

Investigation of Demographic Profiles and Possible Potential Risk Factors Amongst Female Sex Workers Assayed for Human Papillomavirus and HIV Co-infection in Port Harcourt

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Abstract

Female sex workers (FSWs) remain a key priority population for strategic prevention of Human Papillomavirus (HPV) and HIV co-infection, where both infections contribute significantly to cervical cancer burden potentially. However, Port Harcourt, remain the economic hub of the Niger Delta region cum Nigeria oil and gas industries, and thus, harbors numerous sex-workers hotspot locations, yet lacks evidence of empirical and localized robust data on the demographic profiles, prevalence, and possible risk factors amongst FSWs in relation to HPV and HIV co-infection and coordinated evidence-based studies. This study aimed to investigate the socio-demographic profile and some associated risk factors amongst FSWs in Port Harcourt and also examine the distribution of high-risk HPV (genotypes 16 and 18) seropositivity and HIV infection across the studied population. A descriptive and cross-sectional research design study was conducted from March to October 2025 among 186 FSWs recruited through convenient and random facility-based sampling technique from brothels, hotels, bars, and street hotspots locations across four geographical mapped out zones in Port Harcourt. Data on demographic characteristics were collected via interviewer-administered questionnaires, while Aseptic five (5) mls of venous blood collected was tested for anti-HPV-16/18 IgG using robust ELISA assay kits and the HIV status was determined using rapid testing algorithm, namely, Determine™ followed by SD Biotec for confirmation. Descriptive statistics were used to summarize the profiles and stratify the infection markers amongst the studied population. The studied population had a mean age of 24.72 ± 6.19 years (range 16–43), with 98.4% being single and 91.0% having secondary or tertiary education. Sex work activities that occurred mainly in street-based (40.9%) or hotel/bar-based (38.7%) settings. High-risk HPV seroprevalence was 10.8% (HPV-18: 10.8%; HPV-16: 2.2%), HIV prevalence was 15.6%, and co-infection of HPV and HIV stood at 3.2% respectively. Numerically, higher high-risk HPV positivity occurred among younger participants (≤ 25 years: 13.7%) and those newer to sex worker services, while inconsistent condom use showed the strongest gradient with HIV (23.0% vs. 5.5% in consistent users). FSWs in Port Harcourt are predominantly young, single, and relatively educated subjects, yet exhibited persistent high-risk behaviors and very low HPV awareness education, thus, sustaining an elevated HPV and HIV burden in fast-growing environment like Port Harcourt. The integration of HPV screening into HIV services in our healthcare facilities would help, if we must achieve the much-touted universal health coverage for all Nigerians.

Keywords: Female Sex Workers, HPV, HIV Co-infection, Port Harcourt, High-risk Behaviors, Cervical Cancer prevention, Advocacy.

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection worldwide, with certain high-risk strains

(notably HPV-16 and HPV-18) causally linked to anogenital cancers, particularly cervical cancer [1, 2]. Globally, HPV accounts for nearly all cases of cervical cancer, which remains a

leading cause of cancer-related mortality among women in low- and middle-income countries. In sub-Saharan Africa, the burden of HPV-related diseases is disproportionately high, driven by limited access to preventive measures such as vaccination, screening, and treatment, compounded by high rates of co-infections like HIV [3, 4].

Nonetheless, female sex workers (FSWs) represent a key high-risk population for HPV acquisition and transmission due to occupational risk factors, including multiple sex partners, inconsistent condom use, and barriers to healthcare services provided an evidence-based reason for that [5, 6]. Nevertheless, pooled estimates indicate a high prevalence of HPV among FSWs globally, often exceeding 30-40%, with even higher rates reported in molecular studies from sub-Saharan Africa [7]. In Nigeria, cervical cancer is the second most common cancer among women and a major cause of cancer deaths, with pooled HPV prevalence among women estimated at 25-42% and significantly elevated rates (often >80-96% in molecular assays) among FSWs [8, 9]. High-risk genotypes such as HPV-16 and HPV-18 predominate in many settings, though regional variations exist [10, 11].

