

Original Article

High-Risk Cervical Human Papillomavirus Prevalence in a Northeast Nigeria Community: A Descriptive Study

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Abstract

Background: Disparities in cervical screening result in disproportionate cervical cancer burdens in populations. This study assessed cervical human papillomavirus (HPV) infection prevalence in a rural northeast Nigeria community with low access to cervical screening.

Methodology: A community health outreach was conducted at a primary healthcare facility in Azare, Bauchi State, Nigeria. The women who wished to and consented to undergo gynaecological consultations were non-randomly enrolled on the study and provided their sociodemographic data and cervical specimens (Pap smear and cytobrush exfoliates in viral transport media) for the study. These were analysed cytologically and for the presence of HPV deoxyribonucleic acid (DNA).

Results: Of 62 women screened (mean age 38.5 ± 9.8 years), 34 (54.8%) tested positive for HPV DNA (95% confidence interval = 43-67%). Among these positive cases, 19 had no intraepithelial lesion or malignancy (NILM), 8 were designated atypical squamous cell of undetermined significance (ASCUS), and 6 showed low-grade squamous intraepithelial lesion (LSIL). In contrast, one case was high-grade SIL (HSIL). Thirty single infections were seen, HPV 16 being the commonest (18 cases), followed by HPV 18 (9 cases), while non-16, non-18 genotypes (genotypes 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 67, 68), collectively termed "Others", accounted for 3 cases. Coinfections among different genotype classes (genotypes 16, 18 and Others) occurred in 4 additional cases. Most of the women had a primary education or higher (43; 69.4%), were married (53; 85.5%), and were multiparous (52; 83.9%). However, the majority had not heard about cervical cancer (35; 56.5%), while 60 (96.8%) women had never been screened previously.

Conclusions: The results suggest a high prevalence of cervical HR-HPV and SIL in Azare. Improved public enlightenment and access to cervical cancer screening services may help to decrease transmission of HPV and subsequent cervical cancer in the population.

Keywords: Cervical screening, Human papillomavirus, Genotype, Pap smear, Northeast Nigeria

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Introduction

Cervical cancer is a significant public health problem globally. Current estimates reveal a notable rise in age-standardised incidence and mortality rates in transitioning countries.[1] Infection of the cervical epithelium by high-risk human papillomaviruses (HR-HPV) is essential for transforming healthy tissue into premalignant and malignant states.[2] These viruses are sexually transmitted, with certain genotypes strongly linked to cervical cancer. To develop effective prevention strategies, it is crucial to understand the prevalence of high-risk HPV (HR-HPV) types, awareness levels, and associated risk factors within a population.

The burden remains considerable in Nigeria, especially among women in rural and underserved areas. Overall, pooled HPV prevalence among Nigerian women is estimated at 32% ranging from 4.2% to 76% in various studies.[3] The Northeast Nigeria region shows the highest prevalence (~48.1%), suggesting a potentially greater burden.[4] Genotype profiles also varied among regions. The northeast Nigeria study found a predominance of HPV 18, 16, 33, 31, while other researchers in Edo, South-South Nigeria, detected genotypes 16, 18, 35, 45, 52, and 58, with HPV 16 and 18 accounting for about 54.2% of infections, while co-infections accounted for approximately 29.2% of cases.[4,5] Additionally, using next-generation sequencing, other genotypes such as HPV 71, 82, and 20, which are currently not covered by existing vaccines, have been reported in the country, further highlighting the need for population HPV testing, especially among underserved communities, to guide intervention efforts more effectively.[6]

Risk factors associated with HR-HPV infection in Nigeria include low educational level, early sexual debut, high parity, and multiple lifetime sexual partners.[4] Multiple HPV infections are also frequently reported. Screening uptake remains very low, especially in rural areas where many women have never undergone cervical cancer screening. Even among educated women, screening rates are low, indicating that health awareness does not necessarily translate into higher participation.[7] Without a nationwide screening programme, a significant proportion of infected women develop overt malignancy, often presenting late.[8]

Despite the high burden of cervical cancer in Northeast Nigeria, there is a lack of data on the prevalence of cervical HR-HPV infection among rural community women. Available data from Central Nigeria show a higher prevalence of HR-HPV genotypes among rural compared to urban women.[9] Without these rural-specific data, there's a risk that national/regional intervention policy will be mis-targeted. This underscores the need for the present study to determine the prevalence of cervical high-risk HPV genotypes and the associated cytological abnormalities among women in Azare, a rural community in northeast Nigeria.

