALTH

# Intent to Receive Human Papillomavirus Vaccination among School-going Pre-teens and Adolescent Girls

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## ABSTRACT

**Background and Objective:** Adolescents (9–19 years) make up 22% of Nigeria's population and represent a key target group for human papillomavirus (HPV) prevention initiatives. Although the effectiveness of HPV vaccination in preventing cervical cancer is well-established, gaps in awareness and intention to vaccinate persist among this age group. This study aimed to assess the willingness to receive the HPV vaccine among adolescent students in Kano State, Nigeria.

**Methods:** A school-based cross-sectional study was conducted among 381 female adolescents aged 9–19 years in Kano State, Nigeria. Descriptive statistics and Chi-square or Fisher's exact tests were used for group comparisons, and multivariable logistic regression was employed to identify factors associated with vaccination intention.

**Results:** Of the 381 adolescent schoolgirls surveyed, 62.5% expressed a positive intention to receive the HPV vaccine. Positive intention was significantly associated with being in junior secondary school, from a middle- or high-income family, and of Hausa ethnicity. Adolescents who discussed HPV vaccination with their parents were nearly 40 times as likely to express positive intent (adjusted odds ratio [AOR] = 39.8, confidence interval [CI]: 5.87–437,  $p < 0.001$ ) while those who discussed it with peers were significantly less likely to have positive intent to receive HPV vaccine (AOR = 0.09, CI: 0.01–0.52,  $p = 0.018$ ). Surprisingly, higher levels of confidence in the vaccine's effectiveness were inversely associated with intention to vaccinate.

**Conclusion and Global Health Implications:** The findings of this study highlight the need to enhance HPV awareness through parental education, peer-led discussions, and school-based vaccination programs. Discussions with parents emerged as the most significant factor associated with positive intent to vaccinate, suggesting that parental influence plays the most important role in adolescent girl vaccine acceptance.

**Keywords:** Adolescent, Girls, Human papillomavirus, Intention, School Age, Vaccine

## INTRODUCTION

Human papillomavirus (HPV), a sexually transmitted infection that is mostly asymptomatic, infects nearly every sexually active person at some stage in their lives.<sup>[1]</sup> While most HPV infections usually resolve spontaneously, some strains persist, leading to genital warts, and others are known to cause cancer.<sup>[1]</sup> The most common HPV-associated malignancy is cervical cancer,

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ranked the fourth most common cancer among women. In 2022, cervical cancer accounted for approximately 660,000 new cases and around 35,000 deaths globally, 95% of which occurred in low and middle-income countries and highest in sub-Saharan Africa (SSA).<sup>[2]</sup>

Nigeria, a SSA country, was reported to account for 12,075 new cases and 7,968 deaths in 2020, the fifth-highest cervical cancer death rate after India, China, Brazil, and Bangladesh.<sup>[3,4]</sup> In Northern Nigeria, the prevalence of HPV infection among young girls aged 9–20 years was reported to be 13.2%.<sup>[5]</sup> This prevalence is expected to rise without cost-effective strategies for early detection and prevention as estimated by the World Health Organization (WHO).

In addition, it is estimated that 60.9 million Nigerian women aged 15 years and older will be at higher risk of developing cervical cancer.<sup>[6]</sup> This figure highlights a significant gap in achieving the 90-70-90 Global strategy for achieving cervical cancer elimination targets by 2030.<sup>[7]</sup> One of the key pillars of this strategy is ensuring that 90% of girls receive full HPV vaccination by the age of 15 years, highlighting the importance of HPV vaccination in cervical cancer prevention.<sup>[8]</sup>

