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Prevalence and Risk Factors Associated with HIV Infection among Pregnant Antenatal Care Attendees in Limpopo Province, South Africa

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Abstract:

Early screening for HIV infection provides an opportunity for mother-to-child transmission and optimizes the care of HIV-infected mothers and unborn babies to improve clinical outcomes. This study aimed to determine the prevalence and the risk factors associated with HIV infection among pregnant women attending antenatal care at the District Hospital and its feeder community health center of the Limpopo Province (LP), South Africa. The study was a cross-sectional descriptive study carried out over 2-months from 01 May 2019 to 30 June 2019. A consecutive sample of pregnant women who attended antenatal care during the study period was asked to participate. In total, 211 pregnant women participated in this study. Their mean age was 28.4±5.7 years, ranging from 18 to 41 years. More than half (56.4%) were aged <30 years old, 51.7% had secondary education, 71.1% were unmarried, and 72.0% were unemployed. The majority (66.4%) of pregnant women had multiple pregnancies and 70.6% were in the third trimester. Few (0.95%, n=2) had a history of alcohol use. The HIV prevalence was 15.2%, and significantly high in illiterate, elementary school-educated and multiparous women. The HIV infection rate in this setting is relatively associated with the level of education and parity. The social risk factors of health in each municipality should be considered when local health authorities implement policies. Women should be continually provided with health education about modes of transmission of HIV prevention particularly those with lower levels of education and reproductive age.

Keywords: South Africa; Limpopo Province; Capricorn District; HIV prevalence; Pregnant Women

Introduction

Human immunodeficiency virus (HIV) is a sexually transmitted infection that has been considered to be a major public health problem for many years with serious medical, economic, and social impacts.[1] Globally, in 2022, it was estimated that 39.0 million people were living with HIV, and women and girls constituted slightly more than half (53%) of all people living with HIV.[2] The prevalence rate of HIV infection is found to be highest in low and middle-income countries with sub-Saharan African countries accounting for more than 60% of all new infections.[3] The consequence of HIV in pregnant women or pregnancy is mother-to-child transmission of HIV which may cause adverse pregnancy outcomes such as miscarriages and stillbirth;[4-7] premature live births,[7,8] low birth weight of babies,[9,10] and maternal mortality,[11] which are the major challenges for the healthcare system in developing countries, particularly sub-Saharan African countries.

Several interventions have been established including the Joint United Nations Programme on HIV/AIDS (UNAIDS) 90–90-90 HIV treatment target by 2020; the Millennium Development Goal to cut off and reverse the spread of HIV/AIDs by 2015; and the UNAIDS global plan towards the elimination of new HIV infection among children by 2015.[12-14] In spite of progress being made towards achieving the set target for these programs, there is still a continuing of incident of maternal and new-born HIV infections in certain regions of the world, particularly in low-and-middle income countries.[15]

In sub-Saharan African countries, several research showed a higher prevalence rate of HIV infection among pregnant women. A cross-sectional study of randomly selected pregnant women in government hospitals in Botswana found an HIV prevalence rate of 17%[16] and 24.1%[17]. In a retrospective cross-sectional study conducted in Ethiopia, the overall prevalence of HIV infection among pregnant women was 7.1%.[18] In Nigeria, a cross-sectional seroprevalence study carried out on pregnant women attending the antenatal clinic of a tertiary hospital in Abuja found the prevalence of HIV was 12.3%.[19] The national cross-sectional survey conducted in South Africa (SA) among pregnant women attending antenatal care at public healthcare facilities reported that 30.7% of the women were HIV infected.[20] Other SA studies reported a prevalence rate ranging from 15 to 45%.[21-23] The prevalence rate of HIV infection among pregnant women in sub-Saharan African countries is unacceptably high as compared to the prevalence rates reported in other developing countries, which reported rates of 0.35% in Pakistan[24], and 0.28%[25] and 0.22 in India.[26]