Methods

Participants

This cross-sectional descriptive study enrolled participants non-randomly at a single community health outreach in a Primary Health Centre in Azare, Katagum Local Government Area, Bauchi State, Nigeria. General medical and gynaecological consultations were offered. Adult women attending the outreach who were 18 years or older and who provided consent for pap smear and HPV testing were enrolled into the study. Persons younger than 18 years or older women who refused permission to participate were excluded. The study was conducted in accordance with the Declaration of Helsinki. Ethical approval for this study was obtained from the Federal Medical Centre, Azare Ethics and Research Committee (approval date: 18th October 2024). Consented participants were administered a questionnaire by an interviewer who had good knowledge of the subject matter and was able to translate the questions into the most commonly spoken language. All completed questionnaires were checked for completeness and accuracy. The data collected was handled with utmost confidentiality.

Sample collection

A trained female health worker collected cervical samples from 62 women using a cytobrush, placing them in viral transport medium (Jiangsu Rongye Technology Co., Ltd, China). Cytology smears were also prepared on dry slides with Ayres' spatula. The specimens were transported to the laboratory for viral DNA detection and cytomorphological analysis of the smears.

DNA Extraction

Viral DNA was extracted using the Liferiver viral DNA/RNA Isolation Kit (Shanghai ZJ Bio-Tech Co., Ltd). Cervical cells collected in preservative fluid were lysed with a lysis buffer. Cellular proteins were digested, and deoxyribonucleases and ribonucleases were inactivated with Proteinase K, followed by ethanol precipitation. The target nucleic acids were bound to silica gel membranes in a column, washed with ethanol buffer in a centrifuge at 12,000 rpm, and eluted to obtain purified viral DNA.

PCR Performance

The samples were tested for high-risk oncogenic HPV DNA using multiplex real-time PCR on a MIC thermocycler (Biomolecular Systems, Australia). The PCR Master Mix (Bosphore HPV screening kit v1, Anatolia Geneworks, Turkey) contained Taq polymerase, PCR buffer, dNTPs, and primers and probes specific for HPV types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 67, 68, plus the human GAPDH internal control. Positive controls included synthetic nucleic acid sequences for HPV genotypes and the GAPDH gene, each tagged with FAM, HEX, TEXAS RED, or Cy5. Reaction mixtures of 25 µl were prepared by adding 5 µl of sample DNA to 20 µl of Master Mix.

The initial denaturation step was at 95°C for 10 minutes, followed by 40 cycles of PCR at 97°C for 20 seconds, annealing and extension at 60°C for 40 seconds, and a final hold at 32°C for 20 seconds. PCR amplification was monitored in real-time, eliminating the need for gel electrophoresis. Threshold cycle (Ct) values were used for interpretation: Ct values equal to or less than the positive control value (≤ 28) indicated a positive HPV result. In contrast, higher Ct values were considered negative. The Bosphore HPV kit identified HPV 16 on the FAM channel, HPV 18 on HEX, and other types, termed "Others" (31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 67, 68) in the TEXAS RED channel, with internal (positive) controls detected on Cy5. Each PCR run included a no-template negative control, containing all reaction components except the nucleic acid template, to monitor for contamination and non-specific amplification.

Cytology Assessment

Cytology smears were manually stained by a cytotechnician using the Papanicolaou staining technique and then examined by a pathologist. Interpretations followed the Bethesda System for Reporting Cervical Cytology. They included categories such as negative for intraepithelial lesion or malignancy (NILM), low-grade squamous intraepithelial lesion (LSIL), high-grade squamous intraepithelial lesion (HSIL), or atypical squamous cells of undetermined significance (ASCUS).

