

Assessment of Human Papilloma Virus Infection and Vaccine Awareness among Female Secondary School Students in Enugu Metropolis, Nigeria: A Pre-Vaccination Rollout Survey

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Received July 01, 2026; Revised August 03, 2026; Accepted August 10, 2026

Abstract Background: The prevalence of human papilloma virus (HPV) infection is high in the general population and HPV is considered an important cause of cervical cancer which is a preventable disease. However, previous studies done in other settings in Nigeria and other African countries suggested that there was low level of awareness of HPV infection and its vaccine. **Objectives:** This study assessed the knowledge and awareness of HPV infection and its vaccine among female secondary school students in Enugu metropolis, Nigeria, prior to the National HPV vaccination rollout in October 2023. **Methods:** A cross-sectional survey was conducted among 647 female students aged 10–19 years in Enugu metropolis in October 2023. Data was collected using structured, self-administered questionnaires. Descriptive statistics and chi-square tests were used to explore associations between knowledge and demographic variables. **Results:** The mean age of participants was 13.45 ± 1.81 years. Overall, 78% had never heard of HPV, and 79.8% demonstrated poor knowledge of the HPV vaccine. Students older than 13 years and those with more educated parents showed significantly higher awareness. Schools were the most cited source of information (53%). Misconceptions about HPV symptoms and prevention were common. **Conclusion:** Awareness of HPV and its vaccine was poor among the target demographic, underscoring the need for early school-based education and multi-sect oral stakeholder engagement to improve awareness of HPV infection and its vaccination uptake.

Keywords: HPV, Cervical Cancer, Vaccine Awareness, Adolescents, Nigeria, School Health

Cite This Article: Odimegwu CL, Okoro OS, Nnagbo JE, Chime PU, Mbanefo NR, Adiri CO, Uwaezuoke SN, Nnaji HC, Nkwo PO, Eze MI and Ezeani IU, “Assessment of Human Papilloma Virus Infection and Vaccine Awareness among Female Secondary School Students in Enugu Metropolis, Nigeria: A Pre-Vaccination Rollout Survey.” *American Journal of Public Health Research*, vol. 14, no. 4 (2026): 118-124. doi: 10.12691/ajphr-14-4-6.

1. Introduction

Cervical cancer is a major public health threat to women in many low and medium resource countries including those in sub-Saharan Africa, and Cancer of the cervix is the second most common malignancy in women world wide [1]. Annually, 600,000 cases of cervical cancer with 233,000 deaths are reported [2]. It is a major cause of cancer related death in developing countries and most cases usually present in advanced stage. In Nigeria, it is the commonest gynecological cancer [3] as well as the commonest cause of cancer death among women, with a mortality rate of 25/100,000 [3]. In Nigeria, the crude incidence and age standardized incidence of cervical cancer are 17.1/100,000 and 29.0/100,000 women

respectively. [4] Current estimates indicate that every year, 14,089 women are diagnosed with cervical cancer and 8,240 die from the disease. [4] This is very high and measures to stem the tide of high cervical cancer burden in Nigeria, need urgent implementation. It is therefore imperative to recognize the causal role of human papilloma virus (HPV) in cervical cancer. [5]

The prevalence of human papilloma virus infection is high in the general population and the World Health Organization (WHO) estimates that more than 1 billion people are infected with human papilloma virus annually. [6,7] Human papilloma virus is a sexually transmitted viral infection and is implicated in over 99% of cervical cancer cases [7], persistent infection with high-risk HPV types, notably types 16 and 18, is a well-established etiological factor [8]. Consequently, prevention strategies focusing on HPV vaccination and cervical cancer screening have

become pivotal to reducing incidence and mortality.

At present, human papilloma virus vaccination is considered to be the most important way to reduce cervical cancer incidence [9]. In response to the global call to eliminate cervical cancer as a public health problem, the World Health Organization (WHO) launched a global strategy in 2020 that includes achieving 90% HPV vaccination coverage among girls by age 15, 70% screening coverage, and 90% access to treatment by 2030 [10]. Central to this effort is the timely administration of the HPV vaccine to adolescent girls aged 9–14 years, ideally before sexual debut [11].

