Original Research Article

KNOWLEDGE AND UPTAKE OF HUMAN PAPILLOMA VIRUS VACCINE AMONG FEMALE ADOLESCENTS IN PORT HARCOURT, NIGERIA. A CALL FOR URGENT INTERVENTION

ABSTRACT

Background: Infection with high-risk types of the Human Papilloma virus (HPV) has been associated with the development of cancers in both females and males, affecting the genital, oropharyngeal and anal regions. Safe and effective vaccines are available against high-risk types which are responsible for majority of cases of cervical cancer. This study was conducted to assess the level of knowledge and uptake of the HPV vaccine among female adolescents in Port Harcourt, Nigeria.
Methodology: A descriptive cross-sectional survey conducted among in-school female students of both public and private secondary schools in Port Harcourt metropolis, aged 9 - 19 years. A total of 328 participants were recruited using multi-stage sampling. Information on socio-demographics, sexual history, knowledge of HPV, its vaccine and vaccine uptake were collected using a self-administered, semi-structured questionnaire. Data was analyzed using SPSS version 23. Descriptive and analytical tests were performed to determine associations and predictors of vaccine uptake.
Results: The level of knowledge of the availability, protective role, and schedule for administration of the HPV vaccine was poor (≤36%). Only 2.1% of girls interviewed were vaccinated with 42.9% of these having taken only one dose, thus being incompletely vaccinated. The mean age at vaccine uptake was 13.4±1.2 years. The most common reason given for not having taken the vaccine, is unawareness of the vaccine (322/328). Uptake of the vaccine was better among students at public schools.
Conclusion: Social mobilization towards primary prevention of HPV infection should also focus on adolescents. Social media and school health programs/ clubs should be exploited/ improved to provide detailed and adolescent-friendly information necessary to stimulate improved uptake of the vaccine and thus reduce the devastating potential consequences of infection with the HPV.

Keywords: HPV, Vaccine, Cervical cancer, Adolescents, Port Harcourt, Nigeria

1. INTRODUCTION

Human Papilloma virus (HPV) infection is the most common viral infection of the genital tract (1, 2). It is widely documented that about three-quarters of sexually active individuals of both the male and female gender, will get infected with the HPV at least once in their lifetime (3). Reported prevalence rates in Nigeria range from 10% in Port Harcourt (4), 18.6% (3) and

26.3% in Ibadan, (5) to 37% in Abuja (6). The sequelae of HPV infection could include cervical, vaginal, vulval, and anal cancer in females, anal and penile cancer in males and oropharyngeal carcinoma in both males and females. These lesions are, however, more common in immunocompromised persons. (7,1). Therefore, apart from causing most cervical cancers which are the greatest public health concern associated with HPV infection, high risk HPV types (HrHPV) account for about 12% of oropharyngeal cancers, 90% of anal cancers and 50% of vulvar, vaginal, and penile cancers (8, 9). The incidence rates of various HPV-associated cancers in females in 2021, according to the ICO/IARC are 11.9 for cervical cancer, 0.37 for anal cancer, 0.91 for vulval cancer, 0.16 for vaginal cancer, 0.11 for oropharyngeal cancer, 0.53 for cancer of the oral cavity and 0.15 for laryngeal cancer (10). Cervical cancer incidence in Nigeria is still unacceptably high even though there are well documented, scientifically proven, effective, and accessible methods for its prevention. It is the second most frequent cancer among women in Nigeria, being more common among women aged between 15 and 44 years. Recent estimates indicate that in Nigeria, 12075 women are diagnosed with cervical cancer and 7968 die from the disease per year (10).