In Nigeria, localized data highlight geographic differences in HPV epidemiology. In Port Harcourt, the economic hub of the Niger Delta region and center of the country's oil and gas industry, HPV genotype 18 has been identified as predominant among women, often linked to high-risk sexual behaviors including prostitution [12, 13]. Despite this, comprehensive seroprevalence and genotypic data specifically among FSWs in Port Harcourt remain very scarce, with existing studies primarily focusing on lower-risk groups such as university students or general female populations, where seroprevalence is notably lower (approximately 9-10%) [14]. This gap is particularly concerning given the city's transient, mobile population associated with oil-sector activities pulling massive migration to the region for greener pasture and oil money, which may facilitate STI transmission patterns given the level of huge social engineering dynamics and interactions [15, 16].

The interplay between HPV and HIV further exacerbates risks in this population. HIV co-infection, prevalent at 10-25% among Nigerian FSWs, impairs immune clearance of HPV, promotes persistence of high-risk strains, and accelerates progression to precancerous lesions and invasive cervical cancer [17-19]. Behavioral and structural factors, including inconsistent condom use, alcohol consumption, stigma, and limited healthcare access, sustain elevated infection rates [20].

Nigeria's introduction of HPV vaccination into the national routine immunization program in October 2023 represents a landmark step toward reducing HPV-related disease burden. The campaign targeted 7.7 million girls aged 9-14 years with a single-dose regimen, marking one of the largest HPV vaccination drives in Africa [21]. While this initiative is promising, adult high-risk groups such as FSWs are largely excluded from catch-up efforts, leaving them vulnerable to vaccine-preventable strains like HPV-16 and HPV-18 [22, 23].

Despite growing recognition of HPV's impact in Nigeria, critical gaps persist in localized, evidence-based surveillance among high-risk populations like FSWs in Port Harcourt. Nevertheless,

it is strongly believed that such data are essential for assessing true prevalence, genotype distribution, co-infection patterns, and associated risk factors to inform targeted intervention strategies, including integration of HPV screening into existing HIV services and potential adult vaccination catch-up programs [24, 25]. This study addresses these gaps by investigating demographic profiles; potential risk factors and their associations with HPV and HIV co-infection amongst FSWs in Port Harcourt, providing foundational evidence to guide equitable prevention strategies in this underserved key population.

Methodology

Study Population

The study population comprised of active female sex workers (FSWs) of reproductive age (16 years and above) engaged in sex work for at least six months, being sexually active, and who provided consent for their samples and demographic data to be used in the study within Port Harcourt City, spanning Obio/Akpor and Port Harcourt Local Government Areas, the capital of Rivers State in the Niger Delta region of southern Nigeria. Port Harcourt is located at approximately 4.8156°N and 7.0498°E along the Bonny River.

As Nigeria's principal oil-refining and industrial hub, it hosts a dense, transient population driven by oil-sector activities, contributing to numerous hotspots for sex work including brothels, hotels, bars, and streets. These individuals constituted a high-risk group due to frequent sexual exposure, inconsistent condom use, and historically low utilization of preventive health services. A well-structured interviewer-administered questionnaire was used to collect socio-demographic characteristics (age, marital status, education level). Pidgin English was used where necessary to ensure participant understanding. The study was based on descriptive and cross-sectional research design conducted from March to October 2025.

Sampling Size Calculation

To determine the minimum sample size of the subjects recruited in the study, the seroprevalence of HPV antibodies (9.1%) reported among female university students in Port Harcourt was used as follows:

Using the formula: $n = \frac{z^2 pq}{d^2}$

Where n = required sample size

Z = Z-value corresponding to 95% confidence level (1.96)

p = estimated prevalence (0.091)

E = margin of error (0.05)

Plugging in the values:

n = 128.4192

The sample size for this present study was increased to 186 to enhance statistical significance and power.

Study Area

The study was conducted in Port Harcourt City (Obio Akpor and Port Harcourt L.G.A), the capital of Rivers State, Nigeria, located at approximately 4.8156°N and 7.0498°E. As a major socio-economic hub of oil and gas activities in the Niger Delta, Port Harcourt had a dense population and numerous hotspots for sex work, including brothels, hotels, bars, and streets. These characteristics made the area suitable for accessing diverse categories of female sex workers. The study area was also further divided into four study zones, namely Port Harcourt South; Port

Harcourt East; Port Harcourt West, and Port Harcourt North, for seamless coverage and good and equitable representation of the entire study area [26].