There are various demographic risk factors associated with HIV infection among pregnant women. A study conducted among pregnant antennal care (ANC) attendees in public health facilities in Cameroon found an association between marital status and HIV infection, with pregnant women who were married or living with their partner less likely to be HIV infected than unmarried women.[27] On the contrary, a study from SA found a higher prevalence of HIV infection among unmarried women than married women but the result was not statistically significant.[28] Zhong and co-authors in their cross-sectional study in Southwest China found that pregnant women who were unmarried/widowed/divorced were significantly more likely to have HIV.[29]

One Indian study found the level of education significantly associated with HIV infection among pregnant women with illiterate women as compared to literate women more like infected with HIV.[30] A similar study reported level of education was significantly related to HIV infection, and women with primary and secondary school

education were more likely to be HIV infected than those with tertiary education.[16,27] Other studies found no significant association between the level of education and HIV infection.[29,30] Some studies found that parities[27] and employment status[31] were also found to be significantly associated with HIV infection. Multiparous women are almost three time more at risk of infection than nulliparous[27], and a greater proportion of the unemployed pregnant women were more likely to be HIV infected than the employed pregnant women.[31] In contrast, other studies found no significant relationship between parity and HIV infection.[29] In a univariate analysis of a study in Botswana, women who drink alcohol were significantly more likely to be infected with HIV[16]. This finding is similar to a cross-sectional study conducted in Russia, which found that pregnant women who consume alcohol were likely to be HIV infected.[32]

It is worth noting that there is a wide variation in the burden of HIV infection among pregnant women between provinces of South Africa, and the risk factors might be different,[20] therefore, it should be noted that there is no one-size-fits-all solution for any disease. Though efforts to achieve 2020 targets were not reached in South Africa, it is still possible to fulfill the 2030 goal of eliminating AIDS as a public health threat. Therefore, understanding the HIV prevalence and identifying its risk factors among pregnant women in our settings is essential for policymakers' evaluation of existing intervention programs in order to establish localized strategies.

In South Africa, routine screening of all pregnant women is standard practice, and primary healthcare nurses and medical practitioners are the first contacts for pregnant women to receive maternal care, playing a significant role in identifying pregnant women who are HIV infected. Despite this, there is little knowledge about the prevalence of HIV infection and its risk factors among pregnant women attending antenatal care (ANC) at Seshego District Hospital and its feeder community health center in LP. Therefore, this study aimed to determine the prevalence of HIV infection and its risk factors during the antenatal period among pregnant women.

Research Method

Study Design and Setting

This is cross-sectional quantitative descriptive study was undertaken in Seshego District Hospital and its feeder community health centre. The two institutions are public healthcare facilities situated in the Polokwane Municipality of the Capricorn District of the LP, South Africa. The hospital is a 180-bed hospital with only 36 beds allocated for maternity, and on average, 350 pregnant women are seen per month. The community health centre is 10 km away from the district hospital. Based on the 2022 census conducted by Statistics South Africa (StatsSA), Seshego township has a total population of 628,999, with 178 001 households. The researchers collected the data over a period of two months, from May 01 to June 30, 2019.

Study Population

The study population comprised all pregnant women attending ANC at the district hospital and its feeder community health centre. The inclusion criteria were pregnant women who attended an ANC aged 18 and older, who were not sick or have a mental disorder, and able to provide consent. Those not meeting these inclusion criteria were asked to participate in the study and complete the informed consent before participating in the study.

Sample Size and Sampling Technique

The minimum sample size of 147 was required for the present study, which was calculated using Cochran's[33] single population proportion formula, where n is the sample size, $Z^2_{1-\frac{\propto}{2}}$, the value of standard normal variables at 95% confidence interval = 1.96, according to the national cross–sectional survey done in South Africa between 1 October and 15 November 2017, p the estimated HIV prevalence in pregnant women in Limpopo province was found to be 9.6%,[20] sampling error of 5% and 10% non-response rate.

$$n = \frac{Z^2_{1-\frac{\propto}{2}} p(1-p)}{d^2}$$

A consecutive sample of pregnant women aged ≥18 who reported to the two healthcare facilities and met the inclusion criteria during data collection was asked to participate in the study. To ensure the quality of the data collected is accurate, the number of respondents enrolled was limited to 15 per day at each site.

