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Research Article

Socio-demographic, Reproductive and Behavioural Determinants of Human Immunodeficiency Virus Infection Among Pregnant Women Attending Primary Healthcare Centres in Port Harcourt Local Government Area, Rivers State, Nigeria

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Abstract

Human immunodeficiency virus (HIV) infection remains an important public health concern among pregnant women because of its implications for maternal health and mother-to-child transmission. This study assessed the prevalence and determinants of HIV infection among pregnant women attending Primary Healthcare Centres (PHCs) in Port Harcourt Local Government Area (PHALGA), Rivers State, Nigeria. A facility-based analytical cross-sectional study was conducted among 373 pregnant women attending six selected PHCs in 2025. Data were collected using a structured interviewer-administered questionnaire and antenatal records. HIV status was obtained from documented antenatal HIV test results. Data were analysed using IBM SPSS Statistics version 27. Pearson's chi-square test and binary logistic regression were used for bivariate and multivariable analyses, respectively, with $p < 0.05$ considered statistically significant. Sixteen of the 373 participants were HIV-positive, giving an overall prevalence of 4.29% (95% CI: 2.30–6.28). In the adjusted analysis, primary education was associated with higher odds of HIV infection compared with tertiary education (AOR = 2.15, 95% CI: 1.11–4.18; p = 0.024), while students had lower odds compared with unemployed women (AOR = 0.41, 95% CI: 0.17–0.96; p = 0.039). Women earning ₦71,000–₦100,000 and ₦151,000–₦200,000 had higher odds than those earning >₦200,000. Smaller family sizes were associated with lower odds of infection than households with ≥5 members. Among reproductive characteristics, only second-trimester gestation remained significant after adjustment (AOR = 0.29, 95% CI: 0.09–0.94; p = 0.039). Behaviourally, absence of previous voluntary counselling and testing (VCT) and previous sexually transmitted infection (STI) history were independently associated with HIV infection. These findings support continued integration of HIV testing, STI services, health education, and appropriate linkage to HIV care within antenatal services at PHC level.

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1. Introduction

Human immunodeficiency virus (HIV) remains an important global public health challenge, particularly among women of reproductive age and pregnant women. HIV infection during pregnancy has implications for maternal health and can increase the risk of mother-to-child transmission when infection is undiagnosed or inadequately managed. Evidence from sub-Saharan Africa indicates that HIV acquisition during pregnancy and lactation remains an important contributor to paediatric HIV infections and highlights the need for prevention, repeat testing, partner services, sexually transmitted infection (STI) screening, condom promotion, and risk-reduction counselling [1–4]. Marston et al. [2] further demonstrated that HIV acquisition during pregnancy or postpartum may be associated with increased risk of vertical transmission because newly infected women may have high viral loads before diagnosis. Evidence from pregnancy cohorts also indicates that maternal HIV infection is associated with adverse pregnancy outcomes, including low birth weight and preterm birth [5]. Nigeria continues to experience a substantial HIV burden, although prevalence varies geographically and across population groups. A systematic review and meta-analysis of HIV prevalence among pregnant women in Nigeria found considerable variation across studies and geopolitical zones, underscoring the importance of local epidemiological evidence [6]. Bayesian modelling has similarly demonstrated substantial geographical variation in HIV prevalence and burden in Nigeria [7]. In Rivers State, recent studies continue to demonstrate HIV infection among pregnant women. Wobo and Amadi reported an HIV seroprevalence of 4.8% among 16,605 pregnant women in Rivers State [8], while Aleruchi et al. reported HIV seroprevalence among pregnant women in Gokana Local Government Area [9]. Studies conducted in Port Harcourt and other Local Government Areas of Rivers State have also documented variation in HIV distribution according to demographic and contextual characteristics [10, 11]. HIV testing during antenatal care is particularly important because knowledge of HIV status provides an entry point for prevention, treatment, counselling, and prevention of mother-to-child transmission services. Evidence from Nigeria indicates that educational level, residence, and other sociodemographic characteristics influence HIV testing among pregnant women [12]. Nzelu et al. [12] found that higher educational attainment and urban residence were associated with greater likelihood of HIV testing among pregnant women in Nigeria. Similar evidence from sub-Saharan Africa indicates that HIV testing coverage has increased over time, but important differences remain according to education, socioeconomic status, parity, residence, and other individual and community characteristics [13–15]. A pooled analysis involving more than two million women in 41 sub-Saharan African countries demonstrated substantial temporal increases in HIV testing but persistent differences between countries and population groups [13]. Multilevel analyses have likewise identified education, antenatal-care utilisation, urban residence, and other socioeconomic characteristics as important determinants of HIV testing [14, 15]. Evidence from Nigeria also indicates that missed opportunities remain within the antenatal HIV counselling and testing pathway. Morhason-Bello et al. [16] documented missed opportunities for HIV counselling and testing among pregnant women in Nigeria. Community-based approaches have also been evaluated as mechanisms for improving access to HIV testing among pregnant women [17]. In Rivers State, Pius et al. [18] found that pregnant women generally recognised the importance of routine HIV counselling and testing, although service-delivery constraints, including workload among healthcare workers, could affect the quality of counselling. Abraham and Clow [19] similarly reported that women's experiences of HIV counselling and testing during pregnancy have implications for service delivery and policy. Socioeconomic and educational circumstances may influence HIV-related knowledge, testing behaviour, healthcare utilisation, and access to preventive services. Evidence from sub-Saharan Africa indicates that socioeconomic and educational characteristics are associated with HIV testing uptake [13–15]. In Nigeria, higher educational attainment has been associated with greater likelihood of HIV testing [12], while studies examining HIV-related knowledge and stigma have demonstrated that knowledge and perceptions may influence testing decisions [20]. These findings are relevant to the present study because educational attainment, occupation, income, and household circumstances may capture differences in access to information and health services. Reproductive characteristics may also be relevant to HIV prevention among pregnant women. Timing of antenatal care provides an opportunity for HIV testing and other preventive interventions. Evidence from Nigeria indicates that the timing of first antenatal-care contact varies substantially among women, with late booking remaining common in primary healthcare settings [21, 22]. Pregnancy intention may also influence interaction with reproductive-health services. A systematic review of unintended pregnancy in sub-Saharan Africa found that unintended pregnancy is influenced by multiple socioeconomic and reproductive factors [23], while evidence from East Africa has also demonstrated substantial levels of unintended pregnancy among women living with HIV [24]. Research among pregnant women living with HIV in Nigeria has additionally examined birth preparedness and status disclosure as important components of maternal HIV care [25]. Behavioural and clinical characteristics are also relevant to maternal HIV prevention. A systematic review and narrative synthesis of maternal HIV acquisition during pregnancy and lactation in sub-Saharan Africa identified behavioural and contextual factors associated with HIV acquisition and emphasised integrated prevention approaches [3]. Multiple sexual partnerships have also been associated with HIV seropositivity among pregnant women in Nigeria [26]. HIV acquisition during pregnancy may occur in the context of sexual networks and partner-related factors, making risk-reduction counselling, partner testing, condom promotion, and STI services important components of antenatal HIV prevention [2, 3]. STIs are particularly relevant because HIV and STIs may share sexual and contextual risk factors. Recent evidence from Rivers State demonstrates an ongoing burden of STIs among reproductive-age adults [27]. Integrating STI screening and treatment with HIV services may therefore strengthen maternal HIV prevention. Studies from other African settings have also demonstrated the importance of HIV testing, counselling, and integrated maternal services [28–30].

