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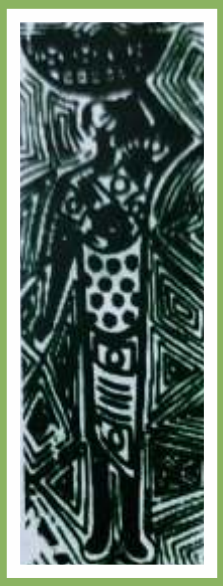

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Table of Contents

Nigerian Journal of Paediatrics

Volume 51 Number 3
July-September 2024

ORIGINAL RESEARCH

PAN GUIDELINES

CASE REPORT

EDUCATIONAL SERIES

ORIGINAL RESEARCH

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The State of Human Papillomavirus (HPV) Vaccination Among Secondary School Adolescents in Nnewi, Nigeria Prior to Free Routine HPV Vaccine Rollout

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Abstract

Background: Human papillomavirus (HPV) has been linked to various cancers of the genital, oropharyngeal, and anal regions in both sexes.

Objective: To assess the vaccination rate and factors influencing the uptake of the HPV vaccine among secondary school students in Nnewi, Nigeria, prior to the introduction of free HPV vaccine in the routine national immunisation program.

Methods: A cross-sectional, descriptive survey was conducted among male and female students aged 10 to 18 years in public and private secondary schools between April and July 2023. A total of 200 participants were recruited using multi-stage sampling. Data on relevant sociodemographic characteristics, awareness about the HPV vaccine, details of HPV vaccination and reasons for not vaccinating were collected using pretested interviewer-administered questionnaires.

Results: Nearly two-thirds (62.0%) of participants were aged 15 to 18 years. Sixty-five per cent had not previously heard about HPV infection or the HPV vaccine. However, only 3 (1.5%) female participants reported receiving the HPV vaccine. Significant associations were found between awareness of HPV infection and HPV vaccination status ($p = 0.006$). The major reasons for not receiving the HPV vaccine were a lack of information about the vaccine (100%), where to get the vaccine (27.9%]), and the cost of the vaccine (6.0%).

Conclusion: The study revealed a low level of awareness about HPV infection or vaccine and a very low HPV vaccination rate among the participants. Public enlightenment and advocacy about HPV and the HPV vaccine should be prioritised to enhance knowledge and uptake after the free HPV vaccine rollout.

Keywords: Cervical cancer, Cancer Prevention, Human Papillomavirus Vaccine, National Immunization Program, Southeast Nigeria.

Introduction

The Human papillomavirus (HPV) is the most common viral infection of the reproductive tract and a prevalent cause of sexually transmitted infections (STIs) globally.[1] HPV infection rate is highest in Africa (24%), Eastern Europe (21.4%), and Latin America (16.1%).[2] Approximately 8 in 10 sexually active individuals will experience an HPV infection at least once in their lifetime, often without developing noticeable symptoms.[3] While most HPV infections clear up within 12-24 months due to immune responses, persistent infections with high-risk HPV strains can lead to HPV-related diseases such as cancers and genital warts.[3,4]

HPV infection is a significant public health concern due to its association with various cancers, with an estimated 5% of all cancers worldwide being attributable to HPV.[1,-3,5,6] Globally, more than 700,000 HPV-related cancer cases are reported annually, claiming over 400,000 lives.[7] Of the 700,000 cases of HPV-related cancers reported each year, cervical cancer accounts for the largest portion (86.3%), followed by vaginal and vulvar cancer (6.6%).[7] Other HPV-related cancers include male head and neck cancers (4.3%), male anal cancers (3.1%), female anal cancers (3.1%), penile cancer (2.3%), and female head and neck cancers (1.0%).

