

## North-South Disparities in Human Papillomavirus Vaccine Uptake and Willingness among Female Secondary School Students in Nigeria: Evidence from Ekiti and Gombe States

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### SYNOPSIS

I, Dr Adams Egwakhide am a Nigerian and resident doctor in The Department of Community Medicine at the University of Abuja Teaching Hospital, Gwagwalada, FCT-Abuja. I am currently a senior registrar and the deputy chief resident of my department. I have been studying research methodology, training and mentoring medical students, masters' students and resident doctors for about 5 years. I would be honored to have my manuscript published in your prestigious journal.

This manuscript being sent to you is a study that examined the HPV vaccine uptake and willingness among female secondary school students in two socio-culturally distinct regions of Nigeria. Using a comparative approach, the study highlights important disparities in uptake, and identifies key factors influencing vaccine uptake. Given the burden of Human papillomavirus and its strong link to cervical cancer, particularly in low-resource settings, our findings provide timely and context-specific evidence to support targeted public health interventions. The manuscript has an approximate word length of 5450 words.

We appreciate your consideration.

Thank you

### ABSTRACT

**Background:** Cervical cancer remains a major public health concern, especially in low- and middle-income countries like Nigeria, where it is the second leading cause of cancer-related deaths among women. The disease is mainly caused by the Human Papillomavirus (HPV), and vaccination of girls aged 9–14 years is strongly recommended by the World Health Organization as an effective preventive measure. However, despite the vaccine's proven safety and effectiveness, uptake in Nigeria is still low. This study assessed HPV vaccine uptake, willingness, and predictors among female secondary school students in Ekiti and Gombe States.

**Material and methods:** A comparative cross-sectional study was conducted among 576 female secondary school students selected through multistage sampling. Data was collected using semi-structured, interviewer-administered electronic questionnaires and analysed using SPSS version 26. Chi-square tests was used to test for associations, while binary logistic regression identified predictors of uptake. Statistical significance was set at  $p < 0.05$ .

**Results:** Overall HPV vaccine uptake was low at 83 (14.4%), with slightly higher uptake in Ekiti at 45 (15.6%) compared to Gombe at 38 (13.2%), but this was not statistically significant ( $p = 0.406$ ). Willingness to receive the vaccine was relatively high, with 219 (76%) in Ekiti and 197 (68.4%) in Gombe, with a significant difference between the states ( $p < 0.001$ ). In multivariate analysis, only knowledge (AOR = 9.027), age of respondents (AOR = 6.782), and perception (AOR = 2.036) emerged as predictors of uptake.

**Conclusion:** Despite high willingness, HPV vaccine uptake among respondents was low. Knowledge, perception, and age were key determinants. Strengthening school-based health education and expanding access through school vaccination programs are essential in improving uptake and reducing cervical cancer burden in Nigeria.

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**KEYWORDS:** Human Papillomavirus (HPV), HPV Vaccine, Cervical Cancer, Uptake, Ekiti State, Gombe State, Secondary school, Nigeria.

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## INTRODUCTION

Cervical cancer is the fourth most common cancer among women globally and remains one of the leading causes of cancer-related deaths in low- and middle-income countries [1]. In Nigeria, it is the second most frequent cancer and cause of cancer-related deaths among women. Current estimates indicate that every year 14,943 women are diagnosed with cervical cancer, and 10,403 die from the disease in Nigeria [2].

The development of prophylactic Human papillomavirus (HPV) vaccines represents one of the most significant advances in cervical cancer prevention. Currently available vaccines include the bivalent, quadrivalent, and nonavalent formulations which offer protection against the most oncogenic HPV strains [3]. The World Health Organization (WHO) recommends that females who are 9 to 14 years old should be vaccinated against HPV which is prior to sexual debut, when immunogenic response is highest [4].