Sampling Technique and Eligibility Criteria

A convenient and random sampling technique was explored due to the mobility and hard-to-reach nature of the sex workers population. The Port Harcourt City study area was grouped into four zones, namely Port Harcourt South, West, East, and North, for seamless and inclusive representation of the entire study area. However, three facilities each were selected from each zone by conducting a blind balloting and randomly picking approach, thus picking out three facilities, each wrapped in a piece of paper at random in the midst of many to represent the zone. Recruitment occurred at randomly selected brothels, hotels, bars, and street-based hotspots. Participants were approached through the help of their line managers and group heads and were invited to participate; thus, only those who were available and willing at the time of contact were enrolled each time visited.

Sample Preparation

Five milliliters (5 mL) of venous blood was collected aseptically from subjects who provided consent, using a clean needle and syringe into sterile EDTA vacutainer tubes. The serum was extracted by centrifuging at 1500 rpm for 5 minutes and was stored at -20°C until it was needed for laboratory analysis.

Human Papillomavirus Type 16 (HPV-16) and Type 18 (HPV-18) ELISA Kit Principle

The HPV-16 and HPV-18 ELISA diagnostic kits used are based on the principle of double antibody sandwich and rely on the characteristics of the target analyte with more than two possible epitopes that can be identified by both the pre-coated capture antibody and the detection antibody simultaneously. The pre-coated antibody is an anti-HPV-16/18 monoclonal antibody, while the detection antibody is a biotinylated polyclonal antibody. Samples and biotinylated antibodies are added into ELISA plate wells and washed out with wash buffer after their respective additions to the wells. Then horseradish peroxidase (HRP)-conjugates are added to the wells. Tetramethylbenzidine (TMB) substrate is used for coloration after the enzyme conjugate has been thoroughly washed out of the wells by wash buffer. TMB reacts to form a blue product from the peroxidase activity and finally turns yellow after addition of the stop solution. The color intensity and quantity of target analyte in the sample are positively correlated.

HIV-1/2 Rapid Test (Determine™ HIV-1/2) Principle

The Determine™ HIV-1/2 rapid test kits used for HIV screening are based on the principle of lateral flow immunochromatography. The test detects antibodies to HIV-1 and HIV-2 in serum, plasma, or whole blood. The test strip contains a sample pad, conjugate pad with colloidal gold-labeled HIV antigens, a nitrocellulose membrane with test and control lines, and an absorbent pad. When sample is added, it migrates and rehydrates the conjugates; if HIV antibodies are present, they bind to form complexes that are captured at the test line, producing a visible red line. The control line confirms test validity.

SD Bioline HIV-1/2 3.0 Test Strip Principle

The SD Bioline HIV-1/2 3.0 Test Strip used for confirmation of

positive cases is based on the principle of immunochromatography. It detects antibodies to HIV-1 (including Group O) and HIV-2 separately with distinct test lines. The device contains a sample well, assay diluent, and a membrane with recombinant HIV-1 gp41, p24, HIV-2 gp36 antigens at test lines, and a control line with goat anti-mouse IgG. Sample addition allows migration; positive reactions produce pink lines at respective test regions, while the control line validates the test.

Test Preparation

For HPV-16 and HPV-18 ELISA, all reagents were equilibrated to room temperature (18–25°C) for at least 30 minutes before use, and microplate wells pre-coated with purified recombinant HPV-16 L1 or HPV-18 L1 virus-like particles (VLPs) were inspected visually to confirm the absence of moisture, particulate matter, or damage. Serum samples were diluted 1:101 (e.g., 10 µL serum + 1000 µL sample diluent) in the provided sample diluent; calibrators (including the cut-off calibrator) and positive/negative controls were similarly diluted or used as supplied per kit specifications. For HIV tests, no specific dilution was required; samples were used directly as instructed by the manufacturers.