HPV vaccination is a highly effective strategy for preventing both new HPV infections and HPV-associated cancers. The vaccine provides the most protection when given to young adolescents aged 9–12 years.<sup>[9]</sup> Vaccinating pre-teenage girls with the HPV vaccine before sexual exposure is the most impactful long-term intervention for lowering the risk of cervical cancer.<sup>[4]</sup> However, despite the vaccine's proven effectiveness, global HPV vaccination rates remain below the WHO-recommended 90-70-90 target, particularly in SSA.<sup>[10,11]</sup> This is largely because the implementation of HPV vaccination programs in SSA faces several challenges, including inadequate infrastructure, financial constraints, high vaccine costs, and difficulties in maintaining the cold chain.<sup>[12]</sup> In addition, targeting young girls as the primary age group of interest introduces sociocultural barriers, particularly the stigma associated with HPV being a sexually transmitted infection.<sup>[13]</sup> In Kano state, Nigeria, parental hesitancy has been identified as the major barrier to HPV vaccine uptake, with 32.7% of parents choosing not to vaccinate their children. Most exhibited poor knowledge about the vaccine and expressed concerns about its safety. Some believed that the vaccine was unnecessary because their children were not sexually active, while others felt that accepting the vaccine conflicted with their religious beliefs.<sup>[14]</sup>

Proposed strategies for improving HPV vaccination rates include the utilization of digital health technologies, HPV education for school children, religious and cultural leaders' engagement, social mobilization, and school-based vaccine delivery.<sup>[11,15,16]</sup> Many countries have implemented school-based HPV immunization programs, which have proven to be highly

effective.<sup>[17]</sup> Australia has successfully tried this approach, and the country achieved a completion rate of 81% among girls and 78% among boys aged 15 years. Similarly, Rwanda introduced a comparable campaign, achieving an impressive 94% completion rate by the year 2019.<sup>[17]</sup> In Nigeria, school-based HPV vaccination programs were reported to be feasible with proper community engagement, adequate advocacy, effective communication, and appropriate design, planning, and delivery.<sup>[18]</sup> However, despite the success of school-based programs, the acceptance of the HPV vaccine remains low in many SSA countries.<sup>[19]</sup> Several factors influence vaccine acceptability among school-aged adolescents. This includes social group dynamics, media exposure, immunization settings, and environmental factors.<sup>[11,19]</sup> A report from Ethiopia shows that school adolescents' willingness to accept the HPV vaccine was low. Only 56% were willing to take the vaccine, highlighting the importance of assessing the willingness of school adolescents to accept the HPV vaccine in developing a targeted strategy to improve HPV vaccination uptake.<sup>[19]</sup>

Recognizing the importance of assessing adolescents' willingness to accept HPV vaccines, this study seeks to evaluate the intention of school adolescents in Kano, Nigeria, to receive HPV vaccination and provides insights that will help to improve vaccine uptake in the region.

## METHODS

### *Study Design and Sample*

This cross-sectional study was conducted among female school adolescents aged 9–19 ( $n = 381$ ). Multistage sampling was employed to ensure a representative sample selection. First, the Gwale local government area (LGA) was randomly selected by balloting from all 44 LGAs in Kano state. Next, Government Girls Secondary School, Janbulo, was chosen as the study site from all the secondary schools in Gwale LGA using simple random sampling. Finally, systematic sampling was applied to select eligible students from the school register, ensuring a structured and unbiased selection process. Parents/legal guardians provided informed verbal consent through phone calls for students less than 18 years old while assent was sought from their minors before participation in the study. Older students provided their own informed consent before participating.

This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology statement, an international guideline designed to improve the transparency and quality of reporting in observational studies.<sup>[20]</sup>

### *Data Collection*

This study utilized primary data collected using a structured pre-tested questionnaire. The questionnaire was designed

to assess awareness and participants' intentions regarding HPV vaccination. To ensure reliability, the questionnaire was pre-tested on 20 students from different secondary schools within Kano state. This helped ensure the questions were easily understood and appropriately structured.

### Study Variables

#### Outcome variable

The primary outcome measured was the adolescent intention to receive HPV. The intention was coded "YES" for positive intention and "NO" for negative intention.