Despite proven efficacy and safety, HPV vaccine uptake remains suboptimal in many African countries, Nigeria inclusive [5–7]. In Nigeria, a study by Akpor et al. found that only 5.4% of female undergraduates in Ekiti State had received the HPV vaccine [8]. The study identified low awareness of HPV and its vaccine, as well as concerns about vaccine cost and safety, as key barriers to its uptake. A descriptive cross sectional study design conducted among students of a tertiary institution in Gombe State revealed that the majority (96.3%) of the study participants, have not received HPV vaccine [9]. The study highlighted cultural and religious beliefs as significant barriers, with many parents opposing vaccination due to misconceptions about its purpose.

Given these results, there is a critical need to generate context-specific evidence comparing HPV vaccine uptake and willingness across different regions of Nigeria, especially among secondary school students. Understanding the North–South divide is particularly important due to longstanding disparities in health outcomes, education, and access to services between these regions. However, there is a paucity of comparative studies focusing specifically on adolescent girls in secondary schools which is a key target group for HPV vaccination programs. Ekiti State in southwestern Nigeria and Gombe State in north-eastern Nigeria represent contrasting socio-cultural and developmental contexts. The broad objective of this survey was to assess and compare the uptake and willingness to accept the HPV vaccine among Female Secondary School students in Ekiti and Gombe States, Nigeria, as well as to identify predictors of HPV vaccine uptake.

## METHODOLOGY

### Study Area

The study was conducted in two states in Nigeria which were Ekiti state and Gombe state. Ekiti State is located in the southwestern region of Nigeria. It lies between longitudes 40°51' and 50°45' East of the Greenwich meridian and latitudes 70°15' and 80°51' north of the Equator [10] and comprises of 16 Local Government Areas (LGAs). It is home to 380 private secondary schools and 200 public secondary schools [11]. Gombe state on the other hand is located in the centre of the north east of the country on latitude 9°30' and 12°30'N, Longitude 8°5' and 11°45'E [12]. There are 11 LGAs, 268 public secondary schools and 359 private secondary schools in the state [13].

### Study Design

A comparative cross-sectional study design was used and it was conducted between February and March 2025.

### Study Population

This comprised female students attending public and private secondary schools for at least one academic session in Ekiti and Gombe States. Students that were too ill to answer questions were excluded.

### Sample Size Calculation

The sample size for this study was calculated using the formula for comparing two populations:

$$n = \frac{(Z\alpha + Z\beta)^2 \cdot p_1q_1 + p_2q_2}{(p_1 - p_2)^2}$$

$Z\alpha$ = standard normal deviation (1.96 at 95% confidence level)

$Z\beta$ = the power of the study which is set at 20% (p-value 0.2 or 20% is 0.84)

$p_1$ = estimated proportion of young females with knowledge of HPV and HPV vaccine in a similar study area to Ekiti State is 53.3%

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[8].

p2= estimated proportion of young females with knowledge of HPV and HPV vaccine in a similar study area to Gombe State is 65% [14].

$$n = \frac{(1.96+0.84)^2 \times (0.53 \times 0.47) + (0.65 \times 0.35)}{(-0.12^2)} = 259.48$$

To account for a potential non-response rate of 10%, the sample size should be increased by 10%. The adjusted minimal sample size for each state was approximately 288.

## Sampling Technique:

A multi-stage sampling technique was employed:

**Stage One** (Selection of Local Government Areas {LGAs} in each of the two states): In Ekiti State, four LGAs (which is 25% of the 16 LGAs in Ekiti state) were selected using simple random sampling by balloting. Of which Ikole, Ado-Ekiti, Ijero, Oye were selected. For Gombe State, which has 11 LGAs, the same proportion of LGAs were selected also by balloting, which arrived at two LGAs. These were Dukku and Akko.