Test Procedure for Human Papillomavirus Type 16 (HPV-16) and Type 18 (HPV-18) ELISA Kit

The HPV-16 and HPV-18 ELISA procedures were performed separately but following identical steps in accordance with the manufacturer's instructions for the respective commercial anti-HPV-16 IgG and anti-HPV-18 IgG ELISA kits. 100 µL of each diluted serum sample, calibrator, and control was dispensed in duplicate into the appropriate antigen-coated wells of the 96-well microplate. The plate was sealed and incubated at 37°C for 60 minutes (or as specified, typically 60–90 minutes) in a humidified incubator to allow specific IgG antibodies to bind to the immobilized HPV-16 or HPV-18 antigens. Following incubation, the contents of the wells were aspirated, and the plate was washed five times (or per kit protocol) with 300–350 µL per well of wash buffer using an automated plate washer or manual multichannel pipette to remove unbound components and minimize background. Next, 100 µL of horseradish peroxidase (HRP)-conjugated anti-human IgG secondary antibody (diluted as directed) was added to each well, and the plate was re-incubated at 37°C for 30 minutes (or 60 minutes depending on kit). After another series of five washes with wash buffer, 100 µL of tetramethylbenzidine (TMB) substrate solution was added to each well to initiate enzymatic color development, and the plate was incubated in the dark at room temperature for 10–20 minutes (typically 15 minutes or until color development was optimal). The reaction was terminated by adding 100 µL of stop solution (0.3 M or 0.36 N sulfuric acid, depending on the kit) to each well, producing a stable yellow color change. Optical densities (OD) were immediately read at 450 nm (with optional reference wavelength subtraction at 620–630 nm) using a calibrated microplate reader. Results were interpreted quantitatively or qualitatively based on the manufacturer's validated cut-off criteria, typically by comparing sample OD values to the cut-off calibrator OD (e.g., sample considered positive if $OD \geq \text{cut-off value} \times \text{factor}$, often 1.0–1.1), with borderline or equivocal results retested as required. All steps were performed with precision pipetting to ensure reproducibility, and quality controls were included on each plate to validate the run.

Test Procedure for HIV-1/2 Rapid Test (Determine™ HIV-1/2)

The HIV Determine™ rapid test was carried out using whole blood or serum. A drop of blood or 50 µL of serum was applied to the sample pad of the test strip, followed by the addition of chase buffer to enable migration across the membrane. The strip was left to develop on a flat surface at room temperature. Results were interpreted visually between 15 and 60 minutes: a single control line indicated a negative test, while the appearance of both the control and test lines indicated a positive result. Absence of a control line rendered the result invalid, requiring re-testing with a new strip.

Test Procedure for SD Bioline HIV-1/2 3.0 Test Strip

The SD Bioline HIV-1/2 3.0 rapid immunochromatographic test was used as the confirmatory step in a serial HIV testing algorithm following an initial reactive result on the Determine HIV-1/2 rapid test. After opening the foil pouch and placing the test device on a flat surface, 10 µL of serum or plasma, or 20 µL of whole blood, was carefully dispensed into the sample well marked "S" using a micropipette or capillary tube, avoiding air bubbles or contamination. Immediately afterward, four drops (approximately 100–120 µL) of the provided assay diluent were added vertically into the same well without touching the device. The test was then allowed to develop undisturbed at room temperature, and results were read strictly between 10 and 20 minutes after adding the diluent, as readings beyond 20 minutes may be invalid. A positive result was indicated by the appearance of the control line (C) along with one or both test lines (HIV-1 and/or HIV-2), even if faint, while the absence of the control line rendered the test invalid and required repetition with a new device. If the SD Bioline result was reactive following a reactive Determine test, the sample was considered confirmed HIV-positive per the serial algorithm.

Data Analysis

The collected data were organized via Microsoft Excel. They were subsequently exported into SPSS version 20 to properly analyze the data obtained through the questionnaires at a 0.05 level of significance. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize participants' characteristics. Chi-square tests and independent t-tests were used to determine associations between HPV or HIV infection and relevant demographic or behavioral variables. The results analyzed were presented using tables.

Table 1: Frequency distribution of demographic characteristics among the study population

Characteristic	Category	Frequency (%)
Age (years)	Mean (SD)	24.72 (6.19) -
Marital Status	Single	183 (98.4)
	Widowed	3 (1.6)
Education Level	No formal education	7 (3.8)
	Primary	10 (5.4)
	Secondary	84 (45.2)
	Tertiary	85 (45.7)

Ethical Considerations

Ethical approval for the study was obtained from the Rivers State Ministry of Health Ethics Committee (RSHMB/RSHREC/2025/031). Written informed consent was obtained from all participants after clear explanation of study procedures, potential risks, and benefits. Participation was completely voluntary, and individuals had the right to withdraw at any point without penalty. All data were treated confidentially using identification codes rather than personal names. Biological sample collection was conducted using aseptic techniques by trained personnel. Participants who tested positive for HIV or HPV were referred to designated healthcare facilities for appropriate counseling and management.