For the primary prevention of HPV infection and its sequelae, safe and effective HPV vaccines made from virus-like particles (VLPs) comprised of self-assembled pentamers of the viral L1 protein capsid have been developed since 2006 and were recommended for use by the World Health Organization (WHO) in 2009. All these vaccines confer immunity against the most common high oncogenic risk HPV types responsible for cancerous change (11). There are three types which are approved for use. The bivalent vaccine (Cervarix®, manufactured by Merck, MSD, UK) approved for use in 2006, protects against HPV types 16 and 18; the quadrivalent vaccine (Gardasil®, manufactured by GlaxoSmithKline, Brentford UK) approved for use in 2009 protects against HPV types 6, 11, 16 and 18 and the nonavalent HPV vaccine (Gardasil®9, also manufactured by GlaxoSmith Kline, Brentford UK) which was approved for use in 2014 provides protection against an additional five most common carcinogenic HrHPV types; 31, 33, 45, 52 and 58. Cervarix® targets the L1 protein

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from HPV types 16 and 18; Gardasil® targets L1 from HPV types 16, 18, 6 and 11 while Gardasil®9 an adjuvanted non-infectious recombinant 9-valent vaccine targets L1 from 16, 18, 31, 33, 45, 52, 58, 6 and 11. These vaccines all induce HPV type-specific L1 antibodies which block the virus from interacting with its specific receptors at the epithelial cells and thereby provide humoral immunity against HPV infections in females who are HPV-negative (11, 7,12, 13)

WHO's recommendation regarding HPV prevention is that the primary targets be all girls and boys aged 9-15 years; however, encourages vaccination in all persons through age twenty-six years if they have not been vaccinated before. Though approved through forty-five (45) years of age in some countries such as the United States of America, it is best before the onset of sexual intercourse, because vaccination after exposure doesn't offer any added protection against the already contracted virus type. Those aged 9 to 14 years at the time of the first dose should employ a 2-dose schedule (0,6 months) while a 3-dose schedule (0, 1–2, 6 months) is recommended for those 15 years or older (through 26 years) as well as for immunocompromised persons (14, 15). The effectiveness of these three (3) vaccines at protecting females against cervical intra-epithelial lesions (CIN) caused by infection with HPV types covered by the vaccines have been widely reported and HPV vaccination has been shown to provide herd protection as well (16,17). It is also very reassuring to note that reports of cross-reactivity of vaccine types not contained in the bivalent and quadrivalent vaccines (Cervarix® and Gardasil®) with other high oncogenic risk types not covered by these vaccines do occur, thus offering further protection to vaccinated females (18, 19,20).

Most secondary school students lie within the recommended age for vaccination; therefore, it is pertinent that these students are aware of and are fully vaccinated, to prevent cervical cancer later in life if they get exposed. The median age at sexual debut of Nigerian women is reported as 16.7 - 17.9 years which is within the age of adolescence (10) and young women, below 25 years of age have been observed to have the highest rates of HPV infection (21). It

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is estimated that if 90% of adolescent girls get the HPV vaccine globally, over 40 million lives could be saved in the next century (22). In a study of women in the United States of America, 25% of persons aged between fourteen (14) and nineteen (19) years were found to be positive for HPV (23). Early vaccination is therefore paramount to prevent HPV infection, as a proxy for cervical cancer prevention. Prevention of HPV infection is more effective and efficient because the treatment of HPV infection is fraught with a lot of challenges as there is no treatment for the viral infection itself (24) and treatment modalities for the diseases caused by the virus have been associated with poor outcomes, as well as recurrence (25).

The introduction and sustenance of HPV vaccination in various countries across the world, has led to a significant decline in the incidence rates of cervical cancer (26); however, it is currently not a component of the Nigerian national immunization program. These HPV vaccines are available in Nigeria but unfortunately are neither given free nor subsidized by the government because it is not part of the National Immunization Programme. The bivalent vaccine which is the most commonly available costs about costs about thirty thousand naira ($70) per girl who is 9 - 15 years of age or forty-five thousand naira ($105) per girl who is above 15 years of age, to be fully vaccinated. This is outrightly unaffordable by most in the lower and middle class, and particularly so for those with multiple children in that age group. Among the population with higher socio-economic status who can afford the vaccines therefore, their appreciation of the benefits would determine their decision on whether to procure these vaccines or not. This decision is guided by their level of knowledge of the impact, modes of transmission, and most importantly, the means of prevention of HPV infection.