Data Collection

A self-administered questionnaire was completed by consenting pregnant ANC attendees, which included socio-demographic data such as maternal age, place of residence, level of education, marital status, and parity, occupation of the women, alcohol intake, and HIV status. Maternal age was categorized into four groups (<25, 25–29, 30-34, and >35). The primary outcome was HIV status (positive or negative), which was obtained directly from the antenatal card. In the majority of the respondents, the antenatal card was unavailability, therefore, the women were asked about their HIV status. The researcher developed the tool using relevant literature,[16,27,30-32] and piloted it on 15 pregnant women at a healthcare facility other than the actual study site to make sure that the questionnaire was appropriate and understandable.

Data Analysis

Data were captured and analyzed using Microsoft Excel and Statistical software (Stata 9.0, StataCorp, College Station, Texas, United States of America [USA]), respectively. The result of the study was presented using mean and standard deviation for continuous variables, and frequencies and percentages for categorical variables. The association between HIV infection and demographic information of the participants was assessed using Chi-square or Fisher Exact tests, accordingly. Logistics regression analysis was used to assess risk factors associated with HIV infection. All variables significant at p <0.25 in the univariate model were included in the multivariable logistic regression analysis. The cut-off value of less than 0.25 is supported by literature.[34,35] In the multivariate logistic regression, all variables were considered significant at a p-value less than 0.05. The Hosmer–Lemeshow goodness-of-fit test was used to assess how well the data fit in the final multivariable model and was found not to violate good fit (p > 0.05).[36]

Ethical Considerations

Ethical clearance for the study was obtained from the Pietersburg/Mankweng Research Ethics Committee (Ref: PMREC03UL2019B). Permission to conduct the study was obtained from the provincial Department of Health Research and the management of the hospital. The study also obtained the second ethics approval from Sefako Makgatho Health Sciences University Research Ethics Committee (Ref: SMUREC/S/407/2022: PG), since the data was used for the degree of MSc in Statistics. The

researcher informed all pregnant women about the aim and objectives of the study before asking them to participate in the study, and those willing to participate were given informed consent to complete it. The confidentiality and privacy of the study respondents were ensured by not linking personal identifiers with respondent's information.

Results

Demographic Characteristics

A total of 211 pregnant women participated in this study. The distribution of the respondent's socio-demographic characteristics has been represented in Table 1. The mean age of the respondents was 28.4 with a standard deviation of 5.7 years, ranging from 18 to 41 years. Slightly more than half (56.4%) of the participants were in the age group less than 30 years old. The predominant educational level was secondary education (51.7%), while 45.5% had tertiary education and 2.8% had no formal education. Nearly two-thirds (64.9%) of the pregnant women were unmarried and 35.1 were married and/or cohabiting. More than two-thirds (72.0%) were unemployed and 28.0% were unemployed. Most (36.5%) of the pregnant women were primiparous followed by 33.6% nulliparous. Only 29.9% of the respondents were multiparous.

A higher proportion of the pregnant women (70.6%) were in the third trimester followed by 26.1% in the second trimester and a small proportion 3.3% in the first trimester. Nearly all (99.05%) of the pregnant women in this study said that they don't have a history of alcohol use and few (0.95%) had a history of alcohol use. Seventy-six percent of the respondents were from urban areas and only 23.7% were from rural areas.