**Stage Two** (Selection of secondary schools from each sampled LGA): Ekiti State is home to a total of 524 secondary schools, which were categorized into public and private schools. Among these, there are 191 public schools, averaging approximately 11 public schools per Local Government Area (LGA). For this study, three public schools were randomly selected by balloting from each of the four LGAs being surveyed. Additionally, there are a total of 333 private schools in Ekiti State with an average of 20 private schools per LGA [11]. Five private schools (out of 20) were randomly selected by balloting from each LGA in the state. This results in the selection of eight schools (both public and private) from each LGA, leading to a combined total of 32 schools surveyed in Ekiti State. Similarly, the secondary schools in Gombe State were also stratified into public and private schools. There were 448 public secondary schools in Gombe state. Since Gombe State has 11 LGAs, this means that there is an average of 40 public secondary schools per LGA. In this study, three public secondary schools were randomly selected by balloting from each of the two LGAs selected in stage one. This brought the total of public secondary schools selected in this state to six i.e., three per LGA. Additionally, there are only 89 private secondary schools in Gombe State. Since there are 11 LGAs in Gombe State, this means the state has an average of nine private secondary schools per LGA. Five were randomly selected by balloting in each LGA, so that 10 private schools were selected from the two LGAs in Gombe state. In summary, this selection involved choosing a total of eight schools per LGA i.e., three from public schools and five from private schools resulting in a total of 16 schools surveyed in Gombe State.

**Stage Three** (Selection of classes from the selected secondary schools): In each selected school, classes were stratified into Senior and Junior classes (JSS and SSS) classes. Then one class was selected using simple random sampling by balloting from each class (senior and junior classes) for every school in both Ekiti and Gombe States.

**Stage Four** (Selection of students): Using systematic random sampling, students were selected from each class. We first obtained the official class register, which served as our sampling frame and counted the total number of female students. Next, we calculated the sampling interval by dividing the total number of female students by the desired sample size. After that, we randomly selected a starting point, which was a number between one and the calculated sampling interval. We then chose the subsequent female students by repeatedly adding the sampling interval to the initial starting point until we reached the desired sample size. If the selection process exceeds the last female student on the register, we implemented a wrap-around procedure to ensure that the sampling continues appropriately. A total of nine students were selected from each school in Ekiti State. Five from the junior classes and four from the senior classes. 18 students were also selected from each school in Gombe State. Nine came from the junior classes, and the same number from the senior classes.

## DATA COLLECTION

Data was collected with a pre-tested, semi-structured interviewer-administered questionnaire which was adapted from previous studies [5,9,15–17].

## Validity and Reliability

The questionnaire underwent face and content validation by public health experts. The questionnaire was also pre-tested using 10% of our sample size in one school that was not selected in either Ekiti and Gombe State to fine tune the data collection tool. In addition, Cronbach's alpha was used to assess the internal consistency of the questionnaire with a threshold of  $\geq 0.7$  considered

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acceptable. After inputting the pre-test responses into SPSS 26.0 a Cronbach alpha of 0.8 was calculated which indicates a high level of internal consistency.

## Data Collection Procedure

Trained research assistants administered the questionnaires to participants during regular school hours, following prior approval from the relevant school authorities and assents from parents/ guardians where necessary. To ensure the accuracy and completeness of the data, the research assistants conducted face-to-face interviews with participants, guiding them through the questionnaire and addressing any questions or concerns that may arise during the process. These interviews were conducted in the teacher's offices, library, and dining rooms in utmost confidentiality. Where feasible, vaccination cards or school health records was used to validate self-reported uptake of HPV vaccine.

## Data Analysis Plan

The data collected was cleaned in MS excel 365 and imported into the Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics such as frequencies and percentages were used to summarise quantitative data and the uptake. Non-parametric tests such as the chi-square tests was used to find associations between uptake and willingness to receive the HPV vaccine across both states. Binary logistic regression was performed to identify predictors of uptake of the HPV vaccine, with results presented as adjusted odd ratios (AORs) and 95% confidence intervals (CIs). A p-value <0.05 was considered statistically significant.