However, the burden of cervical cancer has remained high in low- and middle-income countries (LMICs), where more than 85% of cases and related deaths occur [1], due to low level of knowledge of the role of HPV infection in cervical cancer and the need for vaccination against the virus [12].

Nigeria, the most populous country in Africa, introduced the first phase of the HPV vaccination campaign in October 2023, targeting 16 states including Enugu, prior to national integration into the country's National Program on Immunization (NPI) [9]. This study was conducted just before this historic rollout, offering a critical baseline assessment of HPV-related knowledge and perceptions among adolescent girls in Enugu. Understanding the knowledge levels and attitudes of this demographic is particularly vital because they represent the primary target for vaccination and constitute a key population for the prevention of HPV-related diseases.

Several studies across Nigeria and other African countries have consistently shown low awareness of HPV and the HPV vaccine among adolescent girls [13,14]. Notably, in many communities, fears regarding vaccine-induced infertility have been propagated by anti-vaccination movements and some religious figures, undermining public confidence [15,16]. These fears often reflect deeply rooted socio-cultural and religious values, highlighting the complex intersection of health beliefs and vaccine hesitancy.

Educational institutions remain one of the most trusted and effective platforms for health information dissemination among adolescents. Previous interventions in Uganda [17], Kenya [18], and Ghana [19] have demonstrated that school-based health education significantly improves knowledge and increases HPV vaccine acceptability. However, in Nigeria, HPV education is not yet systematically incorporated into the school health curriculum, resulting in missed opportunities for early intervention and prevention.

Furthermore, the influence of parents, particularly mothers, and religious institutions cannot be overstated. Studies have shown that parental education level and occupation significantly influence children's health behaviors, including vaccine acceptance [20]. When engaged appropriately, these stakeholders can serve as powerful allies in dispelling myths and promoting accurate health information [21]. Hence, the active collaboration of healthcare providers, school authorities, faith-based organizations, and policy makers is essential in improving HPV vaccine awareness and acceptance.

This study was therefore designed to assess the baseline knowledge and perceptions of HPV infection and

vaccination among female secondary school students in Enugu State, Nigeria, prior to the integration of the HPV vaccine into the national immunization schedule. By identifying gaps in awareness, sources of misinformation, and demographic disparities in knowledge, this study aims to inform future school- and community-based interventions. The findings are expected to guide policy formulation and stakeholder engagement strategies that align with national and global efforts to eliminate cervical cancer through HPV vaccination.

2. Methods

2.1. Study Area

Enugu metropolis, the capital of Enugu State, is a vibrant city with a mix of historical significance and modern development. Enugu Metropolis consists of three LGA's namely Enugu -East, Enugu south and Enugu North. Enugu North is the central part of Enugu metropolis, serving as the administrative and economic hub of Enugu State. It is home to the state capital, Enugu, and plays a crucial role in governance, commerce, and infrastructure development [22].

2.2. Study Site

This study was conducted at Queen's School Enugu, an all-girls secondary school, is one of the nine (9) public all-girls secondary schools within Enugu North [23]. Founded on 4 October 1954 by the then Eastern Nigeria Government as the only girls' government secondary school in the region [24], the school is known for academic excellence, moral integrity, cultural richness, and national unity.

Study Population

Female students enrolled in junior or senior secondary school who gave assent and received parental consent during the study.

Method of participant selection

Participants were recruited using a multistage sampling method. The names of the 3 local government area in Enugu metropolis were each written in a piece of paper and were put inside an envelope and Enugu North LGA was randomly selected. The 9 all girls secondary school in Enugu North LGA were then each written on a piece of paper and put inside an envelope and Queens secondary school was randomly selected. All the female students enrolled in junior and senior classes at Queen secondary school who gave consent and received parental consent were recruited for the study.

Sample size

A total of 647 female students aged 10 to 19 years enrolled in junior and senior classes at Queen secondary school who gave consent and received parental consent were recruited for the study.

Study Design

This study was a descriptive cross-sectional study was conducted in October 2023 in Enugu metropolis, Nigeria. The survey was timed to precede the first-phase introduction of the HPV vaccine in 16 pilot states, including Enugu.

Data Collection Instrument

A structured, pretested, self-administered questionnaire was used to collect data on demographic characteristics, knowledge of HPV infection, modes of transmission, symptoms, prevention, and awareness of the HPV vaccine. The self-administered questionnaires were conducted in English, the primary language of instruction at Queen's School Enugu. The gathered data were entered into a Microsoft Excel spreadsheet, then sorted and cleaned and exported for final statistical analysis.