Cervical cancer is the fourth most common cancer among women, causing substantial morbidity and mortality.[8,9] It is estimated that HPV accounts for up to 92.9% of cervical cancer cases.[10] More than 90% of the 342,000 deaths attributed to cervical cancer in 2020 occurred in low- and middle-income countries.[9,11] In Nigeria, 12,075 cervical cancer cases were reported in 2020, out of which about 7,968 died.[11,12.] The high burden of cervical cancer in Nigeria and other developing countries is partly due to the lack of routine HPV screening and vaccination programs. To address this burden, the World Health Organization (WHO) recommends incorporating HPV vaccination into comprehensive strategies to prevent HPV-related malignancies.[3]

The first HPV vaccine was licensed in 2006; currently, the WHO has licensed six HPV vaccines. All the vaccines contain virus-like particles (VLPs) targeting high-risk HPV serotypes 16 and 18.[3,13] The nonavalent vaccine also includes VLPs against serotypes 31, 33, 45, 52, and 58, while the quadrivalent and nonavalent vaccines provide protection against anogenital warts caused by HPV types 6 and 11. The six available vaccines include the bivalent (Cervarix®, Cecolin®, and Walrinvax®), quadrivalent (Gardasil® and Cervavax®), and nonavalent (Gardasil9®) HPV Vaccine formulations.[3,13] HPV vaccines are most effective when administered before sexual debut and consequent exposure to HPV infection. WHO recommends targeting girls aged 9-14 years for HPV vaccination programs, with secondary targets including boys and older females where feasible and affordable. Initially, a two-dose schedule of six months in between doses was recommended for girls aged 9-14 years, and a three-dose schedule for those 15 years or older. However, immunogenicity trials have shown that a single dose can elicit an immune response comparable to a multidose regimen. Therefore, WHO now recommends a one- or two-dose schedule for girls aged 9-14 years and girls/women aged 15-20 years, and two doses six months apart for women older than 21 years.

As of 2022, 125 countries have introduced the HPV vaccine for girls and 47 countries

for boys in their national immunisation programs.[13] Before the free HPV vaccine rollout in Nigeria, it was available only on a request basis to the very few whose parents could afford the relatively expensive vaccine.[14-18] In order to curb the burden of cervical cancer in Nigeria, the Nigerian Federal Ministry of Health (FMOH) and partners planned a two-phased free HPV vaccine introduction in 2023 and 2024 for girls aged 9-14 years, followed by routine administration to 9-year-old girls. To enhance the success and effectively monitor the progress of the free HPV vaccine rollout, it is crucial to document the baseline coverage rate and the factors influencing it. This will inform stakeholders on the best approaches to optimise routine HPV vaccine uptake and address potential barriers to vaccine acceptance and coverage. Therefore, this study assessed the HPV vaccination rate and the determinants of vaccine uptake among secondary school students in Nnewi, Anambra State.

Methods

This cross-sectional, descriptive study was conducted among secondary school students in Nnewi North Local Government Area, Anambra State, from 28th April to 31st July 2023. Using the formula for calculating sample size in a cross-sectional study, a minimum sample size of 176 was calculated using a prevalence of 13.2% in a previous study in Jos by Cosmas *et al.* to achieve a power of 80%, precision of 95%, and assuming a non-response rate of 10%.[19,20] A total of 200 students were studied. Multi-stage sampling was used to select students from all classes (JSS1-SS3) in selected secondary schools. To ensure a good mix, co-educational and same-sex schools, male and female genders, and classes were selected using a stratified sampling method. Random sampling was used to select classes to be studied. This was followed by selecting participants in each class by simple random sampling using the class register as the sampling frame. A total of six schools participated in the study, comprising three public and three private schools. The total population of students in the 48 private schools was 17,938, while that of students in the eight public schools was 9,374, giving a ratio of approximately 1:0.5.