Evidence concerning HIV among pregnant women also extends beyond Nigeria. Studies in Ethiopia have documented HIV burden among pregnant women attending antenatal care [31, 32], while research on HIV and pregnancy outcomes has demonstrated that maternal HIV infection may be associated with adverse birth outcomes [5]. Evidence from Ghana has examined HIV knowledge among women of reproductive age [33], and studies across sub-Saharan Africa have investigated HIV testing, prevention, PrEP awareness, and antenatal HIV services [3, 34–37]. These studies provide broader regional context while highlighting the importance of locally generated evidence. Despite the growing body of evidence on HIV in Nigeria and Rivers State, there remains limited facility-level evidence examining socio-demographic, reproductive, and behavioural characteristics simultaneously among pregnant women attending primary healthcare facilities in Port Harcourt Local Government Area (PHALGA). Local evidence is important for identifying characteristics associated with HIV infection and for informing targeted maternal HIV prevention and testing services. Therefore, the aim of this study was to assess the prevalence and socio-demographic, reproductive, and behavioural determinants of HIV infection among pregnant women attending selected primary healthcare centres in PHALGA, Rivers State, Nigeria.

2. Methods

2.1. Study Design and Participants

A facility-based analytical cross-sectional study was conducted among pregnant women attending selected PHCs in Port Harcourt Local Government Area (PHALGA), Rivers State, Nigeria. The study was conducted among pregnant women aged 15–49 years attending ntenatal care at six selected PHCs: Azuabie, Mgbuduku, Okuru, Abuloma, Churchill Model PHC, and Amadi-Ama PHC. Participants were eligible if they were pregnant women aged 15–49 years attending antenatal care at the selected facilities and consented to participate. Women who were critically ill, declined participation, or did not meet the eligibility criteria were excluded.

2.2. Data Collection

Data were collected using a structured, interviewer-administered questionnaire developed and adapted following a review of previous studies on HIV infection, HIV testing, and associated factors among pregnant women and women of reproductive age [9–11, 16, 17, 23]. The reviewed studies provided a basis for identifying and structuring questionnaire items relevant to the objectives of the present study. The questionnaire comprised sections on socio-demographic characteristics, HIV testing and status, reproductive characteristics, and sexual behaviour. The socio-demographic section obtained information on age, age at marriage, marital status, religion, educational level, occupation, monthly income, and family size. The reproductive characteristics section assessed age at first pregnancy, gestational age at HIV screening, pregnancy planning, gravidity, and number of living children. The sexual behaviour section assessed relevant behavioural characteristics associated with HIV infection. HIV status was obtained from documented HIV testing results recorded in the antenatal records of participating health facilities rather than relying solely on participants' self-reported HIV status. This approach was adopted to improve the accuracy of outcome measurement and minimise potential reporting bias. The questionnaire was subjected to expert review to establish face and content validity. It was subsequently pre-tested among 20 pregnant women attending a primary healthcare facility outside the selected study facilities but with characteristics comparable to those of the study population. The pre-test produced a Cronbach's alpha coefficient of 0.82, indicating good internal consistency of the instrument. Feedback obtained during the pre-test was used to improve the clarity, sequencing, wording, and comprehensibility of the questionnaire items. Before data collection, research assistants were trained on the objectives of the study, ethical procedures, informed consent, administration of the questionnaire, and accurate recording of participants' responses. Following the training, the questionnaire was administered electronically using KoboCollect. Completed questionnaires were reviewed for completeness and consistency before submission to the study database.