## Ethical Considerations

Ethical approval was obtained from the Gombe State Ministry of Health (MOH/ADM/621/V.1/616) and the Ministry of Health and Human Services, Ado Ekiti, Ekiti State (MOH/EKHREC/EA/P/110). Permission was also obtained from school authorities in the LGAs where the study respondents were recruited. Furthermore, assent was obtained from students who were below the age of 18 while informed consent was obtained from those that were 18 years and above. Confidentiality and anonymity were maintained throughout the study, and participation was voluntary with the option to withdraw at any time without negative consequences.

## RESULTS

A total of 576 responses were analysed. 288 respondents each were from Ekiti State and Gombe State resulting in a 100% response rate.

**Table 1: Socio-demographic characteristics of respondents in study areas**

| Variables                          | Ekiti state (n=288) | Gombe state (n=288) |
|------------------------------------|---------------------|---------------------|
| <b>Age (in years)</b>              |                     |                     |
| 10-14                              | 284(98.6)           | 27(9.4)             |
| 15-18                              | 4(1.4)              | 261(90.6)           |
| <b>Mean</b>                        | 12.44±1.26          | 16.52±1.36          |
| <b>Class</b>                       |                     |                     |
| Junior secondary school            | 192(66.7)           | 117(40.6)           |
| Senior secondary school            | 96(33.3)            | 171(59.4)           |
| <b>Religion</b>                    |                     |                     |
| Christianity                       | 262(91.0)           | 0                   |
| Islam                              | 24(8.3)             | 288(100)            |
| Traditional                        | 2(0.7)              | 0                   |
| <b>Marital status</b>              |                     |                     |
| Divorced                           | 0                   | 5(1.7)              |
| Married                            | 0                   | 35(12.2)            |
| Single                             | 288(100)            | 245(85.1)           |
| Widowed                            | 0                   | 3(1.0)              |
| <b>Father's level of education</b> |                     |                     |
| I don't know                       | 112(38.9)           | 129(44.8)           |
| No formal education                | 0(0)                | 20(6.9)             |
| Primary                            | 8(2.8)              | 11(3.8)             |
| Secondary                          | 59(20.5)            | 68(23.6)            |
| Tertiary                           | 109(37.8)           | 60(20.8)            |
| <b>Mother's level of education</b> |                     |                     |
| I don't know                       | 101(35.1)           | 127(44.1)           |
| No formal education                | 0                   | 38(13.2)            |
| Primary                            | 10(3.5)             | 24(8.3)             |

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|           |           |          |
|-----------|-----------|----------|
| Secondary | 56(19.4)  | 78(27.1) |
| Tertiary  | 121(42.0) | 21(7.3)  |

The study participants from the Ekiti state arm were the youngest in this study with a mean age of  $12.44 \pm 1.26$  years, while those from Gombe state were older with  $16.52 \pm 1.36$  years. 91% of the respondents from Ekiti practiced Christianity with only about 8.3% being Muslims. In contrast, 100% of respondents from Gombe State were Muslims. Similarly, all the respondents in Ekiti State were single but there was more variation in marital status among those in Gombe state as 12.2% were married at the time of the study. The level of education of the parents of the respondents were higher in Ekiti State with more parents in this region having tertiary education.(Table 1)