Data Analysis

Data were analyzed using SPSS version 25 (IBM Corp, Armonk, New York). Socio-demographic characteristics and awareness of HPV and HPV vaccines were analyzed using frequencies, percentages, means, and standard deviations. Knowledge of HPV related diseases and HPV vaccine were assessed using 4 stem questions each. Each correct answer was allotted score one [1] and every wrong answer was allotted score zero [0]. The total score was 4. Good Knowledge was graded if above the half mark of 2 (>2) while Poor Knowledge was 2 or less (≤ 2). Discrete variables were summarized using frequency tables and percentages, while quantitative variables were analyzed using the mean and standard deviation. Chi-square tests and Fisher's exact were used to assess associations between knowledge levels and demographic variables. All tests were two-tailed and statistical significance was set at $p < 0.05$.

Ethical Considerations

Approval was obtained from the Ethical Review Committee of an academic institution overseeing health research in Nigeria. Written informed consent was obtained from parents/guardians, and assent was obtained from the students. Confidentiality and voluntary participation were ensured.

3. Results

Participants' Demographics variables

A total of 647 female students participated in the study. The participants' age ranged from 10 to 19 years, with a mean age of 13.45 ± 1.81 years. Of the total, 341 (52.7%) were aged ≤ 13 years while 47.3% were older than 13 years. The majority (94%) of respondents identified as Christians. Twenty five percent of respondents' mothers attained primary education, 38% attained secondary education while 37% attained tertiary education. Majority of the students were in junior class 70% while 30% were in senior class. Twenty four percent of their fathers were civil servants, 22.7% were farmers, 24.3% were artisans while 27% were traders, results as shown in Table 1.

Knowledge and Perceptions of Human Papilloma Virus (HPV) Infection

A substantial proportion of respondents 506 (78.2%) reported that they had never heard of HPV infection, while only 21.8% ($n = 141$) indicated prior awareness. Among those who were aware of HPV infection, 75(53%) reported school-based instruction as their main source of information, while 32 (23%) cited social media.

Concerning knowledge of HPV transmission among those who have awareness of HPV infection, 96 (68%) of respondents identified sex as the mode of transmission while (45) 32% were not aware of the mode of transmission.

Regarding HPV-related diseases among those with awareness of HPV infection, 51(36%) indicated knowledge of any disease linked to the infection while 90 (64%) had no knowledge of diseases linked to HPV infection.

Among those with awareness of HPV infection, 84(60%) believed HPV infection is preventable, while 57(40%) were not aware. Knowledge of HPV symptoms was low among those with awareness of HPV infection; 113(80%) had no awareness of symptoms, while 23(20%) were not aware of the symptom.

Overall, 90% of respondents had poor knowledge of HPV, results as shown in Table 2.

Mother's Education Level and HPV Knowledge

The majority of students demonstrated poor HPV knowledge. However, awareness increases with maternal level of education, primary education (1.9%), secondary (24.3%), and Tertiary level (32.5%) as shown in Table 3.

Impact of Father's Occupation and HPV Knowledge

Students whose fathers were civil servants had the highest number of students with better HPV knowledge (51.6%). Poor knowledge was more prevalent among students whose fathers were farmers (10.9%), traders (14.2%), artisans (11.46%) and clergy (15.38%), as shown in Table 4. The association was statistically significant ($\chi^2 = 14.872$, $p = 0.021$).

Knowledge about HPV Vaccine

A staggering 79.8% of respondents had never heard of the HPV vaccine. When asked which disease the HPV vaccine prevents, only 36.3% correctly identified cervical cancer, while 67.7% were not aware disease prevented by the vaccine. Overall, 87.5% of respondents had poor knowledge about the HPV vaccine, while only 12.5% demonstrated better knowledge as shown in Table 5.

Impact of age on awareness of HPV vaccine

Among students with better vaccine knowledge, 61.83% were older than 13 years while 38.12% were less than 13 years, as shown in Table 6. Students >13 years were nearly twice as likely to be in the better knowledge group compared to those ≤ 13 years (Pearson $\chi^2 = 7.648$, $p = .006$) (Table 6).