#### Explanatory variables

The explanatory variables assessed in relation to adolescents' intention to receive the HPV vaccine included a range of sociodemographic, informational, and psychosocial factors. Sociodemographic variables comprised age group (9–15 and 16–19 years), school grade (junior or senior secondary school), parent level of education (no formal education, secondary, or tertiary education), family socioeconomic status (low, middle, or high income) as adapted for a previous study,<sup>[21]</sup> and ethnicity (Hausa, Yoruba, or others). Informational and behavioral variables included whether the participant had received information about HPV, had been tested for cervical cancer, or had previously received the HPV vaccine. Additional factors included their preferred location for receiving the vaccine (school health program, private or public health facility); their level of confidence in the HPV vaccine to prevent cervical cancer (ranging from not confident to extremely confident); and whether they had discussed the HPV vaccine or prevention with peers, parents/guardians, or teachers.

#### Data Analysis

Descriptive analysis was performed to generate frequencies and proportions for categorical variables. Data reported was stratified by age group and compared using Pearson's Chi-squared test or the Fisher exact test depending on the expected cell counts. Variable with substantial missing data (Preferred Location to Receive the Vaccine) was excluded from multivariable analyses to preserve sample size and reduce bias due to missing data. This is due to excessive missingness of the data (>80%) making imputation inappropriate.

To identify factors associated with adolescent intention to receive the HPV vaccine, a multivariable logistic regression analysis was conducted using a backward stepwise elimination approach. Variables with a  $p < 0.10$  in bivariable analyses were considered for inclusion. Although stepwise elimination was guided by statistical significance ( $p < 0.05$ ),

variables of contextual or theoretical relevance were retained in the final model regardless of statistical significance, particularly if they improved model fit or adjusted for potential confounding.

Multicollinearity was assessed using Variance Inflation Factors (VIFs), with none of the included variables exceeding a VIF of 5. All statistical analyses were performed using R statistical software (version 4.4.3), with a 95% confidence level and a significance threshold of  $p < 0.05$  for interpretation.

## RESULTS

A total of 381 adolescent schoolgirls participated in the survey, of whom 238 (62.5%) expressed a positive intention to receive the HPV vaccine while 143 (37.5%) reported a negative intention [Table 1]. Most respondents were in the 9–15-year age group (57.5%), enrolled in junior secondary school (50.1%), of Hausa ethnicity (87.4%) or belonged to families of middle socioeconomic status (70.9%). The majority had not previously received the HPV vaccine (98.2%).

A bivariate analysis [Table 1] showed that a higher proportion of those intending to vaccinate were aged 9–15 years (63.9% vs. 46.9%,  $p = 0.001$ ) and in junior secondary school (53.8% vs. 44.1%,  $p = 0.066$ ). In contrast, respondents with a negative intention were more likely to be from families with parents who had tertiary education (100%,  $p < 0.001$ ) and less likely to be from Hausa ethnic backgrounds (76.2% vs. 94.1%,  $p < 0.001$ ). Adolescents in the positive intention group were more inclined to receive the vaccine at school-based programs or private facilities, whereas all participants in the negative intention group preferred public health facilities ( $p < 0.001$ ).

Participants with positive intentions to vaccinate were more likely to report moderate-to-high confidence in the HPV vaccine's ability to prevent cervical cancer. Specifically, 33.2% reported being confident, 21.4% were very confident, and only 3.8% were extremely confident, while those with negative intentions were more likely to report being very confident (53.1%) or extremely confident (18.9%) but less likely to be "confident" (11.9%). Furthermore, positive intention was also more common among adolescents who discussed HPV vaccination with their parents (8.8% vs. 1.4%,  $p = 0.003$ ) or teachers (2.5% vs. 0.0%,  $p = 0.088$ ). However, fewer in this group discussed the topic with peers (2.1% vs. 12.6%,  $p < 0.001$ ).