The inclusion criteria were secondary school students from 10 to 18 years old who gave consent/permission for the study. Ethical approval was obtained from the Ethics Committee of Nnamdi Azikiwe University Teaching Hospital, Nnewi (NAUTH/CS/66/VOL. 15/135/2022/102). Permission was also obtained from the Ministry of Education, Anambra State, Post Primary School Board, and the management of the secondary schools where the research was conducted. A pretested, semi-structured, interviewer-administered questionnaire was used to obtain relevant data. This included the age of the participants, gender, class, parents' educational level and occupation, HPV vaccination status, and whether the participant ever heard about HPV infection or HPV Vaccine. Their sexual history was assessed by asking if they had ever had sexual intercourse, the age at sexual debut, the number of partners, and the use of barrier contraceptives. The family's socioeconomic status was determined using Oyedeji's classification.[21] To elicit accurate information, and ensure confidentiality, interviews were conducted in a room with adequate privacy. Adequately trained same-sex research assistants interviewed the participants. All data obtained during the study were kept confidential.

Data analysis

The data were analysed using IBM SPSS Statistics software version 25.0. Numerical variables such as age were summarised using mean and standard deviation. Categorical variables (gender, class category, socioeconomic status, school type) were summarised using frequency and percentages. The Chi-Square test determined the association between sociodemographic variables (gender, age group, socioeconomic status, student status, class category, and school category) and HPV vaccination status. Where conditions for the Chi-Square test were violated, the Fisher exact test was used. P-values less than 0.05 were considered statistically significant.

Results

Sociodemographic characteristics

Table I shows their sociodemographic characteristics. Among these students, 76 (38.0%) were younger adolescents 10-14 years of age, while 124 (62%) were older adolescents aged 15-18 years. The participants had a mean age of 15.0±1.9 years, and there were 110 (55.0%) males and 90 (45.0%) females (45.0%), giving a male-to-female ratio of 1.2:1. Junior secondary students numbered 103 (51.5%), while senior secondary students were 97 (48.5%). The majority (98%) of them were Igbos and of the Christian religion (99.5%), while more than half (54.5%) belonged to families with low socioeconomic class.

Table I: Sociodemographic characteristics of the participants

Variable		Frequency	Percentage
Age group (years)	10 – 14	76	38.0
	15 – 18	124	62.0
Sex	Female	90	45.0
	Male	110	55.0
School Type	Public and Boys only	30	15.0
	Public and Girls-only	26	13.0
	Public and Co-education	40	20.0
	Private and Boys only	9	4.5
	Private and Girls-only	10	5.0
	Private and Co-education	85	42.5
Class	Junior	103	51.5
	Senior	97	48.5
Ethnicity	Igbo	197	98.5
	Others	3	1.5
Religion	Christians	199	99.5
	Muslims	1	0.5
Socioeconomic Class	Upper class	28	14.0
	Middle class	63	31.5
	Lower class	109	54.5

Social classes: 1 and 2 - Upper, 3 - Middle, 4 and 5 -Lower

HPV vaccination rates among participants

Out of the 200 participants, 197 (98.5%) were not vaccinated, while 3 were vaccinated, for an HPV vaccination rate of 1.5%.

Relationship between sociodemographic characteristics and HPV vaccination status

The school type significantly affected the vaccination status of the adolescents (p = 0.026). Of the three girls vaccinated, one was from private girls only, while two came from public girls-only schools, giving a vaccination rate of 10% and 7.7%, respectively, in both school types. All three vaccinated adolescents were older, belonged to families of high socioeconomic class, and got vaccinated at government hospitals. There was no statistically significant relationship between vaccination status and socioeconomic class, school class or ethnicity, with all associations having p-values> 0.05, as shown in Table II.

Table II: Relationship between sociodemographic characteristics and HPV vaccination rate