Table 1. Participants démographies variables

Parameters	Frequency	Percentage (%)
Age group		
<13years	341	52.70
>13 years	306	47.30
2. class of study		
Junior class	453	70.00
Senior class	194	30.00
3.Religion		
Christians	608	94.00

Parameters	Frequency	Percentage (%)
Muslims	30	4.60
Others	9	1.40
4.Mother's Education level		
Primary education	160	25.00
Secondary education	247	38.00
Tertiary education	240	37.00
5.father's occupation		
Farmers	147	22.70
Civil servants	155	24.00
Artisans	157	24.30
Traders	175	27.00
Clergy	13	2.00

Table 2 Awareness and perception of HPV infection

Parameters	Frequency	Percentage (%)
1.Awareness of HPV infection(n=647)		
Not aware	506	
Aware	141	78
		22
2.source of information(n=141)		
Social media	32	
School based instruction	75	23
Church	34	53
		24
3.Awarenes of mode of transmission of HPV(n=141)		
Not aware	96	
Aware	45	68
		32
4.Awareness of HPV related diseases(n=141)		
Not aware	90	
Aware	51	64
		36
5.Awareness of HPV prevention(n=141)		
Not aware	57	
Aware	84	40
		60
6.Knowledge of HPV symptoms(n=141)		
Not Aware	113	
Aware	28	80
		20

Table 3.Mother's education level and HPV knowledge

Parameters	Frequency	Percentage
1.Primary level of education(n=160)		
Aware of HPV infection	3	1.90
Not aware of HPV infection	157	98.10
2.secondary level of education(n=247)		
Aware of HPV infection		
Not aware	60	24.30
	187	75.70
3.Tertiary level of education(n= 240)		
Aware of HPV infection	78	32.50
Not aware	162	67.50

Table 4. Father's Occupation and HPV Knowledge

Parameters	Frequency	Percentage (%)
1.Farmers (n=147)		
Aware of HPV infection	16	10.90
Not aware of HPV infection	131	89.10
2.civil servants (n=155)		
Aware of HPV infection	80	51.60
Not aware of HPV infection	75	48.40
3.Artisans(n=157)		
Aware of HPV infection	18	11.46
Not aware of HPV infection	139	88.54

Parameters	Frequency	Percentage (%)
4.Traders(n=175)		
Aware of HPV infection	25	14.29
Not aware of HPV infection	150	85.71
5.clergy (n=13)		
Aware of HPV infection	2	15.38
Not aware of HPV infection	12	84.62

Table 5. Knowledge about HPV Vaccine

Parameters	Frequency	Percentage
1.Awareness of HPV vaccine(n=647)		
Aware	131	20.20
Not aware	516	79.80
2.Awareness of disease prevented by HPV vaccine(n=131)		
Prevent cervical cancer	48	36.3
Not aware	83	67.7

Table 6. Impact of age on awareness of HPV vaccine(n=131)

Parameters	Frequency	Percentage
1.< 13 year	50	38.17
2.>13 year	81	61.83

4. Discussion

This study found an alarmingly low level of awareness and understanding of Human Papilloma Virus (HPV) and its vaccine among adolescent girls, with nearly 80% of participants unaware of the virus and nearly 88% lacking basic knowledge of the vaccine. This is consistent with previous studies across Nigeria, and other sub-Saharan African countries that identified poor awareness levels among adolescent populations [7,13,14]. In Lagos [13], Ibadan [14], and Anambra [25], low levels of awareness ranging from 15% to 25% were reported among secondary school girls.

Comparatively, awareness and uptake of HPV vaccination remain significantly lower in sub-Saharan Africa than in high-income countries [26,27]. A study conducted in South Africa reported that only 22% of adolescent girls were aware of the vaccine [28], while less than 10% had been vaccinated. This low awareness may partly be attributed to poor integration of HPV education into school curricula, vaccine misinformation and weak policy implementation as highlighted in a systematic review by Bruni et al. [29]

One of the most significant findings of this study is the role of schools in facilitating HPV knowledge. Over half (53%) of the students who had heard of HPV cited school-based instruction as their primary source of information. The centrality of the school environment in shaping adolescent health knowledge is well supported by studies in Uganda [17], Kenya [18], and Ghana [19] all of which confirm that school-based health education significantly increases awareness and improves perceptions about HPV and its vaccine. Despite the proven impact, HPV education is still not systematically integrated into school curricula in many Nigerian schools.