Over the years in Nigeria, attempts at public enlightenment and increased vaccination coverage have been made by various concerned parties, from both the public and private sector. Many of these have subsidized screening and vaccination activities given along with health education programs. The expected impact of these activities would include increased

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uptake of the HPV vaccines. It is expected that adolescents in senior secondary schools in urban settings such as Port Harcourt metropolis should more likely be aware of and been vaccinated against cervical cancer than their rural counterparts. This study was designed to assess the knowledge of HPV vaccines and their uptake, as a measure of the impact of such activities and thus guide future interventions against cervical cancer in Port Harcourt, Nigeria.

2. MATERIAL AND METHODS

A cross-sectional descriptive study carried out in Port Harcourt metropolis, the predominantly urban region of Rivers State, in the south-south geopolitical zone of Nigeria. It was conducted among in-school female secondary school students in Port Harcourt metropolis aged between 9 and 17 years. Port Harcourt metropolis is the hub of oil and gas exploration activities in Nigeria and therefore harbors numerous industries operating in this sector as well as complimentary sectors including hospitality and therefore encourages indiscriminate social and sexual activities that allow for transmission of sexually transmitted infections. Transactional sex and multiple sexual partners are common occurrences. Most public enlightenment and educational activities tend to be concentrated here as well. Public schools are government-funded and tend to be over-subscribed, usually by students from families in the lower socio-economic class of society. The reverse is the case for private-owned schools which are moderately populated and enjoy better funding and management. Students at private schools are usually from upper middle to upper class families and are generally believed to have access to better educational content and opportunities.

Participants were selected using multistage sampling technique. Information on their socio-demographic details, including their age, knowledge of HPV vaccine and the vaccination status of respondents were collected using self-administered, structured questionnaires. Data was analyzed using Statistical Package for Social Sciences version 23. Five questions were used to measure knowledge. Participants responded with “Yes,” “No,” or “I do not know” to these questions. The maximum total score ranged from 0–5 with a higher score

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indicating better knowledge about the vaccine. The overall level of knowledge of participants was categorized using the modified Bloom's criteria (Seid & Hussen, 2018). Good knowledge score was 4-5 (80-100%), moderate score was 2.5-3.9 (50-79%) and poor if the score was less than <2.5 (<50%).

Chi square analysis was used to determine associations between their socio-demographic characteristics, school proprietorship and knowledge, as well as uptake of the vaccine. Bivariate logistical regression was used to determine the predictors of HPV vaccine uptake for effect size (odds ratio) at 95% confidence interval. A variable was considered significant if $P \leq 5\%$.

3. RESULTS AND DISCUSSION

3.1 RESULTS

Three hundred and twenty-eight (328) participants were interviewed. Their mean age was 13.8± 0.1 years and majority 63(19.2%) were 13 years old. Table 1 shows the socio-demographic characteristics of study participants.

Table 1: Socio-demographic characteristics of participants (N=328)

Variables	n (%)
Age (years)	
9	1 (0.3)
10	14 (4.3)
11	23 (7.0)
12	40 (12.2)
13	63 (19.2)
14	58 (17.7)
15	60 (18.3)
16	46 (14.0)
17	16 (4.9)
18	2 (0.6)
19	5 (1.5)
Religion	
Christian	321 (97.9)
Muslim	7 (2.1)
School Type	
Public	164 (50.0)
Private	164 (50.0)

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Class	
JSS1	35 (10.7)
JSS2	40 (12.2)
JSS3	98 (29.9)
SS1	46 (14.0)
Fathers' educational level	
Primary	7 (2.1)
Secondary	103 (31.4)
Tertiary	218 (66.5)
Mothers' educational level	
Primary	13 (4.0)
Secondary	108 (32.9)
Tertiary	207 (63.1)

Table 2 shows the level of knowledge of HPV vaccines among the study participants. Correct responses have been emboldened. Majority did not have basic information about the availability, protective role, and schedule for administration of the vaccine.