Variable		Frequency	Vaccination status		Fisher's Exact Test
			Vaccinated	Non-vaccinated	
Age group (years)	10 – 14	76	0 (0.0)	76 (100.0)	0.290
	15 – 18	124	3 (2.4)	121 (97.6)	
Sex	Female	90	3 (3.3)	87 (96.7)	0.589
	Male	110	0 (0.0)	110 (100)	
School Type	Public and Boys only	30	0 (0.0)	30 (100.0)	
	Public and Girls-only	26	2 (7.7)	24 (92.3)	0.026*
	Public and Co-education	40	0 (0.0)	40 (100)	
	Private and Boys only	9	0 (0.0)	9 (100.0)	
	Private and Girls-only	10	1 (10.0)	9 (90.0)	
	Private and Co-education	85	0 (0.0)	85 (100.0)	
Class	Junior	103	1 (1.0)	102 (99)	0.522
	Senior	97	2 (2.1)	95 (97.9)	
Ethnicity	Igbo	197	3 (1.5)	194 (98.5)	0.765
	Others	3	0 (0.0)	3 (100.0)	
Religion	Christians	199	3 (1.5)	196 (98.5)	0.452
	Muslims	1	0 (0.0)	1 (100.0)	
Socioeconomic Class	Upper class	28	3 (10.7)	25 (89.3)	0.082
	Middle class	63	0 (0.0)	63 (100.0)	
	Lower class	109	0 (0.0)	109 (100.0)	

Relationship between awareness of HPV infection or HPV vaccine, and sexual exposure and HPV vaccination status

Among the 200 respondents, 130 (65%) have never heard about HPV infection or the vaccine, and 173 (86.5%) have not been exposed to sexual intercourse, as shown in Table III. Awareness of HPV infection or vaccine had a statistically significant relationship with being vaccinated (p =

0.006), while exposure to sexual intercourse had no significant relationship with HPV vaccination status.

Reasons for non-uptake of HPV vaccine

Multiple responses were reported by the 197 unvaccinated subjects as reasons for non-uptake of HPV vaccines. The major reasons included insufficient knowledge about the vaccine (197/197 [100%]), lack of information about where to get the vaccine (55/197 [27.9%]), and high cost of the vaccine (12/197 [6.1%]). Other reasons were safety concerns (3/197 [1.5%]), the perception that the vaccine was not meant for boys (2/197 [1.0%]), or that the disease affects mostly females (1/197 [0.5%]), as shown in Figure 1.

Table III: Relationship between awareness about HPV or sexual behaviour characteristics and HPV vaccination rate

Variables		Total	Vaccinated	Non-vaccinated	Fisher's Exact Test
Ever heard about HPV infection	No	130	0 (0.0)	130 (100)	
	Yes	70	3 (4.3)	67 (95.7)	0.006*
Ever heard about HPV vaccine	No	130	0 (0.0)	130 (100)	
	Yes	70	3 (0.0)	67 (95.7)	0.006*
Have you ever had sexual intercourse?	No	173	3 (1.7)	170 (98.3)	0.491
	Yes	27	0 (0/0)	27 (100.0)	