To close this gap, integration of HPV education into health and life sciences curricula at the primary and secondary school levels is imperative. School-based health interventions, including structured classroom sessions, peer education, and teacher training programs, have shown promise in improving adolescent sexual and reproductive health knowledge [14]. Moreover, implementing HPV awareness campaigns through school assemblies and digital learning platforms can further reinforce the messaging.

A major concern highlighted in this study is the mismatch between the ideal age for HPV vaccination and the age at which better knowledge of HPV begins to emerge. According to WHO guidelines, the optimal age for HPV vaccination is 9–14 years, ideally before the onset of sexual activity [11]. However, our findings show that better HPV knowledge is more prevalent in girls older than 13 years, indicating that most girls are not informed about HPV at the time when vaccination would be most effective. This disparity suggests a missed window for early education and intervention. Since vaccine effectiveness is greatest before the onset of sexual activity, targeting younger adolescents—ideally before age 13—is essential.

The progressive increase in awareness with age and academic level is consistent with previous studies in Enugu [30], Cross River [31] and Senegal [32], suggesting cumulative exposure to health education as students advance

Majority (64%) of the respondents who were aware of HPV infection were not aware of diseases caused by HPV infection. This is in keeping with findings from studies in rural Kenya [18] and Ethiopia [33], where general disease confusion and misinformation persist due to limited access to health education.

Additionally, the role of social media as the second

most common information source (23%) also highlights a double-edged dynamic: while it offers access to information, it is also a potential avenue for misinformation. The erroneous beliefs held by many respondents—such as the assumption that HPV causes respiratory infections or confusion with HIV/AIDS—underscore the dangers of unregulated sources. Therefore, coordinated digital literacy and online health education campaigns in collaboration with efforts between educators, healthcare providers, and ministries of education and health are all necessary to ensure that adolescents receive accurate, evidence-based information from trusted sources.

This study found a significant association between parental education and occupation and HPV knowledge. Girls with mothers who had tertiary education and fathers who were civil servants showed better knowledge. This aligns with similar findings from studies in Northern Nigeria [34], Cameroon [35] and Tanzania [36], and which underscore the influence of parental socioeconomic status on adolescent health literacy.

Furthermore, the influence of parental education and occupation, as observed in this study, supports a family-centered approach to adolescent health education. Interventions that engage parents, especially mothers—through community outreach, PTA meetings, and local media could enhance knowledge transfer at home, reinforcing school-based learning.

Globally, countries like Australia [37] and the United States [38] have successfully improved HPV vaccine uptake and awareness through coordinated national strategies and school-linked immunization programs. Nigeria must adopt similar strategies if it is to meet the WHO 2030 targets for cervical cancer elimination. Without timely education and access, vulnerable populations—particularly young adolescent girls—will continue to be left behind.

In conclusion, this study found low level of awareness of HPV infection and HPV vaccine among secondary school girls in Enugu metropolis, and among those who had knowledge of HPV infection and its vaccine, school based instruction was the main source of information. There was also a significant gap between the age of recommended HPV vaccine eligibility and the age of actual awareness. Therefore, systemic integration of HPV education into school curricula, alongside community-based and digital interventions, is crucial to improve knowledge, and ultimately increase vaccine uptake among Nigerian adolescents.

Statement Section

1. There was no conflict of interest of any sort
2. Informed consent was obtained from all the study participants
3. This research was funded by the Authors
4. All the Authors contributed to the different aspects of the research

Okoro OS; conceptualization, data curation, formal analysis, writing original draft, investigation, validation, methodology, writing review.

Odimegwu CL; data curation, formal analysis, writing original draft, investigation, validation, methodology, writing review.

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Adiri CO; data curation, formal analysis, writing original draft, investigation, validation, methodology, writing review.

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Nnaji HC; formal analysis, writing original draft, investigation, validation, methodology, writing review, **Nkwo PO;** conceptualization, data curation, formal analysis, writing original draft, investigation, validation, methodology, writing review.

EzeMI; data curation, formal analysis, writing original draft, investigation, validation, methodology, writing review.

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