2.3. Statistical Analysis

Data were analysed using IBM SPSS Statistics version 27. Categorical variables were summarised using frequencies and percentages. Pearson's chi-square test was used to assess bivariate associations between categorical independent variables and HIV status. Binary logistic regression was used to estimate crude odds ratios (CORs) and adjusted odds ratios (AORs), with corresponding 95% confidence intervals (CIs). Variables included in the multivariable models were assessed for their independent association with HIV infection. Statistical significance was set at $p < 0.05$.

3. Results

3.1. Socio-demographic Characteristics

A total of 373 pregnant women participated in the study. Almost half of the respondents were aged 25–34 years. More than half were married and had attained at least secondary education. Civil/public service constituted the largest occupational group. Most respondents were in the lower and middle income categories, while the majority lived in households with two or fewer members. Table 1 shows the sociodemographic characteristics of the respondents.

3.2. HIV Testing History

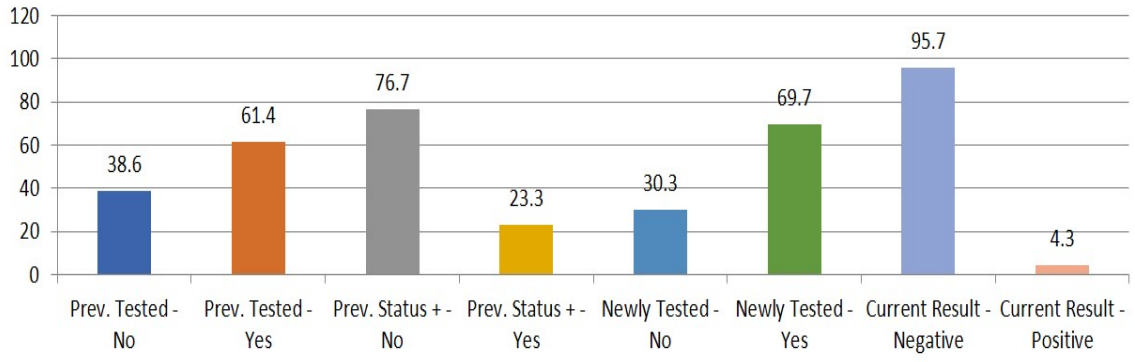


Figure 1: HIV Testing History Among Pregnant women attending Primary Health Centres in PHALGA, Rivers State

Figure 1 shows the HIV testing history of the respondents. Among the 373 respondents, 61.4% had previously undergone HIV testing, while 38.6% had never previously been tested. Among those who had previously tested, 76.7% reported a previous negative result and 23.3% reported a previous positive result. During the current antenatal visit, 69.7% were newly tested, while 30.3% were not newly tested. Overall, 95.7% of respondents were HIV-negative and 4.3% were HIV-positive.

Table 1: Socio-demographic characteristics of pregnant women attending Primary Healthcare Centres in PHALGA, Rivers State (n = 373)

Characteristic	Frequency, n	Percentage, %
Age (years)		
15–24	50	13.4
25–34	184	49.3
35–44	118	31.6
≥45	21	5.6
Age at marriage		
<18 years	50	13.4
≥18 years	207	55.5
Never married	116	31.1
Marital status		
Married	206	55.2
Unmarried	116	31.1
Divorced/separated	35	9.4
Widowed	16	4.3
Religion		
Christian	232	62.2
Muslim	81	21.7
Other	60	16.1
Educational level		
No formal education	24	6.4
Primary	84	22.5
Secondary	175	46.9
Tertiary	90	24.1
Occupation		
Civil/public servant	169	45.3
Self-employed	88	23.6
Student	71	19.0
Unemployed	45	12.1
Monthly income (₦)		
<70,000	73	19.6
71,000–100,000	114	30.6
101,000–150,000	107	28.7
151,000–200,000	44	11.8
>200,000	35	9.4
Family size		
≤2	197	52.8
3–4	123	33.0
≥5	53	14.2

3.3. Prevalence of HIV Infection

Table 2 shows the prevalence of HIV infection according to the sociodemographic characteristics of the respondents. Sixteen of the 373 pregnant women were HIV-positive, giving an overall HIV prevalence of 4.29% (95% CI: 2.30–6.28). By age, prevalence was 4.00% among women aged 15–24 years, 4.89% among those aged 25–34 years, 4.24% among those aged 35–44 years, and 0% among women aged ≥45 years. Prevalence was 3.45% among never-married women, 4.00% among women who married before 18 years, and 4.83% among those who married at ≥18 years. By marital status, prevalence was 4.85% among married women, 2.59% among unmarried women, 8.57% among divorced/separated women, and 0% among widowed women. By education, prevalence was 0% among women with no formal education, 5.95% among those with primary education, 4.57% among those with secondary education, and 3.33% among those with tertiary education. Prevalence was 4.73% among civil/public servants, 5.68% among self-employed women, 4.23% among students, and 0% among unemployed women. By monthly income, prevalence ranged from 2.74% among women earning <₦70,000 to 6.82% among those earning ₦151,000–₦200,000. Prevalence was 3.05% among women from households with ≤2 members, 4.88% among those with 3–4 members, and 7.55% among those with ≥5 members.