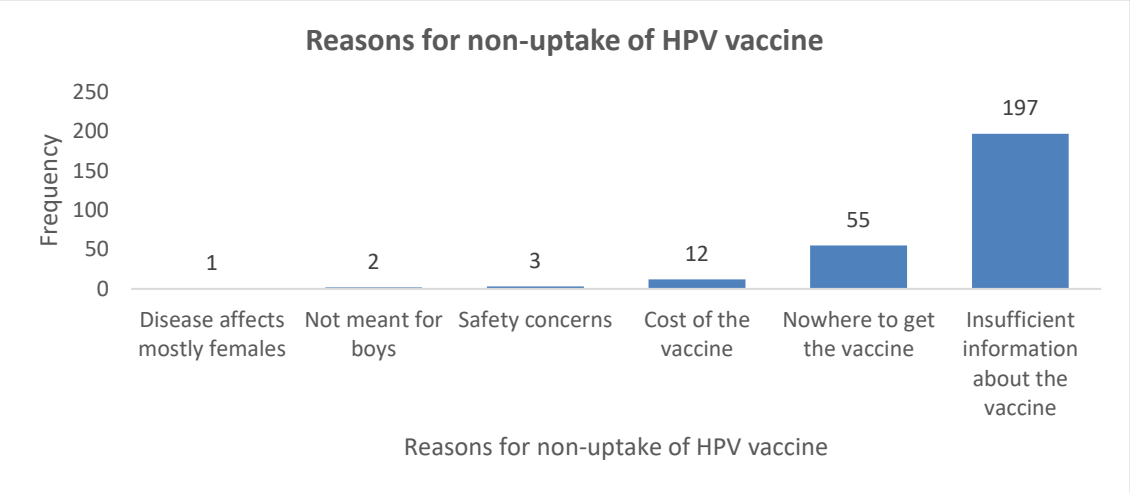

Figure 1: Reasons for non-uptake of HPV vaccine

Discussion

The HPV vaccination rate of 1.5% observed in this study is comparable to the 2.1% documented by Oboro *et al.* in Rivers State, southern Nigeria, among a similar age group, but it is almost three times higher than the rate of 0.5% reported by Ezeanochie *et al.* in Benin.[22,23] The disparity between the rates in this study and the Benin study may be attributed to differences in the level of

awareness about the HPV vaccine, which was 35% in this study compared to only 0.9% in Benin. As observed in this study, awareness of the HPV vaccine significantly influences its uptake. This may explain a higher vaccination rate of 5.1% reported by Ojinmah *et al.*,[24] in a study focused on undergraduates who are expected to be more aware of the HPV vaccine and its importance. HPV vaccination rates have also been documented to be higher in some African countries that have incorporated the HPV vaccine into their national immunisation programs.[25-27] This is believed to be due to the awareness created during the vaccine's introduction and the promotion of its routine vaccine uptake. With the recent rollout of free HPV vaccines and their incorporation into the routine childhood immunisation program, it is anticipated that both awareness and the uptake rate of HPV vaccination in the country will improve significantly over time. For this to happen, it is essential to embark on extensive awareness campaigns, given the observed very low baseline HPV vaccine awareness level and the positive influence of awareness on vaccine uptake. While targeting parents and stakeholders, these campaigns should also focus on the eligible population, who are likely to be receptive to receiving the vaccine and can influence their peers to do the same. In Benin, Nigeria, peer education was found to play a significant role in improving awareness about cervical cancer and enhancing knowledge among female adolescents.[28]

The significant association between HPV vaccination status and school type is not surprising, considering the differences in sex distribution of the schools. All three individuals who received the vaccine were girls from “girls’ only” schools. The absence of vaccination among boys is also not surprising and may be attributed to the focus on preventing cervical cancer in the promotion of the vaccine. Local studies are needed to understand the true burden of HPV-related cancers in males, which would help inform stakeholders about the need for this vaccine among boys.

Although the social class did not attain a statistically significant relationship with HPV vaccination status, it is noteworthy that all three girls who received the HPV vaccine belonged to families in the high social class. These economically privileged families are likely to be more aware of the vaccine and be able to afford its cost. This finding underscores the importance of ensuring the success of the free HPV vaccine rollout to bridge the gap between the rich and the poor.

The study has some limitations. It relied on students' ability to recall whether they had received the HPV vaccine, which could introduce recall bias, particularly among younger students in junior secondary schools. To mitigate this, research assistants were well-trained in techniques to elicit accurate responses. However, obtaining children's HPV immunisation status remains challenging without a well-organised population-based screening program and a verified database for monitoring. Despite these challenges, our findings provide baseline data to understand better the scope of work needed in awareness creation and offer a foundation for monitoring the progress of routine HPV vaccine implementation. Future research could include parental interviews to validate students' responses.

Conclusion

In the year preceding the routine free HPV vaccine rollout, awareness and uptake of the HPV vaccine were low among secondary school adolescents in Nnewi. Vaccine uptake was significantly influenced by awareness, and the major reasons cited for non-vaccination were a lack of information about the vaccine and its cost. This highlights the need to ensure a successful introduction of the routine vaccine to bridge the affordability gap and underscores the importance of conducting massive but targeted awareness campaigns during the rollout.

Authors' Contributions: DCG, UEF, and OCU conceived and designed the study. DCG and MCNP did the literature review. DCG analysed the data, while DCG, UEF, OCU, and USN interpreted the data. DCG and OCU drafted the manuscript, while all the authors revised the draft for sound intellectual content and approved the final version of the manuscript.

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