Table 1 Demographic Information of the participants, n=211

	No	%
Age (years)		
<25	61	28,9
25-29	58	27,5
30-34	56	26,5
35+	36	17,1
Level of education		
None/Primary	6	2,8
Secondary	109	51,7
Tertiary	96	45,5
Marital status		
Unmarried	137	64.9
Married/cohabiting	74	35.1
Employment status		
Unemployed	152	72,0
Employed	59	28,0
Parity		
Nulliparous	71	33,6
Primiparous	77	36,5
Multiparous	63	29,9
Gestational Age		
1st Trimester	7	3,3
2nd Trimester	55	26,1
3rd Trimester	149	70,6
Place of residence		
Rural	50	23,7
Urban	161	76,3

Prevalence of HIV infection by Demographic information

The prevalence of HIV in pregnancy was 15.2% (95%CI: 10.6; 20.7). Table 2 presents the association between the respondent's demographic information and HIV infection among pregnant women who participated in this study. The findings showed that HIV prevalence increases with age with women 35 years and older found to be HIV infected than the other groups but the result was not statistically significant ($p>0.05$). Women's level of education was statistically significantly associated with HIV infection ($p<0.05$), and the result indicates that those with no formal education or primary education had higher HIV prevalence than women with secondary and tertiary education.

Table 2 Association between HIV infection and demographic variables

	n	HIV-infected		p-value
		Yes (%)	No (%)	
Age (years)				
<25	61	7(11.48)	54(88.52)	0.266
25-29	58	6(10.34)	52(89.66)	
30-34	56	11(19.64)	45(80.36)	
35+	36	8(22.22)	28(77.78)	
Level of education				
None/Primary	6	3(50.00)	3(50.00)	0.011*
Secondary	109	20(18.35)	89(81.65)	
Tertiary	96	9(9.38)	87(90.62)	
Marital status				
Unmarried	137	21(15.33)	116(84.67)	0.929
Married/cohabiting	74	11(14.86)	63(85.14)	
Employment status				
Unemployed	152	25(16.45)	127(83.55)	0.405
Employed	59	7(11.86)	52(88.14)	
Parity				
Nulliparous	71	6(8.45)	65(91.55)	0.045
Primiparous	77	11(14.29)	66(85.71)	
Multiparous	63	15(23.81)	48(76.19)	
Gestational Age				
1st Trimester	7	1(14.3)	6(85.7)	0.982
2nd Trimester	62	9(14.5)	53(85.5)	
3rd Trimester	142	22(15.5)	120(84.5)	
Place of residence				
Rural	50	7	43	0.792
Urban	161	25	136	
History of alcohol				
Yes	2	0(0)	2(100)	1.000
No	209	32(15.3)	177(84.7)	

*p-value for Fisher's Exact

The HIV status was also significantly associated with parity ($p < 0.05$), with multiparous women having a higher rate of HIV. Marital status, employment status, gestational age, place of residence, and history of alcohol use were insignificantly associated with HIV status ($p > 0.05$).

Table 3 Logistic regression output for HIV infection among pregnant women.

	Univariate Logistics Regression	Multivariate Logistics Regression
	OR (95%CI)	OR (95%CI)
Age (years)		
<25	Ref	Ref
25-29	0.89(0.28;2.82)	0.92(0.25;3.29)
30-34	1.88(0.68;5.27)*	1.45(0.40;5.21)
35+	2.20(0.72;6.70)*	1.72(0.44;6.71)
Level of education		
None/Primary	Ref	Ref
Secondary	0.23(0.04;1.20)*	0.15(0.03;0.91)**
Tertiary	0.10(0.01;0.59)*	0.09(0.02;0.58)**
Marital status		
Unmarried	Ref	
Married/cohabiting	0.96(0.41;2.20)	
Employment status		
Unemployed	Ref	
Employed	0.68(0.28;1.68)	
Parity		
Nulliparous	Ref	Ref
Primiparous	1.81(0.63;5.17)	1.44(0.43;4.79)
Multiparous	3.39(1.22;9.37)*	2.24(0.61;8.21)
Gestational Age		
1st Trimester	Ref	
2nd Trimester	1.02(0.11;9.65)	
3rd Trimester	1.10(0.13;9.53)	
Place of residence		
Rural	Ref	
Urban	1.12(0.46;2.79)	