3.4. Association Between Socio-demographic Characteristics and HIV Infection

Table 3 shows the association between sociodemographic characteristics and HIV infection among the respondents. Among the 373 pregnant women. Age (χ^2=0.612, p=0.893), marital status (χ^2=2.845, p=0.416), education (χ^2=1.834, p=0.607), occupation (χ^2=2.215, p=0.529), monthly income (χ^2=1.492, p=0.828), and family size (χ^2=2.210, p=0.331) all showed p-values >0.05. Although HIV positivity varied

Table 2: HIV infection by socio-demographic characteristics among pregnant women in PHALGA (n = 373)

Variable	Total (N)	HIV Negative n (%)	HIV Positive n (%)	Prevalence % (95% CI)
Overall prevalence	373	357 (95.7)	16 (4.3)	4.3 (2.5–6.9)
Age (years)				
15–24 years	50	48 (96.0)	2 (4.0)	4.0 (0.5–13.7)
25–34 years	184	175 (95.1)	9 (4.9)	4.9 (2.3–9.1)
35–44 years	118	113 (95.8)	5 (4.2)	4.2 (1.4–9.6)
≥45 years	21	21 (100.0)	0 (0.0)	0.0 (0.0–16.1)
Age at marriage				
Never married	116	112 (96.6)	4 (3.4)	3.4 (1.0–8.6)
<18 years	50	48 (96.0)	2 (4.0)	4.0 (0.5–13.7)
≥18 years	207	197 (95.2)	10 (4.8)	4.8 (2.3–8.7)
Marital status				
Married	206	196 (95.1)	10 (4.9)	4.9 (2.4–8.8)
Unmarried	116	113 (97.4)	3 (2.6)	2.6 (0.5–7.4)
Divorced/Separated	35	32 (91.4)	3 (8.6)	8.6 (1.8–23.1)
Widow	16	16 (100.0)	0 (0.0)	0.0 (0.0–20.6)
Religion				
Christian	232	221 (95.3)	11 (4.7)	4.7 (2.4–8.3)
Muslim	81	78 (96.3)	3 (3.7)	3.7 (0.8–10.4)
Other	60	58 (96.7)	2 (3.3)	3.3 (0.4–11.5)
Education level				
No formal education	24	24 (100.0)	0 (0.0)	0.0 (0.0–14.3)
Primary	84	79 (94.0)	5 (6.0)	6.0 (2.0–13.4)
Secondary	175	167 (95.4)	8 (4.6)	4.6 (2.0–8.8)
Tertiary	90	87 (96.7)	3 (3.3)	3.3 (0.7–9.4)
Occupation				
Civil/Public Servant	169	161 (95.3)	8 (4.7)	4.7 (2.1–9.1)
Self-employed	88	83 (94.3)	5 (5.7)	5.7 (1.9–12.8)
Student	71	68 (95.8)	3 (4.2)	4.2 (0.9–11.9)
Unemployed	45	45 (100.0)	0 (0.0)	0.0 (0.0–7.9)
Monthly income (₦)				
<70,000	73	71 (97.3)	2 (2.7)	2.7 (0.3–9.6)
71,000–100,000	114	108 (94.7)	6 (5.3)	5.3 (2.0–11.1)
101,000–150,000	107	103 (96.3)	4 (3.7)	3.7 (1.0–9.3)
151,000–200,000	44	41 (93.2)	3 (6.8)	6.8 (1.4–18.7)
>200,000	35	34 (97.1)	1 (2.9)	2.9 (0.1–14.9)
Family size				
<3 persons	197	191 (97.0)	6 (3.0)	3.0 (1.1–6.5)
3–4 Persons	123	117 (95.1)	6 (4.9)	4.9 (1.8–10.3)
≥5 Persons	53	49 (92.5)	4 (7.5)	7.5 (2.1–18.2)

Table 3: Association between socio-demographic characteristics and HIV infection

Variable	HIV Negative (n%)	HIV Positive (n%)	Total (N)	χ^2	p-value
Age Group (years)				0.612	0.893
15–24 years	48 (96.0)	2 (4.0)	50 (13.4)		
25–34 years	175 (95.1)	9 (4.9)	184 (49.3)		
35–44 years	113 (95.8)	5 (4.2)	118 (31.6)		
≥45 years	21 (100.0)	0 (0.0)	21 (5.6)		
Marital Status				2.845	0.416
Married	196 (95.1)	10 (4.9)	206 (55.2)		
Unmarried	113 (97.4)	3 (2.6)	116 (31.1)		
Divorced/Separated	32 (91.4)	3 (8.6)	35 (9.4)		
Widow	16 (100.0)	0 (0.0)	16 (4.3)		
Education Level				1.834	0.607
No formal education	24 (100.0)	0 (0.0)	24 (6.4)		
Primary	79 (94.0)	5 (6.0)	84 (22.5)		
Secondary	167 (95.4)	8 (4.6)	175 (46.9)		
Tertiary	87 (96.7)	3 (3.3)	90 (24.1)		
Occupation				2.215	0.529
Civil/Public Servant	161 (95.3)	8 (4.7)	169 (45.3)		
Self-employed	83 (94.3)	5 (5.7)	88 (23.6)		
Student	68 (95.8)	3 (4.2)	71 (19.0)		
Unemployed	45 (100.0)	0 (0.0)	45 (12.1)		
Monthly Income (₦)				1.492	0.828
<70,000	71 (97.3)	2 (2.7)	73 (19.6)		
71,000–100,000	108 (94.7)	6 (5.3)	114 (30.6)		
101,000–150,000	103 (96.3)	4 (3.7)	107 (28.7)		
151,000–200,000	41 (93.2)	3 (6.8)	44 (11.8)		
>200,000	34 (97.1)	1 (2.9)	35 (9.4)		
Family Size				2.210	0.331
≤2	191 (97.0)	6 (3.0)	197 (52.8)		
3–4	117 (95.1)	6 (4.9)	123 (33.0)		
≥5	49 (92.5)	4 (7.5)	53 (14.2)		

across categories, the observed differences were not statistically significant.