Result

Demographic and Behavioral Characteristics among FSW

Table 1 shows that a total of 186 female sex workers were included in the final analysis. The mean age of participants was 24.72 ± 6.19 years, with ages ranging from 16 to 43 years. The majority of respondents were single (183; 98.4%), while 3 (1.6%) were widowed. Regarding educational status, most participants had secondary (84; 45.2%) or tertiary education (85; 45.7%), with a smaller proportion having primary education or no formal education.

Prevalence of High-Risk HPV (Genotypes 16 and 18) among the Study Population

Figure 1 illustrates the prevalence of HPV genotypes. The prevalence of HPV16 was 4 (2.2%), while HPV18 was higher at 20 (10.8%). Overall, the prevalence of any high-risk HPV (16 or 18) was 20 (10.8%).

Prevalence of HIV Infection among the Study Population

Figure 2 indicates that out of the 186 participants, 29 (15.6%) were HIV-positive, while 157 (84.4%) were HIV-negative. This indicates a critical burden of HIV infection within the study population.

Prevalence of Co-infection (High-Risk HPV and HIV) and among the Study Population

Figure 3 presents the co-infection rates. The prevalence of co-infection (high-risk HPV positive and HIV positive) was 6 (3.2%).

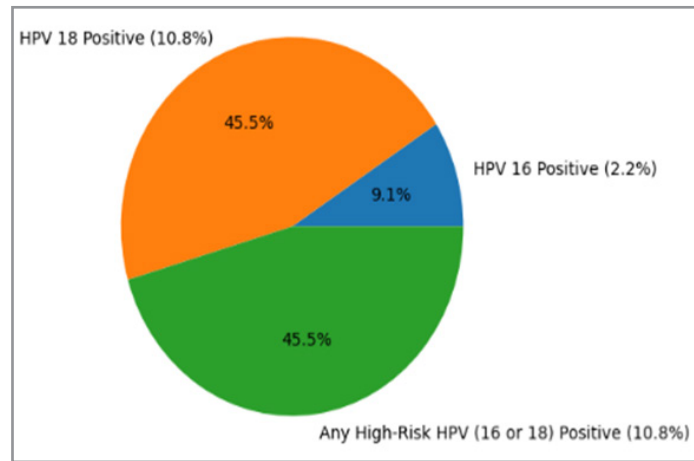


Figure 1: Pie chart of the prevalence of High-Risk HPV (Genotypes 16 and 18) among FSW

