



HUMAN PAPILLOMA VIRUS (HPV) INFECTION AMONG SEXUALLY ACTIVE INDIVIDUALS IN BENIN CITY, EDO STATE, NIGERIA: A CROSS-SECTIONAL STUDY



E. J. Aichienede¹ and I. M. Moses-Otutu²

^{1,2}Department of Medical Laboratory Sciences, School of Basic Medical Sciences, College of Medical Sciences, University of Benin, Benin City, 300001, Nigeria

Correspondence: ifueko.moses-otutu@uniben.edu

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Abstract: Human Papilloma virus is a sexually transmitted pathogen of major global health concern as it is linked with various cancers. The cancers caused by HPV infection are penile cancer and cervical cancer. Penile cancer is a type of cancer affecting the penis tissues. It often originates in surface Skin cells and can spread to other parts of the organ. Cervical cancer is among the most common gynecological cancers globally, with a high mortality rate, primarily impacting women in developing countries. This research aims to determine the prevalence of HPV infection and its associated risk factors among sexually active individuals residing in Benin City, Edo State, Nigeria. A total of 160 participants; 82 males and 78 females were enrolled in this research. The participant's ages ranged from 15 years to 35 years. About 4mls of venous blood was collected from the cubital vein of each participant into sterile plain containers and allowed to clot. Afterwards, each blood sample was transferred to the laboratory and centrifuged at 3,000rpm for 10 minutes to obtain serum. The obtained sera were assayed for HPV IgM antibodies using Sunlong ELISA test kit manufactured by Sunlong Biotech Laboratories. The overall seroprevalence of HPV infection among sexually active participants in Benin City was 10.6%. Females had a higher prevalence of 52.9% HPV IgM antibodies than their male counterparts who had 47.1 % prevalence. HPV infection was only recorded in two age groups: 19-22 years with a prevalence of 47.1% HPV IgM antibodies and 23-26 years with a prevalence of 52.9% HPV IgM antibodies. The associated risk factors such as unsafe sexual practices and age at exposure to first sexual intercourse had influenced the acquisition of HPV infection in this study. This research was able to relate the risk factors of HPV infection to be age at exposure to first sexual intercourse and unprotected sex to the transmission of HPV infection in this part of Nigeria and emphasize the importance of integrating programs and campaigns to prevent the spread of HPV infection nationwide.

Keywords: Human papilloma virus, IgM antibodies, Risk factors, Seroprevalence, Sexually active individuals

Introduction

Human Papilloma Virus is a member of the Papillomaviridae family [Tommasino, 2014] and is widespread in distribution most especially among women. HPV is a sexually transmitted disease with varying prevalence based on populations and regions [De Sanjosé *et al.*, 2007]. Sexually active individuals, who often face elevated risks of contracting sexually transmitted infections (STIs), including HPV, have multiple risk factors. Multiple sex partners, engaging in unsafe sexual behaviors, starting sexual activity at an early age, having many years of sexual activity, and lower educational status are the risk factors predisposing individuals to HPV infection. Sexual contact with individuals who have multiple sex partners significantly increases the chances of HPV transmission, leading to a high prevalence of cervical cancer. This behavior also heightens the occurrence of penile cancer in males, as the virus can spread to their male partners [Ersan *et al.*, 2003]. The safest ways that sexually active individuals can reduce their risk of contracting and transmitting HPV infection is by adopting safer sex practices such as correct and consistent use of condoms, getting the HPV vaccine and getting regular Pap or HPV tests [Ikokuwu *et al.*, 2023].

The cancers caused by HPV infection are penile cancer and cervical cancer. Penile cancer is a type of cancer affecting the penis tissues. It often originates in the surface skin cells and can spread to other parts of the organ [Blanco-Yarosh, 2007]. HPV infection is a significant risk factor for penile cancer, particularly high-risk strains like types 16 and 18,

which can induce cell changes leading to cancer [Gross and Pfister, 2004.]. Cervical cancer is among the most common gynecological cancers globally, with a high mortality rate, primarily impacting women in developing countries. Persistent HPV infection, usually transmitted through sexual intercourse, is the leading cause of cervical cancer [Jain *et al.*, 2017].