Multivariable analysis [Table 2] revealed that adolescents in senior secondary school were 76% less likely to express intent to vaccinate compared to those in junior secondary school (adjusted odds ratio [AOR] = 0.24, confidence interval [CI]: 0.08–0.64,  $p = 0.006$ ). Adolescents from families with higher socioeconomic status were

<b>Table 1: Sociodemographic and informational factors associated with intention to receive the HPV vaccine among adolescents.</b>			
<b>Characteristic</b>	<b>Positive intention to vaccinate (n=238)</b>	<b>Negative intention to vaccinate (n=143)</b>	<b>p-value</b>
Age group (years), <i>n</i> (%)			0.001 <sup>1</sup>
9–15	152 (63.9)	67 (46.9)	
16–19	86 (36.1)	76 (53.1)	
School grade, <i>n</i> (%)			0.066 <sup>1</sup>
Junior Secondary School	128 (53.8)	63 (44.1)	
Senior Secondary School	110 (46.2)	80 (55.9)	
Parent level of education, <i>n</i> (%)			<0.001 <sup>2</sup>
Tertiary education	81 (34.0)	143 (100.0)	
No formal education	41 (17.2)	0 (0.0)	
Secondary school education	116 (48.7)	0 (0.0)	
Family socioeconomic status, <i>n</i> (%)			0.093 <sup>1</sup>
Low income	31 (13.0)	27 (18.9)	
High income	29 (12.2)	24 (16.8)	
Middle income	178 (74.8)	92 (64.3)	
Ethnicity, <i>n</i> (%)			<0.001 <sup>2</sup>
Hausa	224 (94.1)	109 (76.2)	
Yoruba	2 (0.8)	6 (4.2)	
Igbo	0 (0.0)	0 (0.0)	
Others	12 (5.0)	28 (19.6)	
Received information about HPV, <i>n</i> (%)			0.08 <sup>2</sup>
No	210 (88.2)	117 (81.8)	
Yes	28 (11.8)	26 (18.2)	
Receive the HPV vaccine, <i>n</i> (%)			0.11 <sup>2</sup>
Yes	2 (0.8)	5 (3.5)	
No	236 (99.2)	138 (96.5)	
Preferred location to receive the vaccine, <i>n</i> (%)			<0.001 <sup>2</sup>
School health program	95 (42.4)	0 (0.0)	
Private health facility	61 (27.2)	0 (0.0)	
Public health facility	68 (30.4)	23 (100.0)	
Others	0 (0.0)	0 (0.0)	
(Missing)	14	120	
Confidence on HPV vaccine to prevent cervical cancer, <i>n</i> (%)			<0.001 <sup>1</sup>
Not confident at all	48 (20.2)	10 (7.0)	
Extremely confident	9 (3.8)	27 (18.9)	
Slightly confident	51 (21.4)	13 (9.1)	
Confident	79 (33.2)	17 (11.9)	
Very confident	51 (21.4)	76 (53.1)	
Discussed about HPV vaccine or prevention with your peers, <i>n</i> (%)			<0.001 <sup>1</sup>
No	233 (97.9)	125 (87.4)	
Yes	5 (2.1)	18 (12.6)	
Discussed about HPV vaccine with your parents or guardians, <i>n</i> (%)			0.003 <sup>2</sup>
No	217 (91.2)	141 (98.6)	
Yes	21 (8.8)	2 (1.4)	

(Contd...)

**Table 1:** (Continued).

Characteristic	Positive intention to vaccinate (n=238)	Negative intention to vaccinate (n=143)	p-value
Discussed about HPV vaccine or prevention with your teachers, n (%)			0.088 <sup>2</sup>
No	232 (97.5)	143 (100.0)	
Yes	6 (2.5)	0 (0.0)	

<sup>1</sup>Pearson's Chi-squared test, <sup>2</sup>Fisher's exact test. HPV: Human papillomavirus