Data analysis

Statistical analysis of the data was performed using SPSS (IBM®SPSS Inc., Chicago, IL, USA) version 20. Specifically, summary statistics were used to categorise nominal variables into proportions and percentages. The Kolmogorov-Smirnov test indicated a normal distribution for the participants' ages ($p = 0.200$). Therefore, the mean was used as a measure of central tendency, and the student's t-test was employed to assess the statistical significance of the difference in mean age between HPV-infected and non-infected individuals at a 95% level of significance and a two-tailed p-value of < 0.05 . A 95% confidence interval (95% CI) was calculated for the prevalence statistics. Besides this, all other statistical treatments of the data were descriptive, with outputs presented as proportions.

Results

Sixty-two women met the inclusion criteria and underwent cervical cytological and HR-HPV testing. The mean age (with standard deviation) was 38.5 ± 9.8 years. Figure 1 illustrates the age group distribution (by decades), with the 5th decade being the modal age group and the 20-29 range being the least. No participant was younger than 20 years old. The median age at first sexual activity was 17 years (semi-interquartile range of 19-16 years). Nearly 75% of the women were sexually active by age 19.

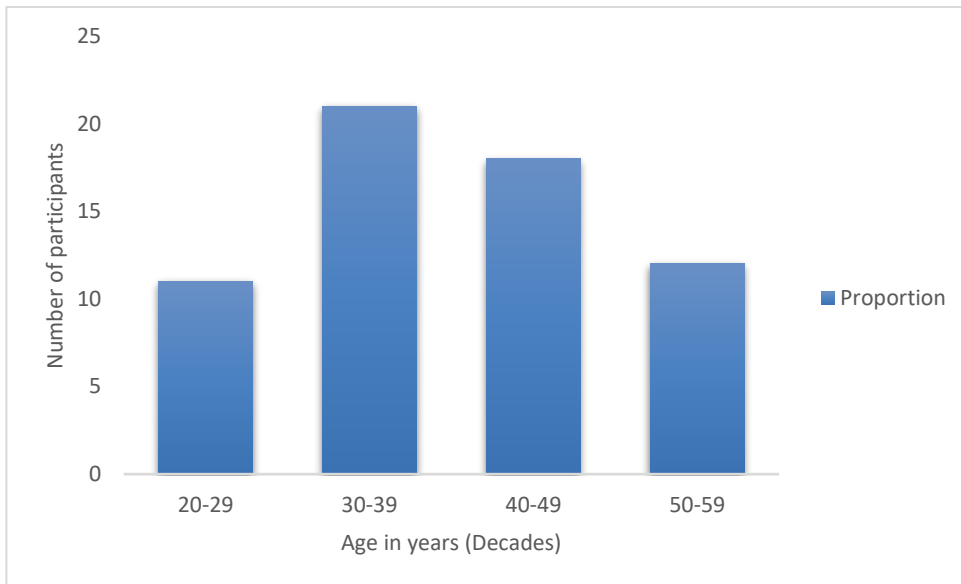


Figure 1: Age distribution of the participants in decades.

Table 1 presents other sociodemographic details of the study population. A total of 43 women had at least a primary education, representing 69.5% of the total. Twenty-four women were engaged in various trades, while five were in formal (government) employment. Most women were married in polygamous families (54.8%) and had one lifetime sexual partner (62.9%). Parity was high, with 52 women having had a pregnancy beyond viability (see Figure 2). Screening for cervical cancer was reported by 2 women (3.2%), while a fifth experienced abnormal vaginal bleeding. Over half had abnormal vaginal discharge, and one woman had a family history of cervical cancer.