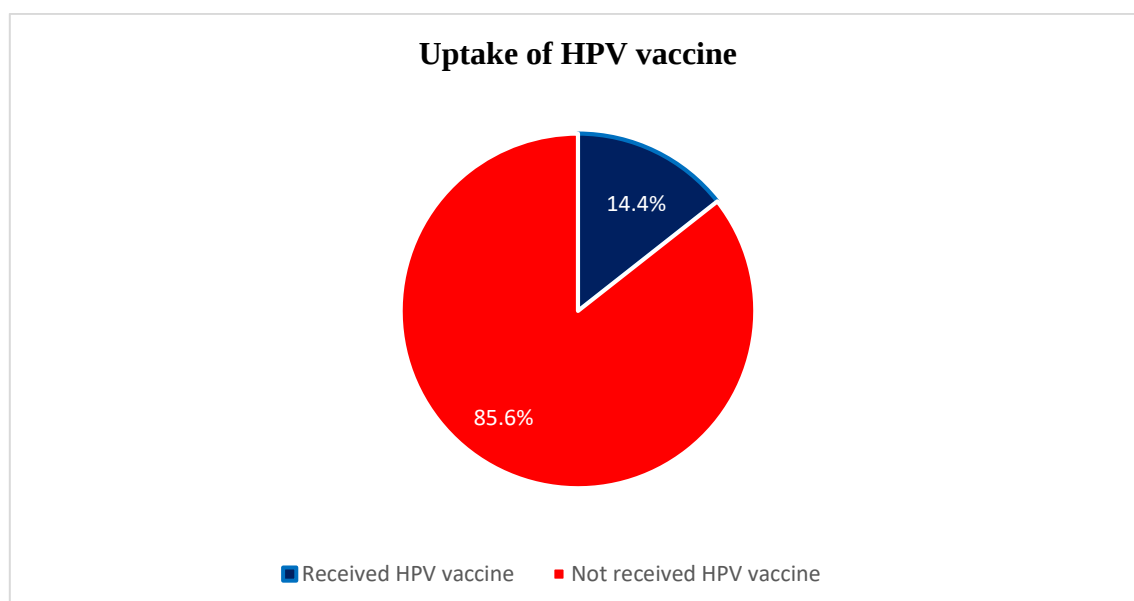


Figure 1: Overall uptake of the HPV vaccine by the students in Ekiti and Gombe States

Table 2: Comparison of Uptake of the HPV vaccine and Willingness to receive the HPV vaccine across Ekiti and Gombe States

| Variables                                      | Ekiti state (n=288) | Gombe state (n=288) | $\chi^2$ value | p-value |
|------------------------------------------------|---------------------|---------------------|----------------|---------|
| <b>Ever received the HPV vaccine before</b>    |                     |                     | 0.69           | 0.406   |
| No                                             | 243(84.4)           | 250(86.8)           |                |         |
| Yes                                            | 45(15.6)            | 38(13.2)            |                |         |
| <b>If yes, number of doses</b>                 |                     |                     | 2.557          | 0.423   |
| One dose                                       | 37(12.8)            | 33(11.5)            |                |         |
| Two doses                                      | 8(2.8)              | 4(1.4)              |                |         |
| Three doses                                    | 0                   | 1(0.3)              |                |         |
| <b>Willing to accept HPV vaccine in future</b> |                     |                     | 15.643         | <0.001* |
| Yes                                            | 219(76.0)           | 197(68.4)           |                |         |
| No                                             | 39(13.5)            | 27(9.4)             |                |         |
| Maybe                                          | 30(10.4)            | 64(22.2)            |                |         |

Table 2 shows that a higher percentage of respondents in Ekiti (15.6%) reported having received the HPV vaccine compared to Gombe (13.2%), though the difference is not statistically significant ( $\chi^2 = 0.690$ ,  $p = 0.406$ ). Regarding the number of doses received, most had received only one dose in both states 12.8% in Ekiti and 11.5% in Gombe with no significant difference ( $\chi^2 = 2.557$ ,  $p = 0.423$ ). For willingness to receive the HPV vaccine in the future, there was a statistical difference in the willingness to receive the vaccine between the two states.