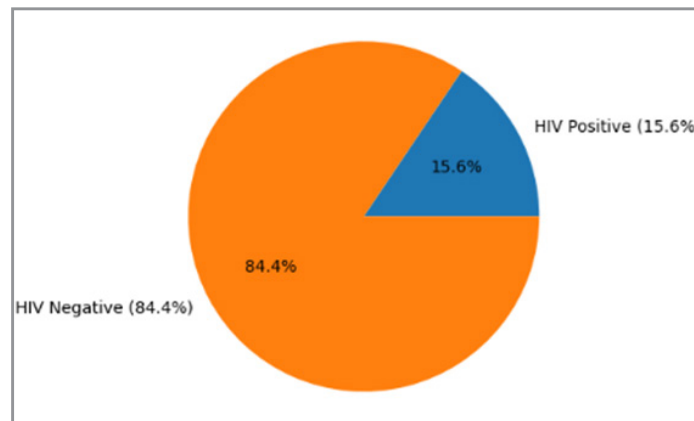


Figure 2: Pie chart showing HIV status prevalence among FSW

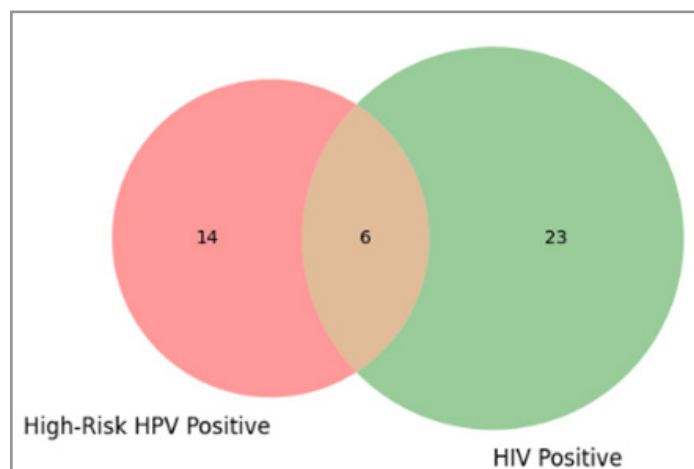


Figure 3: Venn diagram of the prevalence of Co-infection (High-Risk HPV and HIV) among FSW

Discussion

The investigation of Human Papillomavirus (HPV) among high-risk populations (female sex workers) is a critical public health priority in regions with a high burden of cervical cancer. This study provided a localized evidence-based epidemiological data in Port Harcourt, a major economic hub in Nigeria where commercial sex work is prevalent but comprehensive data on HPV and HIV co-infection are limited. By analyzing the prevalence of high-risk HPV genotypes 16 and 18, HIV status, and behavioral drivers, this research informs targeted prevention strategies, including the recent 2023 national HPV vaccination rollout.

The findings revealed a prevalence of 2.2% for HPV-16 and a higher rate of 10.8% for HPV-18 among the sampled popula-

tion. The predominance of HPV-18 in this cohort is consistent with previous research in Port Harcourt, which identified HPV-18 as the leading high-risk genotype in the South-South region. This regional trend highlights the importance of local genotype surveillance, as it differs from many global datasets where HPV-16 is typically more frequent, even as this finding will strongly support local intervention policy strategies without the normal copy and paste method of copying foreign health policies that may not work in our local settings, due to variations in culture and social barriers [27].

However, the overall prevalence of 10.8% for any high-risk genotype (16 or 18) is notably lower than the global pooled prevalence of 39.5% estimated for FSWs [6]. This lower rate might be

attributed to sample size, method of assay or the specific serological detection methods used or regional variations in Nigeria, where some studies in other cities have reported significantly different rates. Despite this, the presence of these oncogenic genotypes remains a significant public health concern given the primary role of HPV in causing cervical cancer amongst women across the globe [28].

This study identified a distinct prevalence of HIV infection within the FSW cohort in Port Harcourt. This reflects the disproportionate impact of the HIV epidemic on sex workers due to occupational exposure and high-risk behaviors. The findings emphasize that sex work continues to be a primary driver of the sexually transmitted infection (STI) burden in the region. The study has several important critical analysis and synthesis that must be acknowledged and explained vividly to underpin the current situation at hand playing out. First, the use of convenience sampling from visible hotspots (brothels, hotels, bars, and streets) in Port Harcourt excludes hidden and non-venue-based female sex workers (e.g., those operating through phone or online networks), potentially introducing selection bias and over-representing more accessible and possibly higher-risk individuals.

Secondly, reliance on serological detection of anti-HPV-16/18 IgG antibodies (ELISA) rather than cervical/vaginal HPV-DNA testing may significantly underestimate current and persistent infections outcomes, as repeatedly demonstrated when our 10.8% seroprevalence is compared with DNA-based studies in similar Nigerian populations that report 70–96% positivity.

Thirdly, the modest sample size of 186 participants, while calculated to detect an expected prevalence with 5% margin of error, limited the statistical power to detect weaker associations (e.g., HPV–HIV co-infection, multiple sexual partners, alcohol consumption) and precluded meaningful multivariate adjustment. Finally, the cross-sectional design prevents establishing temporality between risk behaviours and infection status, and self-reported behavioural data may be affected by social desirability bias despite the use of trained interviewers and Pidgin English experts.

These findings highlight critical evidence gaps that remain in the local epidemiology of HPV and HIV among female sex workers in Port Harcourt and the Niger Delta region. However, no published study to date has applied molecular (HPV-DNA) testing combined with HIV viral load and CD4 monitoring in this specific high-risk group, leaving the true burden of oncogenic HPV persistence and immune impairment unknown. Longitudinal data are entirely absent, making it impossible to assess clearance rates, reinfection dynamics, or the real-world impact of the 2023 national HPV vaccination campaign even though majority of the adult FSWs were not part of the population covered and targeted.