Table 1: Sociodemographic characteristics of the study participants

Factor variable	Category	Proportion	Percentage (%)
Education level	None	19	30.6
	Primary	11	17.7
	Secondary	23	37.1
	Tertiary	9	14.5
Employment status	Formal employment	5	8.1
	Informal employment	57	91.9
Marital status	Married	53	85.5

	Divorced	6	9.7
	Widowed	3	4.8
Type of marriage	Monogamy	25	40.3
	Polygamy	34	54.8
	Widowed	3	4.8
Number of sexual partners	1	39	62.9
	>1	23	37.1
Ever heard of cervical cancer	No	35	56.5
	Yes	27	43.5
Ever screened for cervical cancer	Yes	2	3.2
	No	60	97.8
Abnormal vaginal discharge	Yes	33	53.2
	No	29	46.8
Abnormal vaginal bleeding	Yes	13	21.0
	No	49	79.0
Family history of cervical cancer	Yes	1	1.6
	No	61	98.4

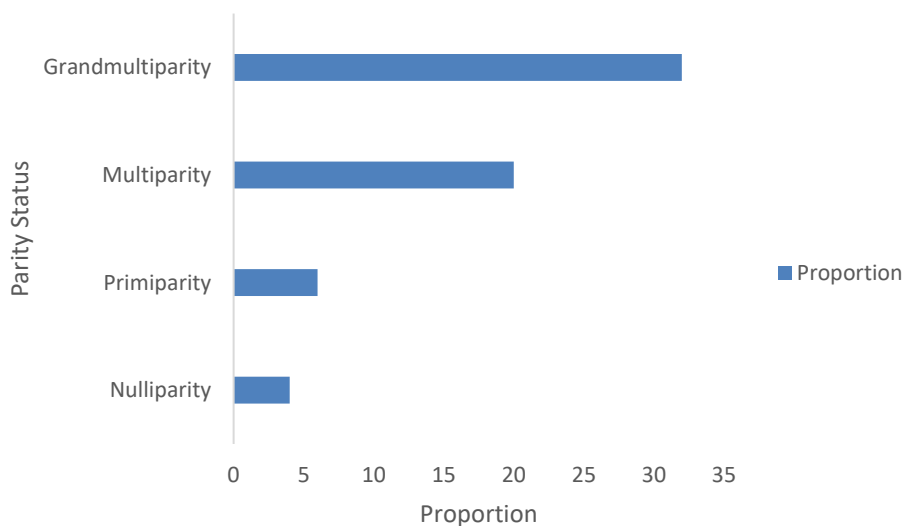


Figure 2: Parity distribution among the participants.

Among the 62 women screened, 34 tested positive for at least one HR-HPV serotype, comprising 30 single infections and 4 coinfections, resulting in a prevalence of 54% (95% CI, 43-67%). Single infections were predominantly caused by HPV 16, accounting for 18 cases, followed by HPV 18 in 9 cases, with 3 infected by other genotypes (HPV genotypes 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 67, 68). Of the four cases with coinfections, all three genotypes (HPV 16, 18 and others) were present in 2 cases, HPV 16 and 18 coinfections occurred in one case, while HPV 18 co-occurred with non-16, non-18 genotypes in one other case. Thus, HPV 16 infection constituted about 60% of infections with a 95% CI of 44-76%.

Figure 3 illustrates the cytological findings from the pap smears. Sixty slides were stained, and 2 slides were unevaluable and were excluded from this analysis. Overall, 19 smears showed observable cytological abnormalities, representing 33.9% of pap tests (95% CI = 22-46%). Among the 34 HR-HPV positive tests, 19 samples were negative for intraepithelial lesions NILM, while 8 showed atypical cells of undetermined significance (ASCUS). Squamous intraepithelial lesions (SIL) were found in seven cases, six of which were low-grade (LSIL) and one was high-grade (HSIL). None indicated cervical cancer. Also shown in Figure 3 are the cytology results for HPV-negative samples. There were 22 NILM, one smear each with ASCUS and HSIL and two showing LSIL. Comparatively, therefore, more cytopathological lesions were seen among HR-HPV women. There was, however, no significant difference in the mean age between HR-HPV-positive and HR-HPV-negative women (38.9 ± 9.4 vs. 38.0 ± 10.5 years; $p=0.729$). Women without formal education were more likely to test positive for HPV (13 out of 19) compared to those with formal education (21 out of 43). Among women in polygamous marriages, 21 of 34 had HPV, versus 11 of 25 women in monogamous marriages. Women reporting abnormal vaginal discharge were as likely to have HPV as those without (15 vs. 19).