As shown in Table 3, in univariate analysis, it was found that an increase in age was associated with increased odds of HIV infection, though this association was not found to be statistically significant in the multivariate logistics regression model. Pregnant women with multiple pregnancies were 3 times more likely at risk of HIV infection [OR=3.39; 95%CI: 1.22-9.37], but the result was also not statistically significant in the multivariate logistics regression model. There was no statistically significant association between marital status, employment status, gestational age, place of residence, and HIV infection. The multivariate logistic regression analysis revealed that only the level of education was significantly related to HIV infection, and pregnant women with secondary [OR=0.15; 95%CI: 0.03-0.91] and tertiary education [OR=0.09; 95%CI: 0.02-0.58] were found with lower risk of HIV infection.

Discussion

The main purpose of this study was to determine the prevalence of HIV infection and its risk factors among pregnant women attending ANC at the district hospital and its feeder community health centre. The finding of this study revealed that 15.2% of pregnant women reported having HIV infection. This finding is comparable to the prevalence rate found in studies conducted in Botswana,[16] and in Nigeria,[19] but higher than the rate in

Ethiopia,[18] Cameroon,[27] Nigeria,[37] Pakistan,[34] and India.[25,26] The HIV prevalence rate in our study is, however, lower than the rates reported in earlier research conducted in Limpopo province,[23] in the Eastern Cape, Gauteng, and Kwa Zulu Natal provinces of South Africa.[20] The prevalence in our study is also smaller than the rate reported in other studies conducted in the Eastern Cape,[15] Kwa Zulu Natal,[21] and Gauteng provinces of South Africa;[22] and in Botswana.[17] And in 2020 at the Ulin Regional General Hospital in Banjarmasin, South Kalimantan, Indonesia there were 13 cases of babies born to mothers with HIV.[39] The possible reason for the lower HIV prevalence rate in our study as compared to others could be attributable to the fact the HIV status was self-reported by the participants, which might be that most pregnant women were unaware of their HIV status.[39] Other possible reasons for such a discrepancy might be due to differences in the culture, prevention, and control measures, socio-demographic characteristics, and the increase in the level of awareness about the disease.

In the present study, the majority (82.9%) of the participants were in the aged less than 35 years, which is in agreement with the findings of previous studies.[16,17,21,22,31] Consistent with many studies, the current study reveals that slightly more than half (51.7%) had secondary education.[16,17,25,31] In contrast, some studies found that most of the pregnant women had tertiary education.[19]

Similar to the result of the 2017 South African Antenatal Sentinel HIV Survey, the current study shows that a few (2.6%) of the pregnant women had a primary education or no formal education.[20] This finding is inconsistent with previous studies which reported that none of the pregnant women no formal education.[19,31] A similar to the findings of many studies, our results reveals that most of the pregnant women were unmarried.[17,20,31] Our finding is however, in contrast with other studies which reported that most of htier participants were married.[19]

Regarding sociodemographic risk factors associated with HIV infection, in our study, the univariate logistic regression analysis revealed that age, level of education, and parity were significantly associated with HIV infection among pregnant women. Women in the age groups [30-34] and ≥35 years had higher odds of being infected with HIV than the younger women, but the result was not statistically significant in the multivariate regression analysis. This finding is supported by studies conducted in South Africa],[21] Cameroon,[27] and in Botswana,[17] which found that older pregnant women are at higher risk of HIV infection compared with those who are younger. Our results concur with a previous study which showed that multiparous women are three times more likely to be infected by HIV than nulliparous,[27] but in the multivariate logistic regression model parity was not statistically significant.