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**Table 3: Multivariate Logistic Regression Analysis of Factors Associated with HPV Vaccine Uptake among Respondent**

| Variable                                     | B      | S.E.  | Wald   | df | p-value           | Adjusted Odds Ratio (AOR) | 95% CI for AOR |
|----------------------------------------------|--------|-------|--------|----|-------------------|---------------------------|----------------|
| <b>Perception category</b>                   | 0.711  | 0.339 | 4.385  | 1  | <b>0.036*</b>     | 2.036                     | 1.047 – 3.959  |
| <b>Knowledge category</b>                    | 2.2    | 0.334 | 43.454 | 1  | <b>&lt;0.001*</b> | 9.027                     | 4.693 – 17.364 |
| <b>Age category (10–14 vs 15–18)</b>         | 1.914  | 0.37  | 26.748 | 1  | <b>&lt;0.001*</b> | 6.782                     | 3.283 – 14.010 |
| <b>Father's level of education (overall)</b> |        |       | 5.538  | 4  | 0.236             |                           |                |
| No formal education                          | -0.101 | 0.445 | 0.052  | 1  | 0.82              | 0.904                     | 0.378 – 2.160  |
| Primary                                      | -0.46  | 0.926 | 0.247  | 1  | 0.619             | 0.631                     | 0.103 – 3.876  |
| Secondary                                    | 0.13   | 0.866 | 0.022  | 1  | 0.881             | 1.139                     | 0.208 – 6.220  |
| Tertiary                                     | -1.138 | 0.522 | 4.746  | 1  | <b>0.029*</b>     | 0.32                      | 0.115 – 0.892  |
| <b>Mother's level of education (overall)</b> |        |       | 2.218  | 4  | 0.696             |                           |                |
| No formal education                          | 0.167  | 0.481 | 0.121  | 1  | 0.728             | 1.182                     | 0.461 – 3.034  |
| Primary                                      | 0.098  | 0.709 | 0.019  | 1  | 0.89              | 1.102                     | 0.275 – 4.421  |
| Secondary                                    | -1.412 | 1.117 | 1.598  | 1  | 0.206             | 0.244                     | 0.027 – 2.176  |
| Tertiary                                     | -0.137 | 0.497 | 0.076  | 1  | 0.783             | 0.872                     | 0.329 – 2.310  |

The multivariate logistic regression model assessed perception category, knowledge category, age category, and parental education as predictors of HPV vaccine uptake. The findings indicated that perception category ( $B = 0.711$ ,  $p = 0.036$ ), knowledge category ( $B = 2.200$ ,  $p < 0.001$ ), and age category ( $B = 1.914$ ,  $p < 0.001$ ) were statistically significant predictors of HPV vaccine uptake. Respondents with a positive perception were about two times more likely to have received the HPV vaccine ( $AOR = 2.036$ ). Similarly, those with good knowledge were approximately nine times more likely to receive the vaccine ( $AOR = 9.027$ ). In addition, respondents aged 10–14 years were about six times more likely to have received the HPV vaccine ( $AOR = 6.782$ ). Parental education was not identified as a significant predictor in the model (Table 3).

## DISCUSSION

This study involved 576 female secondary school students aged 10–18 years, with a mean age of  $12.44 \pm 1.26$  years in Ekiti state and  $16.52 \pm 1.36$  in Gombe state. The religious distribution reflected regional patterns as majority of respondents from Ekiti state were Christians while for Gombe state all the respondents were Muslims which highlights clear religious preferences between the two states and generally between the Southwest and Northeast of Nigeria. This religious differences was observed in other studies in these areas [14,16]. In contrast, all the respondents in Ekiti state were unmarried while majority of those from Gombe state were married reflecting early marriage patterns in parts of Northern Nigeria. There were also marked differences in parental education between the two states. It was observed that a substantial portion of respondents in Ekiti state had fathers and mothers with tertiary level of education, while a considerably minimal number of parents in Gombe state had tertiary education. Similarly, a higher proportion of respondents in Gombe reported not knowing their parents' level of education. These disparities suggest underlying socioeconomic and educational differences between the states, which are important contextual factors when interpreting HPV vaccine uptake.