The association between the number of sexual partners and the risk of cervical cancer was assayed through meta-analysis by Liu *et al.* in their study. Their results suggested that the number of sexual partners was related to the development of cervical cancer [Liu *et al.*, 2015]. Globally, the burden of HPV infection has wider variation in epidemiological distribution. Factors such as geographic, socioeconomic, cultural, and genetic factors contribute to HPV morbidity and mortality. Also, intrinsic individual factors like age, gender, anatomic site, and health status play a role in HPV morbidity and mortality [Le Conte *et al.*, 2018]

Cervical cancer is prevalent at a significantly higher rate in underdeveloped countries, largely because of major factors such as reduced access to testing and the expensive cost of HPV vaccines [Li and Xu, 2017]. The goal of this research was to investigate the rate of occurrence of HPV infection in sexually active participants in Benin City, Edo State, Nigeria. The research was designed to determine the prevalence of HPV infection among young sexually active males and females residing in Benin City, Edo State, Nigeria, the associated risk factors of HPV infection

highlight's the importance of raising awareness of HPV infection in-order to integrate programmed campaigns to prevent the spread of HPV infection nationwide.

Materials and Methods

Study Area

This cross-sectional study was carried out among sexually active individuals in Benin City, Edo State, Nigeria. Benin City is made up of three Local Government Areas namely Egor, Oredo and Ikpoba-Okha Local Government Areas respectively, with a population of 1,086,882. Males are estimated to be 542,545 males and females 544,337. That is about 27.7% (300,797 women) of its total population are women who belong to the reproductive age group.

Study Population

A total of 160 sexually active males and females within the age range 15 years to 35 years, residing in various apartments and family houses (randomly selected) within Benin metropolis, Edo State, Nigeria were recruited in this study. The sexually active nature of these individuals was determined through verbal interaction and use of questionnaires. The questions asked included if they have sexual partners, age at first sexual activity, use of sexual protection and the practice of oral sex.

Specimen Collection

There was prompt and proper collection of about 4mls of venous blood samples from the participants by venipuncture. The samples were dispensed into an appropriately labelled sterile plain container. Each sample was allowed to clot and then centrifuged at 3,000rpm in 10 minutes. The serum obtained was separated into plain containers and stored at -20°C for HPV assay.

Laboratory Analysis

Prior to use, all reagents were brought to room temperature and then mixed homogenously. The frozen sera were brought to room temperature and allowed to thaw for about 45 minutes. The thawed sera were screened for HPV IgM antibodies using commercially available Enzyme Linked Immunosorbent Assay (ELISA) test kit (manufactured by Sunlong Biotech Laboratories). The ELISA plates were read using the spectrophotometer at a wavelength of 450nm and results were interpreted according to the manufacturer's instructions.

Quality Control

The quality control tags of the ELISA kits were checked to ensure it was intact before purchase. After purchase and prior to use, the kits were stored at the manufacturer's recommended temperature (2-270C). The ELISA kits were used in line with the manufacturer's directives. All acquired

data were checked for data precision through the processes of entering the data.

Statistical Analysis

The results obtained from the questionnaire and laboratory investigations were tabulated, encoded, and statistically analyzed using Statistical Package for Social Sciences (SPSS) Version 21. Pearson Chi square tests were used to determine relationships between demographic information and prevalence rates with a 95% confidence interval (levels of significance were accepted at $p < 0.05$).

Results

Of the total 160 sexually active individuals screened, 17 (10.6%) were found to be seropositive for HPV specific IgM antibodies while the remaining 143 (89.4%) were seronegative for HPV IgM antibodies (Table 1).

Table 1: Prevalence of HPV IgM antibodies among Sexually Active Individuals in Benin City, Edo State, Nigeria.

Serology	No. Examine d	Prevalence Percentage	p value	Odds ratio	95% CI
IgM positive	160	17	10.6	<0.001	0.12-2.34
IgM negative	160	143	89.4		6.48
Total		160	100		

Slightly, high prevalence (52.9%) of HPV was obtained among females while males had a prevalence of 47.1%. ($P=0.715$). The distribution of HPV IgM antibodies had age groups 23-36 years recorded the highest percentage prevalence of HPV infection (52.9%) while age groups 19-22 years recorded a 47.1% prevalence. Other age groups recorded no incidence of HPV infection ($p=0.181$). There was an increase in HPV infection among participants who were single (94.1%) compared to their married counterparts (5.9%) ($p=0.182$). The distribution of HPV antibodies was skewed in favour of participants having their first sexual encounter at age >16 (82.4%) when compared to those having their first sexual encounter at age <16 (17.6%) ($p=0.902$). Prevalence of HPV infection was higher among the religious group, Christians (94.1%) when compared to their Muslim counterparts (5.9%) ($P=0.624$).

Table 2: Social Demographic Variables and Prevalence of Human Papilloma virus Infection In Sexually Active Individuals in Benin City, Edo State, Nigeria.