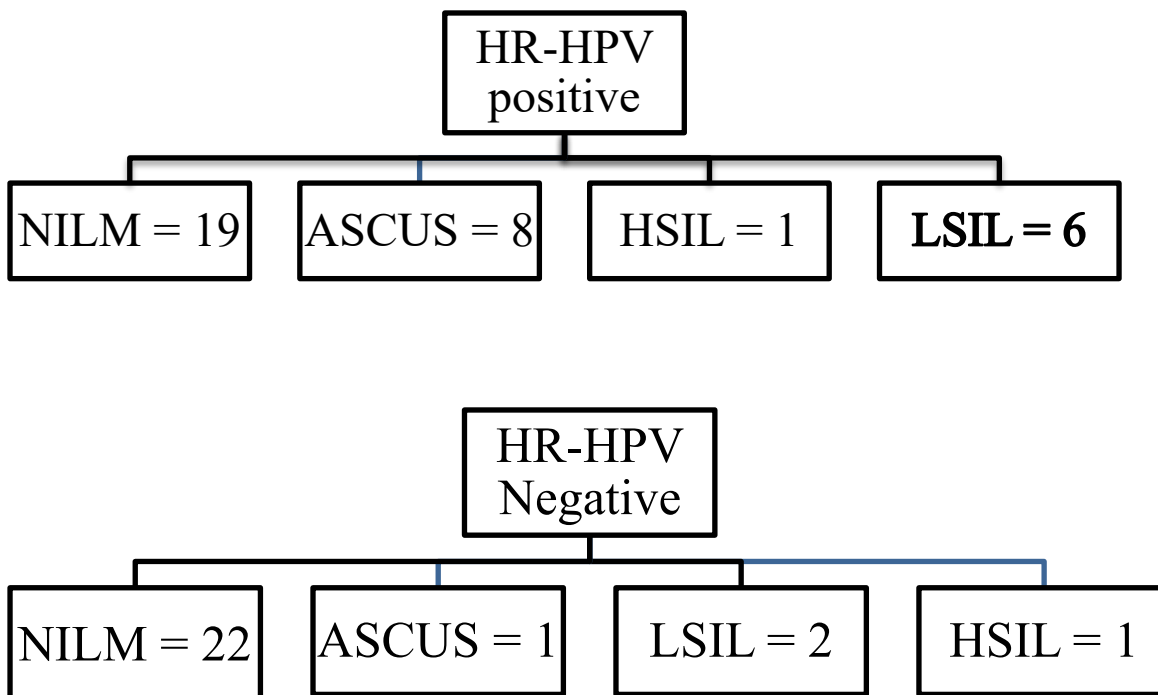


Figure 3: Cytological findings among HR-HPV-positive and HR-HPV-negative tests. HPV, human papillomavirus; HR, high-risk HPV; NILM, negative for intraepithelial lesions or malignancy; ASCUS, atypical squamous cells of undetermined significance; LSIL, low-grade squamous intraepithelial lesion; HSIL, high-grade squamous intraepithelial lesion

Discussion

This study reveals a notably high HPV prevalence of 54.8%, along with common sociodemographic factors of HPV infection in the tested population. This rate exceeds the 48% reported by Manga et al in Gombe, Nigeria [4], which is an urban setting compared to this study's rural location, indicating a possible rural-urban difference in infection transmission. Studies elsewhere in sub-Saharan Africa have also shown differences in HR-HPV infection rates between urban and rural areas [10,11], further supporting the position on urban-rural disparity in HR-HPV prevalence. Also, the report of higher HPV 16 prevalence over other genotypes is in contrast with some other studies from Nigeria that reported more non-16 genotypes, suggesting regional variations in HR-HPV distribution in the country.[12,13] Urgent interventions are therefore needed to reduce this disparity in infection burden and prevent high cervical cancer mortality, especially among underserved rural communities in sub-Saharan Africa.

