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Prevalence and Determinants of HIV Infection among Pregnant Women in Akuapem North District, Ghana

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Abstract:

Background: Human Immunodeficiency Virus (HIV) remains a significant public health concern in sub-Saharan Africa, particularly among pregnant women due to the risk of adverse pregnancy outcomes and mother-to-child transmission (MTCT). Although Ghana has implemented prevention strategies such as Prevention of Mother-to-Child Transmission (PMTCT) programs and antiretroviral therapy (ART), localized data are needed to guide district-level interventions. This study assessed the prevalence and determinants of HIV infection among pregnant women attending antenatal care (ANC) in the Akuapem North Municipality, Ghana.

Results: A total of 912 ANC records were reviewed. The overall HIV prevalence among pregnant women was 1.97% (95% CI: 1.25–3.11). HIV infection was significantly associated with age group (p = 0.001) and place of residence (p = 0.004), with higher prevalence observed among women aged 20–24 years and those residing in rural communities. HIV prevalence showed a declining trend over the six-year period, decreasing from 3.42% in 2019 to 1.06% in 2024, reflecting improvements in HIV prevention and treatment programs. Gestational age, parity, and gravidity were not significantly associated with HIV infection.

Conclusion: HIV prevalence among pregnant women in the Akuapem North Municipality is relatively low and has declined over time, suggesting progress in PMTCT and HIV control efforts. However, young women and those in rural areas remain disproportionately affected. Strengthening targeted health education, expanding rural HIV testing services, and improving access to antenatal HIV care are essential to sustain progress toward the elimination of mother-to-child transmission of HIV in Ghana.

Keywords: *HIV, prevalence, PMTCT, pregnant women, Akuapem North, Ghana.*

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Introduction

Human Immunodeficiency Virus (HIV) continues to represent a major global public health challenge, affecting millions of people worldwide [1]. Despite significant progress in prevention, diagnosis, and treatment, HIV remains a leading cause of morbidity and mortality, particularly among high-risk groups such as pregnant women [2]. The global burden of HIV/AIDS has shifted over the last few decades, with declines in some regions and resurgences in others, such as North America and Europe. However, Sub-Saharan Africa remains the epicenter of the epidemic, accounting for nearly two-thirds of all new infections and deaths [3].

Pregnant women represent a particularly vulnerable group due to both biological susceptibility and social vulnerabilities. HIV infection in pregnancy poses serious risks to maternal health, including increased rates of anemia, opportunistic infections, and obstetric complications [4]. For infants, maternal HIV infection is associated with adverse outcomes such as preterm delivery, low birth weight, stillbirth, and most importantly, mother-to-child transmission (MTCT) of HIV [5]. Without intervention, MTCT rates can be as high as 15–45% during pregnancy, delivery, or breastfeeding [2]. With timely interventions such as antiretroviral therapy (ART), safe delivery practices, and safe infant feeding this risk can be reduced to less than 5% [1].

Sub-Saharan Africa's disproportionately high burden of HIV is driven by multiple intersecting factors, including poverty, limited access to healthcare, high levels of stigma and discrimination, gender inequality, and cultural norms that impede prevention efforts [6]. Over the past two decades, Prevention of Mother-to-Child Transmission (PMTCT) programs have become central to addressing maternal HIV. While ART has proven highly effective in reducing transmission, challenges such as poor healthcare infrastructure, inadequate testing, and low adherence to treatment continue to undermine success [7]. Achieving elimination of MTCT in Africa depends on strengthening healthcare delivery systems, integrating HIV services into antenatal care, and addressing structural inequities [8].

In Ghana, the HIV epidemic is considered moderate compared to other Sub-Saharan African countries, but it remains a significant public health concern. National prevalence among adults is estimated at 1.5%, while among pregnant women the

prevalence is slightly higher at 1.6% [9,10]. Regional variations exist, with prevalence rates among pregnant women ranging from as low as 1% in some districts to as high as 2.1% in the Upper East Region [11]. These variations underscore the importance of district-level surveillance for effective planning. Early detection and treatment through antenatal screening are essential for reducing maternal morbidity and preventing neonatal HIV infections [12].