Overall, the HPV vaccine uptake rate was low in this study with only 45 (15.6%) respondents in Ekiti state and 38 (13.2%) in Gombe state having received the HPV vaccine. These proportions were higher than a descriptive cross-sectional survey done in Lagos state where only 10 (2.6%) of the undergraduate females had received at least one dose of the HPV vaccine [18]. The differences in the results could be explained by the socio-demographic characteristics of the participants with those in the Lagos study focusing on female undergraduates which are demographically not usually targeted for free HPV vaccination activities. Similarly, a descriptive cross-sectional study done in the University of Ilorin among undergraduate students revealed that of the 410 participants, only 6 (1.5%) received the HPV vaccine [19]. Conversely, another cross-sectional survey done across multiple states in Nigeria found that the HPV vaccination rate among adolescent girls 9–17 was 53.9% [15] which is higher than the 45 (14.4%) found in this study. This study was done after an elaborate HPV vaccination campaign in the states which could explain the relatively high proportion of those vaccinated compared to other studies. However, the uptake of the HPV vaccine in these states are far below the WHO's projections for HPV vaccine uptake which is currently at about 90% [20]. If uptake remains persistently low this will lead to a continuation of the high burden of cervical cancer in Nigeria.

Although HPV vaccine uptake was slightly higher in Ekiti compared to Gombe, the difference was not statistically significant ( $p = 0.406$ ). The uptake rates in this study are comparable to those reported in a cross-sectional study done among female undergraduates in North-Central, Nigeria where only 4 (7.6%) respondents had received the vaccination in all three doses [16] and another similar

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study in Gombe state where just 2.1% of students in a tertiary institution had received at least a dose of the vaccine and only 0.4% of them had completed three doses[9]. The major barriers to HPV vaccine uptake identified in these studies were inadequate knowledge about the vaccine and concerns about its cost and safety. This finding suggests that despite notable sociodemographic and educational differences between the two states, this did not translate into significantly different HPV vaccine uptake. Structural issues such as cost, availability, and absence of widespread government-funded programs may be the dominant determinants.

The willingness of the respondents to receive the HPV vaccine in the future was generally high in both study locations, although a statistically significant difference was observed between the two states ( $p < 0.001$ ). In Ekiti State, a large majority of the respondents 219 (76.0%) indicated that they were willing to accept the HPV vaccine in the future, compared with 197 (68.4%) of respondents in Gombe State. However, a greater proportion of students in Gombe State reported uncertainty about vaccination, with 64 (22.2%) indicating “maybe,” compared with 30 (10.4%) in Ekiti State. The proportion of respondents who were unwilling to receive the vaccine was relatively low in both settings at 39 (13.5%) in Ekiti and 27 (9.4%) in Gombe. This unwillingness to receive the vaccine may be due to the lack of knowledge about HPV vaccine benefits coupled with the myths and misinformation associated with the vaccine such as a myth that the vaccine may lead to sexual promiscuity [21]. In addition, lack of parental support and consent to receive the vaccine may be a contributing factor to the unwillingness as many parents have raised concerns about the vaccine’s safety and possible side effects.

The higher level of willingness observed in Ekiti may reflect differences in sociocultural context, access to health information, and exposure to health promotion activities between the predominantly southern and northern regions of the country. These findings are consistent with several regional studies conducted in Nigeria that have reported relatively high levels of willingness to receive the HPV vaccine among adolescents and young women. A descriptive cross-sectional study done among mothers of young girls in Lagos state in 2012 showed that there was a high willingness and intention among the mothers to vaccinate their girls (88.9%) and to recommend the vaccine to others (91.0%) [22]. Similarly, a household survey of 1002 women who participated in the HPV Vaccine and Cervical Cancer Prevention Survey from 26 August to 29 September 2012 at Ibadan North Local Government Area, Mokola Ibadan, Nigeria revealed that there was high willingness (88.6%) to vaccinate[23]. In many of these settings, willingness has been shown to increase significantly after health education interventions, suggesting that knowledge gaps rather than outright resistance often explain vaccine hesitancy.

From a public health perspective, the relatively high willingness to accept the HPV vaccine observed in this study represents a significant opportunity for cervical cancer prevention in Nigeria. However, the presence of uncertainty among a notable proportion of respondents, particularly in Gombe State, suggests the need for intensified health education and community engagement to address misconceptions and improve confidence in the vaccine.