Table 2: Knowledge of HPV vaccines among participants (N=328)

Questions	**Yes n (%)**	**No n (%)**	**I don't Know n (%)**
There is a vaccine to protect one from HPV	**99(30.2)**	12(3.7)	217(66.2)
The HPV vaccine can protect one from most cervical cancers	**71(21.6)**	25(7.6))	232(70.7)
HPV vaccines are most effective if given to people who have never had sex	**26(7.9)**	10(3.2)	292(89)
The HPV vaccine requires two or three doses	**106(32.3)**	27(8.2)	195(59.5)
The HPV vaccine is available in Nigeria	**118(36)**	11(3.4)	199(60.7)

Figure 1 shows participants' scores on knowledge of HPV vaccine. Only 8.5% (28/328) had good knowledge of the vaccines.

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Figure 1: Knowledge of HPV vaccine among Participants

Table 3 shows the distribution of HPV vaccine uptake among participants. Few participants reported to have taken the HPV vaccine 7(2.1%) and of this proportion, some 3(42.9%) reported having taken only one dose. The mean age at vaccine uptake was 13.4±1.2 years. The most common reason given for not having taken the vaccine, is that they didn't know about it (322/328).

The question on reasons for non-uptake of the vaccine had the option of multiple answers (tick all that apply) thus the varied total proportions.

Table 3: HPV vaccine uptake among participants (N=328)

Variables	n (%)
I have taken HPV Vaccine	
Yes	7(2.1)
No	321(97.9)
If yes, Number of Doses taken	
One	3(42.9)
Two	2(28.6)
Three	2(28.6)
If No, Reason(s) why*	
I didn't know about it	322(98.2)
I didn't know where to get it	4(1.2)
It is too expensive	2(0.6)

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[$]Others	2(0.6)

$ Underage, Uninfected, Unnecessary

*The question on reasons for non-uptake of the vaccine had the option of multiple answers (tick all that apply) thus the varied total proportions

Table 4 shows the association between participants' socio-demographic characteristics and HPV vaccine uptake. It shows that there was a significant statistical association between religion and HPV vaccine uptake (X^2 = 5.057, *P* = .025). There was no statistically significant association between HPV vaccine uptake and school proprietorship. Vaccine uptake and knowledge was however better among students at public schools than students at private schools, though the difference was not statistically significant.

Table 4: Association between socio-demographic characteristics and HPV vaccine uptake (N=328)

Variables	**Vaccine uptake**		**X^2**	***P*-Value**
	Yes n (%)	**No n (%)**		
Age (years)				
9		1(100)		
10		14(100)		
11		23(100)	4.135	0.941
12		40(100)		
13	1(1.6)	62(98.4)		
14	2(3.4)	56(96.6)		
15	2(3.3)	58(96.7)		
16	1(2.2)	45(97.8)		
17	1(6.3)	15(93.8)		
18		2(100)		
19		5(100)		
School				
Public	6(3.7)	158(96.3)	3.649	0.056
Private	1(0.6)	163(99.4)		
Religion				
Christian	6(3.7)	315(98.1)	5.057	0.025*
Muslim	1(0.6)	6(85.7)		
Class			4.680	0.456
JSS1		35(100)		
JSS2		40(100)		
JSS3	4(4.1)	34(95.9)		
SS1		46(100)		
SS2	2(3)	64(97.0)		
SS3	1(2.3)	42(97.7)		

* Significant at p<0.05, X^2 Chi-square

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Table 5 shows the predictors of HPV vaccine uptake among participants in a logistic regression analysis. It shows that awareness (heard) of HPV (OR: 0.14, CI at 95%: 0.03-0.76) was associated with HPV vaccine uptake. Those who had heard of HPV had a significant 86% lowered odds of taking the vaccine than those who had never heard of HPV. It also shows that Christians were over 8 times more likely to take the HPV vaccine than Muslims though the association was not statistically significant.