**Table 2:** Factors associated with positive intention to receive the HPV vaccine.

Characteristic	AOR	95% CI	p-value
School grade			
Junior Secondary School	Reference	—	
Senior Secondary School	0.24	0.08, 0.64	0.006
Age group (years)			
9–15	—	—	
16–19	0.62	0.23, 1.79	0.4
Family socioeconomic status			
Low income	Reference	—	
High income	3.08	1.09, 9.08	0.036
Middle income	3.70	1.75, 8.08	<0.001
Ethnicity			
Hausa	Reference	—	
Yoruba	0.09	0.00, 0.93	0.073
Others	0.12	0.03, 0.40	<0.001
Discussed about HPV vaccine with your parents or guardians			
No	Reference	—	
Yes	39.8	5.87, 437	<0.001
Confidence on HPV vaccine to prevent cervical cancer			
Not confident at all	Reference	—	
Extremely confident	0.08	0.02, 0.32	<0.001
Slightly confident	0.98	0.32, 2.86	>0.9
Confident	1.26	0.38, 3.85	0.7
Very confident	0.10	0.03, 0.26	<0.001
Discussed about HPV vaccine or prevention with your peers			
No	Reference	—	
Yes	0.09	0.01, 0.52	0.018
Received information about HPV			
No	Reference	—	
Yes	2.48	0.95, 6.70	0.068

CI: Confidence interval, AOR: Adjusted odds ratio, HPV: Human papillomavirus

significantly more likely to express an intention to receive the HPV vaccine. Those from middle-income households were nearly fourfold as likely to express positive intention to vaccinate compared to those from low-income households (AOR = 3.70, CI: 1.75–8.08,  $p < 0.001$ ). Similarly, adolescents from high-income families were three times

as likely to express positive intention to receive the HPV vaccine (AOR = 3.08, CI: 1.09–9.08,  $p = 0.036$ ). In addition, compared to Hausa participants, those from other ethnic groups were 88% less likely to have positive intent toward receiving the HPV vaccine (AOR = 0.12, CI: 0.03–0.40,  $p < 0.001$ ).



Moreover, adolescents who discussed the HPV vaccine with their parents were nearly 40 times as likely to have positive intentions toward receiving HPV compared to those who had not (AOR = 39.8, CI: 5.87–437,  $p < 0.001$ ). However, adolescents who reported discussing the HPV vaccine with their peers were 91% less likely to have positive intentions toward receiving the HPV vaccine compared to those who did not engage in such discussions (AOR = 0.09, CI: 0.01–0.52,  $p = 0.018$ ). Furthermore, compared to those with no confidence, adolescents who were very confident (AOR = 0.10, CI: 0.03–0.26,  $p < 0.001$ ) or extremely confident (AOR = 0.08, CI: 0.02–0.32,  $p < 0.001$ ) were significantly less likely to have a positive intention.

## DISCUSSION

In this study, we found that nearly two-thirds (62.5%) of school-aged adolescent girls expressed a positive intention to receive the HPV vaccine. Our results showed that younger adolescents (aged 9–15 years), those in junior secondary school, and girls from middle or high-income households were significantly more likely to express willingness to be vaccinated. These findings highlight the importance of sociodemographic characteristics, particularly age, school grade, and socioeconomic status in shaping vaccine-related behaviors. Discussions with parents emerged as the most significant factor associated with positive intent to vaccinate, suggesting that parental influence plays an important role in vaccine acceptance. In contrast, peer discussions were paradoxically associated with lower intention to vaccinate, indicating a more complex relationship between knowledge, social context, and vaccine behavior.

Compared to previous studies in Nigeria, our findings add new insights into predictors of HPV vaccine acceptance among adolescent girls. Prior literature often reported low awareness and uptake of the HPV vaccine in Nigeria and other low-resource settings, frequently attributing this to cost, and limited accessibility.<sup>[22,23]</sup> However, our results revealed a substantial level of intent to vaccinate when the vaccine was perceived as accessible particularly through school-based or private facilities in concordance with similar results of other studies from Nigeria.<sup>[23]</sup> Research has also demonstrated that school-based programs can be an effective strategy to increase HPV vaccine uptake among adolescents in Nigeria.<sup>[24]</sup>

Our findings also highlight some unexpected and counterintuitive associations. A surprising observation was that girls who reported being very confident or extremely confident in the vaccine's ability to prevent cervical cancer were significantly less likely to express a positive intent to vaccinate. This contrasts with previous studies which have shown that stronger beliefs in vaccine effectiveness are typically associated with higher vaccination intention.<sup>[25]</sup>

This conflicting result may suggest the influence of other underlying factors, such as fear of side effects, misinformation, the cultural stigma surrounding HPV and sexual health, and strong religious beliefs prevalent in the study population might contribute to hesitancy. These factors can create a complex subconscious perception where confidence in the vaccine's benefits coexists with apprehensions that reduce willingness to vaccinate.