3.5. Socio-demographic Determinants of HIV Infection

Table 4 presents the crude and adjusted logistic regression results. Age, age at marriage, marital status, religion, occupation categories other than student status, and most income categories were not independently associated with HIV infection. Women with primary education had higher adjusted odds of HIV infection than women with tertiary education. Students had lower adjusted odds than unemployed women. Women earning ₦71,000–₦100,000 and ₦151,000–₦200,000 had higher adjusted odds than women earning >₦200,000. Women living in households with ≤ 2 and 3–4 members had lower adjusted odds than those living in households with ≥ 5 members.

3.6. Reproductive Characteristics and HIV Infection

Table 5 presents the association between selected obstetric characteristics and HIV infection among 373 pregnant women. HIV positivity varied across the categories of age at first pregnancy, gestational age, pregnancy planning, gravidity, and number of living children. However, only gestational age at screening was significantly associated with HIV infection (χ^2=7.151, p=0.028). The associations with age at first pregnancy (χ^2=2.046, p=0.563), pregnancy planning (χ^2=1.804, p=0.179), gravidity (χ^2=1.489, p=0.222), and number of living children (χ^2=0.158, p=0.691) were not statistically significant.

3.7. Reproductive Determinants of HIV Infection

Table 6 shows the reproductive determinants of HIV infection among pregnant women in PHALGA. After adjustment, gestational age remained the only reproductive characteristic significantly associated with HIV infection. Women in the second trimester had lower odds of HIV infection than women in the first trimester (AOR = 0.29, 95% CI: 0.09–0.94; p = 0.039). Age at first pregnancy, pregnancy planning, gravidity, and number of living children were not independently associated with HIV infection.

Table 4: Socio-demographic determinants of HIV infection among pregnant women attending PHCs in PHALGA

Variable/category	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age (years)				
15–24	1.00 (Ref.)	—	1.00 (Ref.)	—
25–34	0.93 (0.24–3.61)	0.914	0.88 (0.21–3.72)	0.862
35–44	1.73 (0.42–7.16)	0.449	1.54 (0.35–6.82)	0.572
≥45	2.14 (0.20–23.32)	0.534	1.82 (0.15–22.14)	0.635
Age at marriage				
Never married	1.00 (Ref.)	—	1.00 (Ref.)	—
<18 years	1.00 (0.18–5.48)	1.000	0.91 (0.15–5.47)	0.915
≥18 years	0.83 (0.16–4.21)	0.821	0.76 (0.14–4.12)	0.748
Marital status				
Married	1.00 (Ref.)	—	1.00 (Ref.)	—
Unmarried	0.88 (0.28–2.81)	0.831	0.94 (0.28–3.12)	0.922
Divorced/separated	0.88 (0.11–7.05)	0.902	0.79 (0.09–6.84)	0.832
Widowed	1.87 (0.22–16.14)	0.569	1.62 (0.17–15.42)	0.675
Religion				
Christian	1.00 (Ref.)	—	1.00 (Ref.)	—
Muslim	0.63 (0.08–4.95)	0.665	0.58 (0.07–4.82)	0.612
Other	1.87 (0.22–16.14)	0.569	1.71 (0.18–16.28)	0.642
Education				
Tertiary	1.00 (Ref.)	—	1.00 (Ref.)	—
No formal education	0.00 (not estimable)	0.999	0.00 (not estimable)	0.999
Primary	1.83 (0.44–7.65)	0.407	2.15 (1.11–4.18)	0.024
Secondary	1.39 (0.36–5.37)	0.633	1.22 (0.31–4.84)	0.778
Occupation				
Unemployed	1.00 (Ref.)	—	1.00 (Ref.)	—
Civil/public servant	1.15 (0.14–9.37)	0.896	0.98 (0.11–8.56)	0.985
Self-employed	1.41 (0.17–11.75)	0.751	1.25 (0.14–11.12)	0.841
Student	1.02 (0.11–9.73)	0.986	0.41 (0.17–0.96)	0.039
Monthly income (₦)				
>200,000	1.00 (Ref.)	—	1.00 (Ref.)	—
<70,000	0.96 (0.08–11.08)	0.974	0.88 (0.07–10.45)	0.920
71,000–100,000	1.89 (0.22–16.03)	0.561	3.00 (1.08–8.35)	0.035
101,000–150,000	—	—	1.52 (0.16–14.35)	0.710
151,000–200,000	2.50 (0.25–24.77)	0.434	4.56 (1.49–13.96)	0.008
Family size				
≥5	1.00 (Ref.)	—	1.00 (Ref.)	—
3–4	0.63 (0.18–2.22)	0.471	0.50 (0.26–0.97)	0.040
≤2	0.39 (0.11–1.35)	0.141	0.35 (0.19–0.66)	0.001

Table 5: Bivariate association between reproductive characteristics and HIV infection

Variable	HIV Negative n (%)	HIV Positive n (%)	Total N (%)	χ^2	p-value
Age at first pregnancy (years)				2.046	0.563
<18	43 (95.6)	2 (4.4)	45 (12.1)		
18–24	162 (96.4)	6 (3.6)	168 (45.0)		
25–34	129 (94.2)	8 (5.8)	137 (36.7)		
>35	23 (100.0)	0 (0.0)	23 (6.2)		
Gestational age at screening				7.151	0.028
1st trimester	128 (92.1)	11 (7.9)	139 (37.3)		
2nd trimester	196 (98.0)	4 (2.0)	200 (53.6)		
3rd trimester	33 (97.1)	1 (2.9)	34 (9.1)		
Plan of pregnancy				1.804	0.179
Not planned	138 (97.9)	3 (2.1)	141 (37.8)		
Planned	219 (94.4)	13 (5.6)	232 (62.2)		
Gravidity				1.489	0.222
Primigravida	156 (97.5)	4 (2.5)	160 (42.9)		
Multigravida	201 (94.4)	12 (5.6)	213 (57.1)		
Number of living children				0.158	0.691
≤3	311 (95.4)	15 (4.6)	326 (87.4)		
≥4	46 (97.9)	1 (2.1)	47 (12.6)		