Ghana has implemented several national initiatives aimed at controlling the epidemic. The Ghana AIDS Commission, in collaboration with global partners such as PEPFAR and UNAIDS, has expanded ART coverage, improved PMTCT services, and integrated HIV testing into antenatal care [13]. However, significant barriers remain, including inadequate rural healthcare coverage, limited availability of skilled healthcare workers, stigma and discrimination against people living with HIV, and gaps in ART adherence among pregnant women [14]. Recent studies show that although PMTCT coverage has improved, challenges with male partner involvement, counselling services, and community-level stigma continue to weaken maternal HIV prevention efforts [15].

Globally, policy frameworks such as the **UNAIDS 95-95-95 targets** aim for 95% of people living with HIV to know their status, 95% of those diagnosed to receive sustained ART, and 95% of those on treatment to achieve viral suppression by 2030 [16]. Ghana has aligned its strategies with these targets, but district-level progress varies, especially in semi-urban and rural areas like Akuapim North District. Localized evidence is therefore critical for monitoring progress toward both national and global goals, including Sustainable Development Goal 3 (SDG-3)**,** which seeks to end the AIDS epidemic by 2030 [17].

Methodology

Study Design

This study employed a retrospective study to examine the records of HIV antibody test results of all pregnant women who attended antenatal care at the Tetteh Quarshie Memorial Hospital in the Akuapim North Municipality.

Study Period

The study included all pregnant women who attended ANC services from 2019 to 2024.

Study Area

The study was conducted at the Tetteh Quarshie Memorial Hospital in the Akuapim North Municipality, located in the south eastern part of the Eastern Region, which is about 58km from Accra, the capital city of Ghana. The Akuapim North Municipality shares boundaries to the north east with Yilo Krobo, north with New Juaben Municipal, south east with Dangbe west, southwest with Akuapim South District and the west with Suhum-Kraboa Coalter District. According to the 2021 population and housing census report, the Akuapim North municipality has a population of 105,315 residents, with women of reproductive age forming a significant proportion. The Municipality has 47 healthcare facilities, including two (2) hospitals, one (1) health research centre, eight (8) health centres, thirty- three (33) community-based health planning services (CHPS), two clinics, and one (1) maternity home These facilities provide antenatal services and HIV testing services as part of routine antenatal care. [18].