Variable	No. Examined	No. positive	Percentage positive	P value	OR	95% CI
Gender						
Males	82 (51.3)	08	47.1	0.715	0.829	0.303-2.269
Females	78 (48.7)	09	52.9			
Total	160(100)	17	100			
Age						
15-18	6 (3.8)	00	00	0.181		
19-22	49 (30.6)	08	47.1			
23-26	74 (46.3)	09	52.9			
27-30	15 (9.4)	00	00			
>30	16 (10.0)	00	00			
Total	160 (100)	17	100			
Marital Status						
Married	28 (17.5)	01	5.9	0.182	3.742	0.473-29.31
Single	132 (82.5)	16	94.1			
Total	160(100)	17	100			
Religion						
Christian	154 (96.3)	16	94.1	0.624	1.725	0.190-15.70
Muslim	06 (3.7)	01	5.9			
Total	160(100)	17	100			

Risk factors associated with the acquisition of HPV infection had participants who engaged in unprotected sex recorded the highest percentage prevalence (76.5%) than those who had protected sex (23.5%) ($p=0.173$). The risk factors also showed that participants who engaged in oral sex also had a high prevalence (52.9%) than those who do not practice oral sex (47.1%) ($p=0.926$) (Table 3).

Table 3: Sexual Activity and prevalence of Human Papilloma virus Infection in Sexually Active Individuals in Benin City.

Variable	No. Examined	No. positive	Percentage Positive	Pvalue	OR	95% CI
Age at first sexual activity						
<16	30 (18.8)	03	17.6	0.902	1.086	0.292-4.047
>16	130 (81.2)	14	82.4			
Total	160(100)	17	100			
Sexual Protection						
Protected sex	62 (38.8)	04	23.5	0.173	2.218	0.689-7.140
Unprotected sex	98 (61.2)	13	76.5			
Total	160(100)	17	100			
Oral Sex						
No oral sex	77 (48.1)	8	47.1	0.926	1.049	0.383-2.872
Oral sex	83 (51.9)	9	52.9			
Total	160(100)	17	100			

Discussion

The 10.6% HPV IgM antibodies obtained among sexually active individuals in this study confirm the nature of work conducted by sex workers predisposes them to an increased risk of contracting HPV infection. Studies have shown that a high number of lifetime partners can lead to a higher transmission of HPV infection [Sellors *et al.*, 2003]. Also possible are factors, such as specific cultural practices or sexual behaviors play a significant role in influencing HPV prevalence. In communities where knowledge about sexually transmitted infections is limited, individuals may

engage in risky behaviors unknowingly. Lack of adequate resources and education in this demographic may cause a higher vulnerability to HPV infection, amplifying the prevalence within this subgroup. There may be major differences in the results obtained from previous studies in different parts of the country and ours because of the diversity of the people living in the various parts of the country and the world at large. The low level of literacy, rate of poverty and overall underdevelopment also encourage the spread of diseases and in turn influences the prevalences obtained.

The analysis of the result in this present study on gender reveals no significant relationship between gender and IgM antibodies of HPV infection among the study participants. Although females had a higher percentage prevalence. Males show a lot more tendency to be in many sexual relationships most especially as adolescents and young adults [Panatto *et al.*, 2012]. Therefore, asymptomatic men can serve as a reservoir host for HPV and transmit the virus to multiple women resulting in a higher prevalence in women than men [Liu *et al.*, 2015]. The differences in the anatomy of the female genitalia also make women more susceptible to the infection. In addition, most HPV research has been focused on females and this in turn leads to better detection and availability of more reports about its epidemiology in females than in males.

The prevalence of HPV infection based on age shows only two age groups recording prevalence of HPV infection (19-22 years and 23-26 years) while the older age groups (27-30 years and >30 years) recorded no prevalence of HPV infection. The reason behind this trend may be a decrease in HPV type prevalence at older age due to: clearance of infection, natural immunity and safer sex practices at older age. Also, a decrease in the number of sexual partners as age increases may explain the age-related pattern of HPV prevalence [Canadas *et al.*, 2004] in this study. Also, the high prevalence of HPV infection within these age groups (19-22 years and 23-26 years) may be attributable to social behaviors such as alcohol and drug use relative to sexual practices and multiple sexual partners in this age groups [Averbach *et al.*, 2010]. In females, another reason for the increased prevalence of HPV infection among this age group may be the highest metaplastic activity that occurs at the cervix within these ages; This metaplastic activity coincides with the greatest risk of contracting HPV infection [Gage *et al.*, 2012].