The multivariate logistic regression analysis identified knowledge, perception, and age as significant predictors of HPV vaccine uptake among the respondents. Students with a positive perception of the HPV vaccine were two times more likely to have gotten the HPV vaccine compared with those with negative perceptions (AOR = 2.04; 95% CI: 1.05–3.96;  $p = 0.036$ ). This suggests that favourable perception towards the vaccine play an important role in influencing vaccination behaviour among adolescents. Similarly, knowledge about HPV and its vaccine was strongly associated with vaccine uptake, with respondents who had good knowledge being approximately nine times more likely to have received the HPV vaccine compared with those with poor knowledge (AOR = 9.03; 95% CI: 4.69–17.36;  $p < 0.001$ ). These finding highlights knowledge as one of the most powerful predictor of vaccine uptake in this study. Age was also found to be a significant predictor of HPV vaccine uptake. Respondents aged 10–14 years were nearly seven times more likely to have received the HPV vaccine compared with those aged 15–18 years (AOR = 6.78; 95% CI: 3.28–14.01;  $p < 0.001$ ). This finding may reflect the fact that HPV vaccination programmes often target younger adolescents before sexual debut, and younger students may also be more likely to receive vaccines through school-based or parental health decisions. Parental education showed limited influence on HPV vaccine uptake in this model. Overall, father’s level of education was not significantly associated with vaccine uptake ( $p = 0.236$ ), although tertiary level of education showed a statistically significant association (AOR = 0.32;  $p = 0.029$ ), indicating lower odds of vaccine uptake relative to the reference group. Mother’s level of education was also not significantly associated with HPV vaccine uptake ( $p = 0.696$ ). These findings suggest that, within this study population, individual-level factors such as knowledge, perception, and age may play a more prominent role in determining HPV vaccine uptake than parental educational background. From a public health perspective, these results emphasize the importance of strengthening health education and awareness programmes targeting adolescents, particularly within schools, to improve knowledge and perceptions about HPV vaccination and ultimately increase vaccine uptake.

### LIMITATION OF THE STUDY

The limitation of the study include the fact that this study did not do one to one matching of respondents in the two-study areas which resulted in majority of the respondents being younger in Ekiti state compared to their counterparts in Gombe state. This age

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difference may have contributed to the difference observed in willingness to receive the HPV vaccine. Also, addition of a qualitative component to the study would have provided an opportunity for triangulation.

## CONCLUSION

The findings revealed a very low level of HPV vaccination coverage, with only 14.4% of respondents having ever received the vaccine. In contrast, willingness to receive the vaccine in the future was relatively high in both states, although a significant proportion of respondents were uncertain about receiving the HPV vaccine, especially those from Gombe State. Key predictors of uptake included levels of knowledge, perception of the HPV vaccine and younger adolescents.

## THE RECOMMENDATIONS INCLUDE:

1. The Federal Ministry of Education (FME) and the Federal Ministry of Health & Social Welfare (FMoH&SW) should implement structured school-based HPV education programs nationwide to improve knowledge on HPV and cervical cancer.
2. The National Primary Healthcare Development Agency (NPHCDC) should develop age-targeted vaccination strategies, prioritizing girls aged 9–14 years through early vaccination campaigns in junior secondary schools.
3. The Federal Ministry of Education (FME) should establish school health clubs and peer education programs in secondary schools nationwide to reinforce HPV vaccine knowledge and promote positive perception towards vaccination.
4. State Ministries of Education should incorporate HPV and cervical cancer education into the secondary school curriculum, particularly at the junior secondary level as the target group for HPV vaccination are usually in this class.
5. State Ministries of Education should also direct secondary schools to organize parent–teacher forums and school outreach programs to educate parents, especially fathers, on the benefits of HPV vaccination and address misconceptions.

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