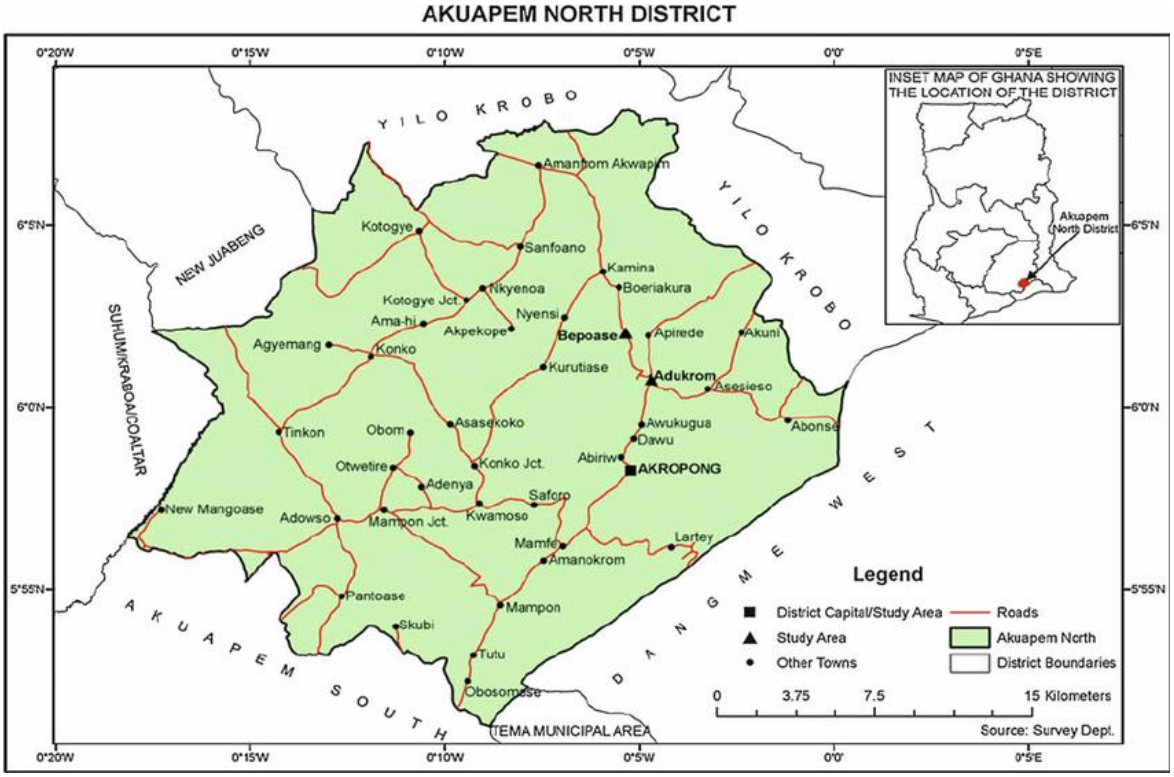

Figure 1: Map of Akuapim North [35]

Study Population

The study population was all pregnant women attended antenatal care (ANC) services at the Tetteh Quarshie Memorial in the Akuapem North municipality.

Inclusion Criteria

ANC records of pregnant women who attended antenatal care services from 2019 to 2024 and have documented HIV test results.

Exclusion Criteria

The study excluded ANC records without HIV test results and incomplete medical records or missing demographic or relevant clinical data.

Sampling Technique

A convenient sampling technique was used for this study. All available ANC records of pregnant women who attended ANC at the Tetteh Quarshie Memorial from 2019 to 2024 were consecutively reviewed. Records that met the inclusion criteria, specifically those with documented HIV results were included in the study until all eligible records within the study period were reviewed.

Ethical Consideration

Ethical approval was obtained from the Ethical and Protocol Review Committee of Baldwin University College. Permission was obtained from the management of the Tetteh Quarshie Memorial Hospital before reviewing health records. To maintain confidentiality, all data collected were anonymized, to protect the privacy and confidentiality of the pregnant women's records reviewed. All collected data was securely stored and accessed only by authorized personnel to ensure participant privacy.

Results

Socio-Demographic and Clinical Characteristics

A total of 912 pregnant women who attended antenatal clinic (ANC) services at Tetteh Quarshie Memorial Hospital (TQMH) between 2019 and 2024 were included in the study. The median age of participants was 30.0 years (IQR 24.5–33), with the majority (30.4%) belonging to the 30–34-year age group, followed by those aged 25–29 years (24.2%) and 20–24 years (20.8%) (Table 1). Only 4.2% were teenagers aged 14–19 years. This age pattern aligns with national data showing that most Ghanaian ANC attendees are within the prime reproductive age group (25–34 years) [19]. Similar findings have been reported in Accra and Kumasi, where mean maternal ages of 29–31 years were observed among ANC populations [20,21].

Most participants resided in urban areas (74.1%), with 25.9% from rural communities, reflecting the hospital's urban catchment and easier access to facility-based antenatal services. Comparable urban predominance has been documented in the Volta and Greater Accra Regions [22, 23]. The high rate of early ANC attendance is noteworthy: 41.3% initiated care in the first trimester, 32.4% in the second, and 26.3% in the third trimester. This early uptake exceeds the national average of approximately 35% for first-trimester registration [18, 24], suggesting increased awareness of the importance of prompt ANC initiation.

In terms of obstetric history, 52.4% of women were primiparous, while 42.0% were multiparous. Regarding gravidity, 25.6% were primigravidae, 32.9% multigravidae, and 41.6% had three to seven previous pregnancies. The predominance of low-parity women is consistent with reports from Sunyani Municipal and Cape Coast Teaching Hospitals, where over half of ANC clients were first- or second-time mothers [24, 25].