Table 5: Predictors of HPV vaccine uptake

Variables	OR at 95%	CI at 95%	*P*-Value
Knowledge of HPV			
Poor			
Moderate	1.58	0.62-4.08	0.35
[1]Good	0.29	0.20-1.6	0.57
Religion			
Christian	8.75	0.91-84.35	0.06
[1]Muslim			
School			
Public	0.16	0.02-1.36	0.09
[1]Private			
Awareness of Ca Cervix			
Yes	0.49	0.11-2.23	0.36
[1]No			
Awareness of HPV			
Yes	0.14	0.03-0.76	0.02*
[1]No			
Class			
[1]JSS1			
JSS2	1.00	0.00	1
JSS3	0.00	0.00	0.998
SS1	0.00	0.00	0.998
SS2	0.00	0.00	0.998
SS3	0.00	0.00	0.998
Fathers' Education			
[1]Primary			
Secondary	0.35	0.08-1.57	0.17
Tertiary	0.00	0.00	0.999
Mothers' Education			
[1]Primary			
Secondary	0.00	0.00	0.998
Tertiary	0.00	0.00	0.999

*** Significant at *P* ≤0.05, OR: Odds Ratio, CI: Confidence Interval, [1]: Reference**

3.2 DISCUSSION

The level of knowledge of our study participants on HPV vaccines, their protective effect, recommended mode of administration and availability in Nigeria was quite poor. Not more

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than 36% were aware of this very pertinent information. This level of knowledge was less than a report of 64.3% awareness of HPV vaccines among undergraduate students in Port Harcourt, some of whom were adolescents (27); however, just like in this study, only about 20% of those were aware of the recommended age for vaccination. I believe that in addition to the above finding, poor knowledge of the transmission dynamics of HPV and its association with cervical cancer as reported from a similar study (27), is a major contributor to poor vaccine uptake. This is because knowing that HPV infection may be asymptomatic for long periods before cancer development, should motivate those who are financially capable of procuring the vaccine, to do so, but that is not the case. It will not also be surprising if vaccinated girls are unaware of their vaccination status and of HPV and cervical cancer related information as they may not have been enlightened on these by healthcare providers who administered the vaccines, because they are minors. This was reported by Gualano *et al*., as fewer vaccinated girls reported that they received information about the vaccines from health care professionals while the majority had received it from their parents (28).

HPV vaccine uptake was also extremely poor with only 7(2.1%) girls having been vaccinated, among whom only 2(28.6%) were completely vaccinated. This is quite unfortunate considering that 99% of cervical cancer cases are associated with genital HPV infection (3) and sadly, the case in most parts of Nigeria and the developing world. Globally, at the time of June 2020, only 55% (107/194) of WHO Member states had commenced HPV vaccination. The Americas and Europe have led this move with 85% and 77% of the countries in these regions having commenced vaccination. The United States, Australia, and Canada were the first countries to implement HPV vaccination as part of their national immunization programs since 2006 and have been followed by many other countries (29). Other low- and middle-income countries had lagged; however, a significant number commenced in 2019. In the WHO AFRO region, only about 31% of countries had commenced vaccination as part of their national immunization program (26).

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Globally, in terms of coverage (uptake of final dose), only about 15 - 20% of girls in the target age had received at least one dose by mid-year 2020. This leaves a large proportion of girls (about 70%) who live in countries that have not yet introduced HPV vaccination into their national immunization schedules largely unvaccinated, among whom are the majority of the most populous countries in the world, including Nigeria (26). The 90% coverage target for HPV vaccination by 2030 set in the recently approved WHO/UNICEF global strategy for cervical cancer elimination as a public health problem is not likely achievable in Nigeria if our current situation persists.

Among our study participants, Students of junior secondary school class 3 comprised the highest number of vaccinees while Christians were more likely vaccinated. Most of the unvaccinated reported unawareness of the vaccine, as the reason. The lack of knowledge of the HPV vaccine has been widely reported to be a major contributor to poor vaccine uptake (30,31,28,32). All hands must be on deck to reverse this dangerous trend. This calls for urgent and sustained action from local government, state and national health authorities, coordinators of school health programs, non-governmental and community-based organizations, professional organizations, and indeed well-meaning individuals to give time, resources and most importantly, strategize and implement effective interventions to geometrically improve these indices. On the contrary, a study among teenage girls in Italy indicated that the main reasons for non-adherence to vaccination were the disagreement of the parents (45.3%) and the lack of evidence on efficacy (26.8%) (28), reasons which may still be linked with poor knowledge.