The prevalence of HPV infection relative to marital status had single participants having higher prevalence than married participants. The increased prevalence of HPV infection among single participants can be linked to their sexual behaviors and patterns of sexual activities such as premarital sexual relationships, differences in sexual health knowledge and behaviors that are not tied to formal marital status. An example is single individuals who are not in a committed monogamous relationship having multiple sexual partners. The predominant religion among our study participants is Christianity. As a result, the percentage seroprevalence of HPV infection was increased in Christians than in Muslims. Religion is not a known factor in acquiring HPV infection.

Based on this study, the age at onset of sexual activity had a higher percentage prevalence among participants who had their first sexual encounter at age >16 years than those having their first sexual encounter at age <16 years. Contrary to the findings from this study, it has been established from the literature that early initiation of sexual activity may coincide with biological factors that make individuals more susceptible to HPV infection. Adolescents and young adults who engage in sexual activity at an earlier age may have immature immune systems, making them more susceptible to viral infections, including HPV. Also, individuals who start sexual activity at a younger age might have had limited access to proper sexual health education which is a very

important part of achieving safer sexual health. Lack of awareness about safe sexual practices, condom usage, and the risks associated with early sexual debut could contribute to a higher likelihood of HPV transmission. These behaviors increase the chances of coming into contact with HPV-infected individuals and enhance the risk of transmission.

From the questionnaire, 98 participants in our study reported they practiced sexual activities without using sexual protection. However, 14 (76.5%) of these 98 participants tested positive for HPV infection. HPV is known to primarily be contacted through direct skin contact, particularly through mucous membranes. Unprotected sexual activities increase the likelihood of direct contact between infected and non-infected mucosal surfaces, facilitating the transmission of the virus. HPV infections often do not cause noticeable symptoms, making it challenging for individuals to be aware of their infection status. Consequently, those engaging in unprotected sex may unknowingly transmit the virus to their partners, contributing to the high prevalence observed in this group. Also, the use of condoms to prevent the transmission of HPV infection may not be a hundred percent effective as any genital contact poses a risk of getting infected with HPV [Mosicki, 2005]. Inconsistent or incorrect condom use may not provide adequate protection against HPV transmission, especially considering that the virus can be seen in areas not covered by condoms but condom use helps to reduce the virus transmission rate.

The percentage seroprevalence of HPV infection in participants who engage in oral sex in this study is 52.9%. HPV can be transmitted through direct mucosal contact, and engaging in oral sex involves intimate contact between the oral mucosa and genital or anal regions. This direct contact provides a route for the transfer of the virus, contributing to the observed prevalence among individuals practicing oral sex. In 2017, a review on oral sex and HPV-related head and neck squamous cell cancer was done by Shah *et al.* [2017], and they were able to prove that sexual practices like oral sex and Oro-anal sex play an important role in the transmission of HPV infection. This infection could potentially result in HPV-associated Head and Neck Squamous Cell Carcinoma (HNSCC). The increased prevalence of HPV infection in participants of this study who engage in this unsafe sexual act highlights the importance of discussing sexual practices that can lead to transmission of this virus with sexually active individuals in our locality.

Conclusion

The seroprevalence of Human Papilloma Virus IgM antibodies among sexually active individuals in Benin City, Edo State, Nigeria was found to be 10.6%. HPV infection was more prevalent in females than in males. Also, HPV infection was more prevalent among sexually active individuals in the ages 19-26 years. Single participants recorded a high percentage prevalence of HPV infection. Age at first sexual encounter predisposed our study participants to HPV infection. Additionally, this research was able to relate the risk factors for acquiring HPV infection to unprotected sex and oral sex. The study's findings emphasize the importance of raising awareness about HPV infection and its mode of transmission among

sexually active individuals in Benin City, as it was observed that knowledge in this regard was relatively low in the study population.

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Competing interests

The authors declare they have no competing interests.

Abbreviations

HPV: Human papilloma virus; IgM: Immunoglobulin M; ELISA: Enzyme linked immunosorbent assay; STI: Sexually transmitted infection; HRP: Horseradish peroxidase; OD: Optical density; SPSS: Statistical package for social sciences; HNSCC: Head and neck squamous cell carcinoma.

Ethical Approval

Approval was gotten from the Ethics and research committee Ministry of Health, Edo State, Nigeria with reference number HA/737/23/D/08210152. Informed consent was gotten from consenting participants before sample collection. Structured questionnaire was used to collect bio-data and other demographic information of each participant.

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