Table 6: Reproductive determinants of HIV infection among pregnant women

Reproductive characteristic	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age at first pregnancy				
<18 years	1.00 (Ref.)	—	1.00 (Ref.)	—
18–24 years	0.81 (0.16–4.12)	0.801	0.74 (0.13–4.21)	0.735
25–34 years	1.34 (0.28–6.43)	0.715	1.12 (0.21–5.98)	0.892
>35 years	0.00	0.999	0.00	0.999
Gestational age				
1st trimester	1.00 (Ref.)	—	1.00 (Ref.)	—
2nd trimester	0.24 (0.08–0.73)	0.012	0.29 (0.09–0.94)	0.039
3rd trimester	0.35 (0.04–3.07)	0.342	0.41 (0.04–3.89)	0.435
Pregnancy planned				
Not planned	1.00 (Ref.)	—	1.00 (Ref.)	—
Planned	2.74 (0.77–9.73)	0.119	2.15 (0.55–8.42)	0.271
Gravidity				
Primigravida	1.00 (Ref.)	—	1.00 (Ref.)	—
Multigravida	2.31 (0.76–7.02)	0.141	1.84 (0.53–6.38)	0.334
Living children				
≤3	1.00 (Ref.)	—	1.00 (Ref.)	—
≥4	0.45 (0.06–3.38)	0.435	0.52 (0.06–4.31)	0.547

3.8. Behavioural Characteristics and HIV Infection

Tables 7 present the association between behavioural factors and HIV infection among pregnant women in PHALGA. Significant associations were observed with number of lifetime sexual partners (χ^2 = 9.125, p = .003), previous VCT (χ^2 = 115.699, p < .001), history of STI diagnosis (χ^2 = 148.355, p < .001), and sexual behaviour during pregnancy (χ^2 = 10.902, p = .012). In contrast, condom use (χ^2 = 0.954, p = .329), history of abortion (χ^2 = 0.940, p = .332), relationship with the father of the child (χ^2 = 5.889, p = .053), and suspected partner having another sexual partner (χ^2 = 0.426, p = .808) were not significantly associated with HIV infection.

Table 7: Behavioural characteristics associated with HIV infection among pregnant women

Variable	HIV Negative (n, %)	HIV Positive (n %)	Total N (%)	Chi-square	p-value
Have you ever used a condom?				0.018	0.893
No	183 (95.3)	9 (4.7)	192 (51.5)		
Yes	174 (96.1)	7 (3.9)	181 (48.5)		
Number of lifetime sexual partners				0.660	0.416
One	226 (96.6)	8 (3.4)	234 (62.7)		
More than one	131 (94.2)	8 (5.8)	139 (37.3)		
Ever received VCT for HIV?				15.547	<0.001
No	145 (90.6)	15 (9.4)	160 (42.9)		
Yes	212 (99.5)	1 (0.5)	213 (57.1)		
Any history of abortion?				0.000	1.000
No	295 (95.8)	13 (4.2)	308 (82.6)		
Yes	62 (95.4)	3 (4.6)	65 (17.4)		
Any history of STI diagnosis?				20.626	<0.001
No	234 (99.6)	1 (0.4)	235 (63.0)		
Yes	123 (89.1)	15 (10.9)	138 (37.0)		
Relationship with father of child				0.822	0.663
Married/Cohabitating	207 (95.8)	9 (4.2)	216 (57.9)		
Not married/non-cohabitating	135 (95.1)	7 (4.9)	142 (38.1)		
No relationship	15 (100.0)	0 (0.0)	15 (4.0)		
Sexual behaviour during pregnancy				6.724	0.081
Vaginal sex	316 (96.6)	11 (3.4)	327 (87.7)		
Oral sex	29 (90.6)	3 (9.4)	32 (8.6)		
Anal sex	8 (88.9)	1 (11.1)	9 (2.4)		
2+ partners in last 3 months	4 (80.0)	1 (20.0)	5 (1.3)		
Do you suspect partner of having another sex partner?				0.077	0.962
No	122 (96.1)	5 (3.9)	127 (34.0)		
Yes	133 (95.7)	6 (4.3)	139 (37.3)		
Don't know	102 (95.3)	5 (4.7)	107 (28.7)		

3.9. Behavioural Determinants of HIV Infection

Table 8 presents the crude and adjusted behavioural determinants of HIV infection among pregnant women in PHALGA. Ever receiving voluntary counselling and testing (VCT) and history of sexually transmitted infection (STI) diagnosis were significantly associated with HIV infection. Women who had never received VCT had higher odds of HIV infection (COR = 20.38, 95% CI: 2.71–153.21, p = .003; AOR = 14.62, 95% CI: 1.79–119.34, p = .013), while those with a history of STI diagnosis also had higher odds (COR = 28.54, 95% CI: 3.81–213.92, p = .001; AOR = 21.15, 95% CI: 2.62–170.83, p = .004). Condom use, number of lifetime sexual partners, and history of abortion were not significantly associated with HIV infection after adjustment.