A school-based approach to HPV vaccination may greatly improve the indices in Nigeria. If school administrators champion the social marketing of HPV vaccination through their school health program; enlighten the parents of their pupils and bargain with vaccine suppliers to get best deals for their students as a whole unit; it would be more easily bought into by parents, would be re-enforced by the pupils and lead to improved knowledge/ awareness and thereby increased vaccine uptake. The school-based approach for vaccination and

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health promotion has been reported to have shown better efficacy than a facility-based approach (26). Among teenage girls who participated in a study in Italy, 71.8% indicated that it would be useful to discuss HPV, it's transmission, clinical features, prevention, vaccination, and cervical cancer at school (28).

Students at public schools had better vaccine uptake, as more of those who were vaccinated with at least one dose of the HPV vaccine were also from the public schools 6(85.7%), though the difference was not statistically significant. I would attribute this observation to free vaccination campaigns/ outreaches that tend to target public schools because their students are believed to be from more indigent families than those in private schools. Students at public schools therefore benefit more from free vaccines than their colleagues in private schools. Awareness of HPV (just having heard of HPV) is not enough, as more detailed information is necessary to achieve the behavioral changes necessary to reduce HPV transmission and increase the uptake of its vaccine. This knowledge gap needs to be closed.

Our study also shows that religion is an important factor as Christians were over 8 times more likely to take the HPV vaccine than Muslims. The predominantly Christian population of Port Harcourt metropolis may have contributed to this; however, it is widely reported that religion is a well-recognized determinant of health care acceptance (33,34) and so, the approach to HPV vaccination campaigns among young girls and the general population must take into cognizance, possible language, cultural and religious barriers while designing effective enlightenment and behavioral change communication materials. Religious settings could be exploited to disseminate information on HPV prevention.

4. IMPLICATIONS OF THE FINDINGS: PROPOSED URGENT INTERVENTIONS

The formation of formidable cross-sectorial alliances and collaboration to push the vaccination agenda e.g., between the health workers, pharmaceuticals, women affairs, school proprietors and educationists is urgently required. Vaccines could be procured and made available at subsidized rates or offered at no cost to those who cannot afford it. School

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health clubs can be supported financially and with skilled manpower to train peer educators who would in turn educate the entire student population. Social mobilization and advocacy at state and national levels, as a route to improve HPV vaccine availability and affordability must be explored extensively by the ministries of Health and other stakeholders in the health sector. Social media drives showcasing vaccinated girls and women as models/ influencers would go a long way to raise awareness and increase vaccine uptake.

5. CONCLUSION

The level of knowledge and uptake of the Human Papilloma virus vaccines is very poor. The average Nigerian family in the middle/ lower class would not be able to afford vaccination of multiple children given our current realities in terms of the cost and economic state of the nation. The government must therefore rise to the challenge and include HPV vaccination in the national immunization schedule to help reduce HPV infection and thereby, the unacceptably high cervical cancer incidence rate in Nigeria. A school-based approach to HPV vaccination programs, particularly focused on upper primary and secondary schools is quite promising and so should be maximized.

CONSENT

Written assent and informed consent were obtained from the participants and their parents/ legal guardians respectively. No personal identifiers of the participants were collected to ensure confidentiality

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ETHICAL APPROVAL

Ethical approval (UPH/CEREMAD/REC/MM74/057) and permission were obtained from the state ministry of education as well as authorities of selected schools.

COMPETING INTERESTS DISCLAIMER:

AUTHORS HAVE DECLARED THAT THEY HAVE NO KNOWN COMPETING FINANCIAL INTERESTS OR NON-FINANCIAL INTERESTS OR PERSONAL RELATIONSHIPS THAT COULD HAVE APPEARED TO INFLUENCE THE WORK REPORTED IN THIS PAPER.

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