Several key factors related to cervical HPV infection were observed. All participants were either married or previously married. Most were multiparous and reported having one lifetime sexual partner; they lived with husbands who often had additional wives. While childbirth trauma and pregnancy-related hormones can predispose the cervical epithelium to HPV infection, the marital context increases this risk. For example, recent studies in sub-Saharan Africa identified a twofold increased risk of HPV among women in polygamous marriages.[11,14] Whilst the present study did not test for associations between marital status or other sociodemographic variables and HPV infection, the finding that all the women had been or were currently married makes it a likely contributing factor. An effort to determine this possibility is urgently warranted for community-level interventions.

Low levels of formal education were noted, and lack of education correlates with decreased health literacy, lower self-awareness, reduced autonomy, and limited access to healthcare services- all of which increase hr- HPV risk. Studies have shown significant associations between HPV status and education level.[14,15] This underscores the importance of culturally tailored health education to protect communities from behavioural health risks.

Most women lacked knowledge about cervical cancer and had not used screening services previously. Mafiana et al, [16]in a literature review, identified a lack of awareness of cervical cancer and its risk factors as the main barrier to screening. This deficiency is closely linked to low education and socioeconomic status, which hinder health-seeking behaviour. It also highlights gaps in health system outreach, as low health literacy prevents access beyond infrastructure issues. Urgent, targeted health communication in rural communities is critical to educate women on preventive services and access, to reduce deaths from advanced cervical disease in the future.

Despite the high prevalence of HPV infection, the rate of cytological abnormalities was relatively low. Several reasons could explain this. First, the infection might be in the incubation period, during which cytopathic changes are not yet visible.[9] Second, the differences in test performance could play a role. For instance, HPV DNA testing generally has higher sensitivity as a screening method, while cytology offers better specificity.[17] This might mean that some women with a low viral load, who have minimal risk of developing observable abnormalities, are missed by cytology. Alternatively, false positives could occur due to cross-reactive, marginally non-oncogenic serotypes in the population.[18] Conversely, cytology may yield false negatives due to its lower sensitivity. Despite these factors, all women who

tested positive on one or both platforms were referred for colposcopy or scheduled for repeat testing after one year if colposcopy was not feasible.

These findings highlight opportunities for targeted interventions to reduce HPV transmission and the long-term burden of cervical cancer in low-resource settings with a high prevalence of Human Papillomavirus (HPV) infection. Effective prevention requires increased access to HPV vaccination for eligible adolescents, particularly before sexual debut.[19,20]. This should be aligned with broader reproductive health education and population-level cervical cancer screening, thereby reducing inequities in reproductive health access and achieving sustainable HPV infection control in rural African populations.[21] However, constraints such as structural barriers, weak health systems, low awareness, and sociocultural misconceptions necessitate deliberate involvement of community leaders, caregivers, schools, and frontline health workers to build trust and improve vaccine acceptability.[21–24]

This study had both strengths and limitations. Its design marks a departure from the opportunistic screening common in many Nigerian studies. Also, screening for HPV DNA using real-time PCR and co-testing with cytology provides additional evidence on the burden of infection and genotypes available in the rural populations. In contrast, the small sample size, convenience sampling technique, and high proportion of women reporting abnormal vaginal discharge or bleeding all serve as major limitations to the study because they might have led to significant selection bias.[25–27] As a result, despite the normal distribution of the data, caution in interpreting the findings is advised, as they may be overestimated. Future research with a larger sample size and randomly selected participants is required to assess true HR-HPV prevalence in this community and explore predictors of the infection in the population”

Conclusion

This study identified a high prevalence of HR-HPV infection among the screened participants and missed opportunities for education and prevention that portend a serious health danger for rural populations with many risk factors; unless prevention efforts are expanded. To curtail this looming catastrophe, it is essential to increase access to low-cost screening programs targeting high-risk women, vaccinate girls before sexual debut or offer catch-up vaccination to older adolescents. Educating both women and men about HPV and cervical cancer, and addressing sociocultural factors that facilitate HPV transmission, will also help to mitigate the scourge. To be effective, these interventions require respectful, community-based, and culturally sensitive approaches. Cautious interpretation of these findings is advised in light of the small sample size and sampling technique employed in this study. Further studies are required to assess predictors of HPV infection and determine the level of knowledge and attitude towards cervical cancer preventive strategies in the population.

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