In the present study, the prevalence of HIV infection was predominantly higher among the illiterates than the other groups and women with secondary and tertiary education were found to have a lower risk of being infected with HIV. A cross-sectional study conducted among pregnant women in Botswana,[16] and India found that illiterate and elementary school-educated women had higher HIV prevalence compared to those with a tertiary education.[30] Similar findings were reported in a Cameroon study, which found that women who were less educated were more likely to be infected with HIV, but in multivariate logistics regression analysis, the result was not statistically significant.[27] In our study, the reasons for the lower risk of HIV infection in highly educated women are not documented. However, an Indian study cited that though education is not directly related to HIV infection, it played a critical role in

awareness of the disease, and more importantly empowered women to be economically independent, which may keep them safe from sexual exploitation, resulting in reduced HIV burden.[30]

In the present study, the finding showed no statistically significant association between marital status and HIV infection in the univariate logistic regression, but pregnant women who were married or cohabiting were less likely to be HIV infected. In contrast, previous studies reported that married or cohabiting pregnant women were found to be significantly associated with lower odds of HIV infection.[27-29] The reason for our study to find no statistically significant relationship between marital status and HIV infection is not documented, however, one study cited that single women due to their economic vulnerability, are more involved in multiple partners which increases their exposure to HIV.[27]

The present study's finding does not concur with the finding of the previous study which showed a statistically significant relationship between employment status and HIV infections.[31] Our findings are consistent with a cross-sectional study conducted in the 10 regions of Cameroon, which showed no statistical association between HIV infection and the area of residence.[27] In the present study, we observed that few (0.95%) of the women consume alcohol and there was no significant association between alcohol consumption and HIV infection. This finding is inconsistent with the previous study that has shown that pregnant women with a history of alcohol consumption are more likely to acquire HIV infection than non-drinkers.[16,32]

Conclusions

This study's findings show that the prevalence of HIV among pregnant women was 15%, and it was significantly higher in pregnant women with multiple pregnancies, increased with age, and lower in those with higher education. Therefore, it is vital for healthcare workers in primary care settings to continually provide health education about modes of transmission of HIV prevention among women with less education and those of reproductive age. Our findings also recommend further studies to identify the behavioral factors of women that may lead to higher rates of HIV infection in local areas.

Study Limitation

This study has several limitations: The study was conducted in one district hospital and its feeder community health centre, making it difficult to generalize the findings to the general population in the Limpopo province. The HIV status was self-reported by the participants, which may be subject to social desirability bias. In addition, this study was a cross-sectional descriptive survey, therefore, this limits causality measures to any of the associated factors in the study. Furthermore, the unavailability of the antenatal card might have led to an underestimation of HIV infection.

Moreover, the small sample might have prevented significant findings for variables other than those found significant. Again, the study did not collect data on the behavioural and background characteristics of the pregnant women, including the HIV status of their spouse, migration status of the pregnant women, accessibility to health care services, knowledge of pregnant women on HIV, mother-to-child transmission, and adherence to HIV treatment (antiretroviral therapy or ART) involves taking medicine as prescribed by a health care provider – this information might be helpful for future interventions.

Author Contributions

Conceptualization, Itumeleng Boshomane, Kontswi Tshabalala and Thembelihle Sam Ntuli; Data curation,

Thembelihle Sam Ntuli; Formal analysis, Thembelihle Sam Ntuli; Investigation, Itumeleng Boshomane; Methodology, Itumeleng Boshomane; Resources, Thembelihle Sam Ntuli; Software, Kontswi Tshabalala and Thembelihle Sam Ntuli; Supervision, Kontswi Tshabalala and Thembelihle Sam Ntuli; Validation, Kontswi Tshabalala, Oratilwe Mokoena and Thembelihle Sam Ntuli; Visualization, Kontswi Tshabalala; Writing – original draft, Itumeleng Boshomane and Kontswi Tshabalala; Writing & editing, Oratilwe Mokoena and Thembelihle Sam Ntuli; Review the manuscript, Itumeleng Boshomane, Kontswi Tshabalala and Thembelihle Sam Ntuli and Oratilwe Mokoena.

Data Availability Statement

Data will be available upon request.

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Conflicts of Interest

None.

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