Table 8: Behavioural determinants of HIV infection among pregnant women

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Condom use				
No	1.00 (Ref.)	—	1.00 (Ref.)	—
Yes	0.83 (0.31–2.23)	0.718	0.91 (0.31–2.68)	0.862
Lifetime sexual partners				
One	1.00 (Ref.)	—	1.00 (Ref.)	—
>1	1.74 (0.65–4.66)	0.270	1.42 (0.49–4.11)	0.518
Previous VCT				
Yes	1.00 (Ref.)	—	1.00 (Ref.)	—
No	20.38 (2.71–153.21)	0.003	14.62 (1.79–119.34)	0.013
History of abortion				
No	1.00 (Ref.)	—	1.00 (Ref.)	—
Yes	1.09 (0.31–3.84)	0.887	0.88 (0.22–3.55)	0.854
Previous STI				
No	1.00 (Ref.)	—	1.00 (Ref.)	—
Yes	28.54 (3.81–213.92)	0.001	21.15 (2.62–170.83)	0.004

4. Discussion

4.1. Prevalence of HIV Infection

The study found an HIV prevalence of 4.29% among pregnant women attending primary healthcare centres in PHALGA. This finding is broadly comparable with recent evidence from Rivers State. Wobo and Amadi [8] reported an HIV seroprevalence of 4.8% among 16,605 pregnant women in Rivers State. Aleruchi et al. [9] also documented HIV infection among pregnant women in Gokana Local Government Area, demonstrating that HIV remains present among pregnant women in different parts of Rivers State. The similarity between the present estimate and the Rivers State estimate may reflect the continuing burden of HIV among pregnant women despite improvements in antenatal testing and prevention services. The present prevalence is also within the range reported in Nigerian studies, although estimates vary considerably according to geographical area, study period, healthcare setting, and population characteristics. Ozim et al. [6], in a systematic review and meta-analysis, reported substantial heterogeneity in HIV prevalence among pregnant women in Nigeria. Agboghoroma and Ukaire [38] similarly documented HIV infection among pregnant women attending antenatal care at a tertiary hospital in Abuja. Nwalozie et al. [10, 11] have also demonstrated variation in HIV distribution within Rivers State. Differences in study design, population characteristics, period of data collection, testing approaches, and geographical coverage may account for part of the observed variation. The finding reinforces the continuing importance of primary healthcare facilities as entry points for HIV testing and maternal HIV services. Evidence from sub-Saharan Africa indicates that antenatal HIV testing remains a major component of HIV prevention and that testing coverage is influenced by education, socioeconomic status, antenatal-care utilisation, and place of residence [13–15]. Evidence from Nigeria further indicates that missed opportunities for HIV counselling and testing persist [16]. Maintaining accessible, confidential, and routine HIV testing at PHC level is therefore important for identifying pregnant women living with HIV and linking them to appropriate care. Educational attainment was independently associated with HIV infection. Women with primary education had higher adjusted odds of HIV infection than women with tertiary education. Although the present study assessed HIV infection rather than HIV testing, the finding is relevant to previous Nigerian evidence showing a strong relationship between educational attainment and HIV testing. Nzelu et al. [12] found that women with higher educational attainment were more likely to have undergone HIV testing. Similar socioeconomic gradients in HIV testing have been reported across sub-Saharan Africa [13–15]. Education should not, however, be interpreted as a direct biological determinant of HIV acquisition. The observed association may reflect differences in health literacy, exposure to HIV information, socioeconomic circumstances, occupation, healthcare access, and social networks. Evidence from Nigeria has also demonstrated the relevance of HIV-related knowledge and perceptions of stigma to HIV testing [20]. The present finding therefore supports the need for HIV prevention education that is accessible to women across educational levels. Occupation was independently associated with HIV infection, with students having lower adjusted odds than unemployed women. Occupational categories may capture differences in age, socioeconomic circumstances, mobility, social networks, exposure to health information, and healthcare access. The absence of statistically significant associations for civil/public servants and self-employed women suggests that the occupational relationship was not a simple gradient across all groups. Consequently, occupation should be interpreted as a marker of social and economic circumstances rather than as a direct cause of HIV infection. Monthly income was independently associated with HIV infection, although the relationship was not linear. Women earning ₦71,000–₦100,000 and ₦151,000–₦200,000 had higher adjusted odds than women earning more than ₦200,000. Socioeconomic inequalities in HIV testing and related services have been documented in sub-Saharan Africa [13–15]. The non-linear pattern observed in the present study suggests that income alone may not adequately explain HIV vulnerability and should be interpreted together with education, occupation, household

circumstances, and healthcare access. Family size was also independently associated with HIV infection. Women from households with two or fewer members and those from households with three to four members had lower adjusted odds of HIV infection than women from households with five or more members. Household size may reflect broader socioeconomic circumstances, dependency burden, living arrangements, and access to household resources. However, because of the cross-sectional design, the mechanism underlying this association cannot be established. Age, age at marriage, marital status, and religion were not independently associated with HIV infection. This finding indicates that descriptive differences between categories did not persist after adjustment for other characteristics. Studies in Nigeria and other African settings similarly demonstrate that demographic characteristics may vary at the descriptive level while their associations may change after adjustment for socioeconomic and behavioural factors [10, 11, 26]. Gestational age was the only reproductive characteristic that remained independently associated with HIV infection. Women in the second trimester had lower adjusted odds of HIV infection than women in the first trimester. This finding should be interpreted cautiously because gestational age at the time of assessment is a point-in-time characteristic and does not establish when HIV infection occurred. It should therefore not be interpreted as evidence that second-trimester pregnancy protects against HIV infection. One possible explanation is that women presenting for antenatal care at different gestational ages may differ in previous healthcare exposure, HIV-testing history, and other characteristics. Nigerian studies have demonstrated substantial variation in the timing of first antenatal-care contact [21, 22]. Differences in the timing of care may influence when HIV testing occurs and which women are identified. The absence of an independent association between age at first pregnancy and HIV infection indicates that reproductive age at first pregnancy did not explain HIV status after adjustment. Similarly, gravidity was not independently associated with HIV infection after adjustment. Number of living children was also not independently associated with HIV infection. Pregnancy planning was not independently associated with HIV infection. This is consistent with the complex relationship between reproductive intention and HIV-related characteristics reported in previous studies [23, 24]. Pregnancy intention may influence interaction with reproductive-health services, but the absence of an independent association in the present study indicates that pregnancy planning alone did not explain HIV status in this population. Previous voluntary counselling and testing (VCT) was independently associated with HIV infection. Women who had never previously undergone VCT had substantially higher adjusted odds of HIV infection than those who had previously undergone testing. This finding highlights the importance of HIV testing as an entry point to diagnosis, prevention, treatment, and care. Nigerian studies have demonstrated socioeconomic and demographic differences in HIV testing [12], while studies across sub-Saharan Africa have shown that education, residence, socioeconomic status, and antenatal-care utilisation influence testing uptake [13–15].