Similarly, adolescents who discussed HPV vaccination with their peers were less likely to express a positive intention to get vaccinated. This suggests that peer influence plays a significant role in shaping vaccine behavior. There was strong evidence that social norms within families and peer groups impacted participants' decisions with adolescents often mirroring the vaccination attitudes and status of their close social circles.<sup>[26]</sup> Peer discussions, rather than encouraging vaccination, might have reinforced hesitancy or skepticism, particularly if negative experiences or concerns were shared. These findings highlight the need for structured, evidence-based communication strategies within peer networks and schools to foster an accurate understanding of HPV and the vaccine's benefits.

## Limitations

Although the results of the present study indicate that family-level discussions, school level, and socioeconomic context are pivotal in shaping vaccine intent, there are important limitations to consider. While the study included a representative sample of adolescent girls in school, it excluded out-of-school adolescents, a group that may have different levels of awareness, attitudes, and access to HPV vaccination. This exclusion was due to the sampling framework used, which was school-based. In addition, self-reported data may be subject to social desirability bias, particularly regarding sensitive topics such as vaccination intent and sexual activity. Participants may have over-reported positive attitudes toward HPV vaccination or under-reported barriers due to perceived social expectations, potentially biasing the results. It is also important to note that the study was conducted in a single school within Gwale LGA, a metropolitan area in Kano State. As such, the findings may not be generalizable to other non-metropolitan or rural LGAs, which may differ in terms of socio-cultural norms, access to information, and attitudes toward vaccination. Furthermore, logistic regression was used despite the outcome being common (>10%), which may overestimate associations. Alternative models were not feasible due to convergence problems. Finally, the cross-sectional nature of this study limits our ability to infer causal relationships between predictors and intent to vaccinate. Longitudinal studies would be valuable to confirm these associations over time and assess how intent translates into actual vaccination behavior.

## CONCLUSION AND GLOBAL HEALTH IMPLICATIONS

This study provides a comprehensive understanding of the sociocultural and communication-related factors that influence HPV vaccine intent among school-aged girls in Nigeria. The most salient finding, that parent-adolescent discussions were the strongest predictor of positive intent, strongly suggests that interventions to improve HPV vaccine uptake should focus on enhancing parental awareness and engagement. In agreement with other published data, our findings reinforce the effectiveness of school-based vaccination programs and underscore the complex role of peer influence and confidence perceptions. There is also a need for further research into the role of vaccine confidence and peer dynamics in adolescent health decision-making.

### Key Messages

1) This study reveals that Nigerian school-aged adolescent girls expressed willingness to receive the HPV vaccine with younger age, junior secondary school enrollment, and higher socioeconomic status positively influencing intent. Parental discussions significantly boost vaccine acceptance, while peer influence paradoxically reduces willingness, suggesting misinformation or social stigma may shape hesitancy. 2) These findings emphasize the need for school-based vaccination programs combined with targeted education campaigns that address parental concerns and counteract peer-related misinformation. 3) The results suggest that improving HPV vaccine uptake in Nigeria requires a multi-faceted approach that considers both sociodemographic factors and the complex social dynamics influencing adolescent health decisions.

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## COMPLIANCE WITH ETHICAL STANDARDS

**Conflicts of Interest:** Dr. Salihu is a member of the editorial board of the journal. **Financial Disclosure:** Nothing to declare. **Funding/Support:** There was no funding for this study. **Ethics Approval:** The research/study was approved by the Institutional Review Board at Kano State of Nigeria, Ministry of Health, number NHREC/17/03/2018, dated March 17, 2018. **Declaration of Patient Consent:** The authors certify that they have obtained all appropriate patient consent. **Use of Artificial Intelligence (AI)-Assisted Technology for Manuscript Preparation:** The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI. **Disclaimer:** None.

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