Furthermore, virtually no research has explored the growing subpopulation of digital or indirect sex workers in the region, nor has any study evaluated the acceptability, feasibility, or effectiveness of self-sampling HPV kits or point-of-care molecular tests among Nigerian FSWs. Addressing these gaps through larger, hybrid (serological + molecular) cohort studies using re-

spondent-driven or time-location sampling is essential to inform targeted screening, vaccination catch-up strategies, and cervical cancer prevention programmes for this highly vulnerable and underserved population.

Conclusion

This cross-sectional study among 186 female sex workers (FSWs) in Port Harcourt revealed a moderate but very important seroprevalence of high-risk HPV (genotypes 16 and 18) at 10.8%, predominantly driven by HPV-18 (10.8%), with HPV-16 occurring in only 2.2% of cases and always in conjunction with HPV-18. HIV prevalence was notably higher at 15.6%, and co-infection with high-risk HPV and HIV was observed in 3.2% of participants. These infection markers were unevenly distributed across demographic profiles, with younger women (≤ 25 years) showing higher high-risk HPV positivity (13.7% vs. 7.1% in those > 25 years), and those with lower education (no formal/primary) exhibiting elevated rates (17.6%). Single participants (98.4% of the sample) accounted for all positive cases, while street-based workers (40.9%) and those with 4–6 years in sex work had numerically higher HPV positivity (13.2% and 18.8%, respectively). Behavioral factors amplified these risks, as inconsistent condom use was linked to substantially higher HIV prevalence (23.0% vs. 5.5% among consistent users), underscoring the interplay between demographics and modifiable exposures in this vulnerable population.

The findings highlight the urgent need for targeted interventions in Port Harcourt's FSW community, where young age, recent entry into sex work, and structural barriers like venue-based operations sustain elevated HPV and HIV burdens, potentially accelerating cervical cancer progression in a high-transmission urban oil hub. Integrating HPV molecular screening and adult catch-up vaccination into existing HIV services, alongside peer-led education on condom consistency and alcohol harm reduction, could mitigate these risks and address the equity gap left by Nigeria's adolescent-focused HPV immunization program. Future studies should employ longitudinal designs and respondent-driven sampling to better capture hidden subpopulations and causal pathways, ultimately supporting Nigeria's alignment with WHO cervical cancer elimination goals by 2030.

Recommendation

Based on the findings, limitations, and identified gaps, the following evidence-based recommendations are proposed:

- **Immediate inclusion of female sex workers in HPV vaccination programmes:** The Federal Ministry of Health and State Primary Health Care Boards should urgently establish adult catch-up HPV vaccination campaigns targeting FSWs aged 18–45 years. Peer-led outreach models already used successfully for HIV testing should be adapted to deliver single-dose or two-dose HPV vaccine at existing drop-in centres, brothels, and hotspots in Port Harcourt and other urban centres. Cost-effectiveness is supported by recent WHO guidance on single-dose efficacy. This approach would rapidly reduce circulation of vaccine-type HPV-16/18 in this high-transmission group.
- **Integration of point-of-care HPV-DNA testing into existing HIV services for FSWs:** Rivers State Ministry of Health and implementing partners such as Society for Family Health, APIN, and FHI360 should pilot and

scale up self-collected or clinician-collected GeneXpert® HPV or other near-point-of-care molecular assays within FSW-friendly clinics. Co-testing for HIV viral load and HPV-DNA on the same platform is already technically feasible. This approach would enable same-day triage to cryotherapy or thermal ablation for screen-positive women. It would also dramatically reduce loss-to-follow-up.

- **Transition from serology to molecular methods in future FSW surveillance:** Subsequent rounds of Integrated Biological and Behavioural Surveillance Surveys and state-level studies should replace or supplement HPV serology with cervical or vaginal HPV-DNA detection. Partial genotyping for at least HPV-16/18/45 should be included. This approach will provide accurate data on current infection, multiple infections, and vaccine impact. It will also align Nigeria with global standards.

Conflict of Interest

No any kind of conflict of interest amongst authors was reported.

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