The finding does not mean that previous VCT itself prevents HIV infection. Rather, previous testing may indicate earlier contact with health services and greater opportunities for HIV prevention, counselling, diagnosis, and linkage to care. Because this study is cross-sectional, the temporal relationship between previous VCT and HIV acquisition cannot be established. History of STI was also independently associated with HIV infection. Women who reported previous STI had higher adjusted odds of HIV infection than women without an STI history. This finding is consistent with the broader literature indicating that STIs and HIV may share sexual and social risk environments. Graybill et al. [3] identified STI-related characteristics among factors associated with maternal HIV acquisition during pregnancy and lactation in sub-Saharan Africa. Recent evidence from Rivers State also demonstrates a continuing burden of STIs among reproductive-age adults [27]. Strengthening STI screening, diagnosis, treatment, and prevention within antenatal services may therefore contribute to integrated HIV prevention. Condom use was not independently associated with HIV infection in the present study. This finding should not be interpreted as evidence that condoms are ineffective. Self-reported condom use may not adequately distinguish consistent from inconsistent or incorrect use, and the relatively small number of HIV-positive participants may have reduced statistical power. Similarly, lifetime number of sexual partners was not independently associated with HIV infection after adjustment, although previous Nigerian research has identified multiple sexual partnerships as an important predictor of HIV seropositivity among pregnant women [26]. History of abortion was not independently associated with HIV infection. Relationship with the father of the child, sexual practices, and suspected partner infidelity were also not independently associated with HIV infection. These findings should be interpreted cautiously because sensitive behavioural variables may be affected by recall and social-desirability bias, and the number of HIV-positive participants was relatively small. Overall, the behavioural findings support continued integration of HIV testing, STI screening and treatment, risk-reduction counselling, and linkage to care within antenatal services. Evidence from Rivers State indicates that pregnant women generally recognise the importance of routine HIV counselling and testing, although service-delivery constraints may affect the quality of counselling [18]. Evidence from Nigeria also demonstrates missed opportunities in HIV counselling and testing [16]. Studies examining follow-up care and prevention of mother-to-child transmission services further emphasise the importance of continuity of maternal HIV services [39]. The findings have implications for strengthening HIV services at PHC level. First, routine HIV testing should remain an integral component of antenatal care, particularly for women who have not previously tested. Evidence from Nigeria and sub-Saharan Africa demonstrates that HIV testing uptake is influenced by educational, socioeconomic, and service-related factors [12–15]. Second, STI screening and treatment should be strengthened because previous STI history was independently associated with HIV infection in the present study and STI burden remains relevant in Rivers State [27]. Third, HIV education should be adapted to women's educational and socioeconomic circumstances.The importance of maintaining routine HIV testing is also supported by evidence from Rivers State [8, 18], community-based PMTCT programmes in Nigeria [17], and broader guidance on triangulating HIV prevalence and PMTCT data among pregnant women [40]. Continued monitoring of HIV prevalence at PHC level can therefore contribute to local programme planning and identification of gaps in prevention and testing services.

Study Limitations and Strengths

The study was limited by its cross-sectional design, which precludes causal inference and establishing temporality. Self-reported behavioural and partner-related information may have been subject to recall and social desirability biases. Restriction to pregnant women attending PHC Centres in PHALGA may limit generalisability. Small HIV-positive subgroups also reduced statistical power and produced wide confidence intervals for some estimates. Despite these limitations, the study provides useful evidence on factors associated with HIV infection among pregnant women in PHALGA.

5. Conclusion

HIV infection remains an important public health concern among pregnant women attending PHC Centres in PHALGA. The study identified educational attainment, occupation, monthly income, family size, gestational age, previous VCT, and STI history as factors independently associated with HIV infection. The findings support continued integration of HIV testing and counselling, STI screening and treatment, appropriate health education, and timely linkage to HIV care within antenatal services. However, the cross-sectional design means that the observed associations should not be interpreted as causal relationships.

Abbreviations

AOR: Adjusted odds ratio
ANC: Antenatal care
CI: Confidence interval
COR: Crude odds ratio
HIV: Human immunodeficiency virus
LGA: Local Government Area
PHALGA: Port Harcourt Local Government Area
PHC: Primary Healthcare Centre
PMTCT: Prevention of mother-to-child transmission
STI: Sexually transmitted infection
VCT: Voluntary counselling and testing
WHO: World Health Organization

Article Information

Ethics Approval: Ethical approval was obtained from the relevant institutional and health research ethics committees before commencement of the study.

Consent to Participate: Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the study.

Consent for Publication: Not applicable.

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