Table 1: Socio-demographic and clinical characteristics of pregnant women

	Median age (30.00)	**Interquartile range (25,75) (24.5, 33)**
Variables	**Frequency (n)**	**Percentage (%)**
Age category (years)		
14–19	38	4.2
20–24	190	20.8
25–29	221	24.2
30–34	277	30.4
35–39	161	17.6
40 and above	25	2.7
Residence		
Rural	236	25.9
Urban	676	74.1

Gestational Age		
First trimester	377	41.3
Second trimester	294	32.4
Third trimester	241	26.3
Parity		
Nulliparous	51	5.6
Primiparous	478	52.4
Multiparous	383	42.0
Gravidity		
Primigravida	233	25.6
Multigravida	300	32.9
Gravida 3–7	379	41.6

Prevalence of HIV infection

Of the 912 women tested, 18 were HIV-positive, representing an overall prevalence of 1.97% (95% CI: 1.25–3.11) (Table 2). The majority (98.03%) tested negative. This prevalence falls below the national ANC sentinel HIV estimate of 2.0% reported by the [26] and demonstrates a continued decline in HIV infection among pregnant women in the Eastern Region.

Comparable prevalence levels have been documented in other Ghanaian ANC studies: 2.3% at Korle-Bu Teaching Hospital [20, 21], and 1.8% at Tema General Hospital [23]. The observed decline from historically higher regional rates (4–5% in the early 2000s; GAC 2005; GHS 2010) highlights the success of national Prevention of Mother-to-Child Transmission (PMTCT) and "90–90–90" HIV control strategies, along with improvements in antiretroviral therapy (ART) coverage and public education.

Globally, the mean HIV prevalence among pregnant women in sub-Saharan Africa is approximately 3.7%, with West Africa averaging 2.4% [16]. Thus, the current prevalence of 1.97% in this study population is below both the regional and continental averages, indicating substantial progress toward elimination of mother-to-child transmission (eMTCT) targets.

The findings suggest that pregnant women attending ANC at TQMH are primarily urban, low-parity women in their late twenties to early thirties, and the HIV prevalence is low and declining. These results reflect effective public-health interventions, particularly routine ANC HIV screening, ART initiation, and early ANC registration. Continued efforts are warranted to maintain this trend, focusing on rural communities and younger women, who remain relatively vulnerable to HIV acquisition.

Table 2: Prevalence of HIV among Pregnant Women

HIV Status	Frequency (n)	Percentage (%)	Lower limit	Upper limit
Negative	894	98.03	96.89	98.75
Positive	18	1.97	1.25	3.11
Total	912	100		

Trends in HIV Prevalence among Pregnant Women (2019–2024)

Figure 2 below illustrates the yearly prevalence of HIV among pregnant women from 2019 to 2024. The data reveal a steady decline over the six-year period. HIV prevalence was highest in 2019 (3.42%), decreased markedly in 2020 (1.8%), rose slightly in 2021 (2.78%), and then declined consistently through 2022 (1.9%), 2023 (1.22%), and 2024 (1.06%).

The overall downward trajectory reflects a sustained reduction of nearly 70% in HIV prevalence among ANC attendees across the study period. This decline aligns with national data from the [26], which reported a reduction in ANC sentinel HIV prevalence from 2.7% in 2018 to approximately 2.0% in 2022, and with findings from other Ghanaian studies that attribute similar

trends to the expanded coverage of Prevention of Mother-to-Child Transmission (PMTCT) programs and universal access to antiretroviral therapy (ART) [20, 22].

The transient increase observed in 2021 (2.78%) may be related to COVID-19 pandemic disruptions, which temporarily reduced routine ANC visits and HIV testing coverage, as documented by [16] and [26]. After resumption of full ANC services and intensified PMTCT campaigns, prevalence continued to decline through 2024.

Overall, the consistent drop from 3.42% in 2019 to 1.06% in 2024 demonstrates substantial progress toward the elimination of mother-to-child transmission (eMTCT) goals and underscores the effectiveness of ongoing HIV prevention and control strategies in the Eastern Region.

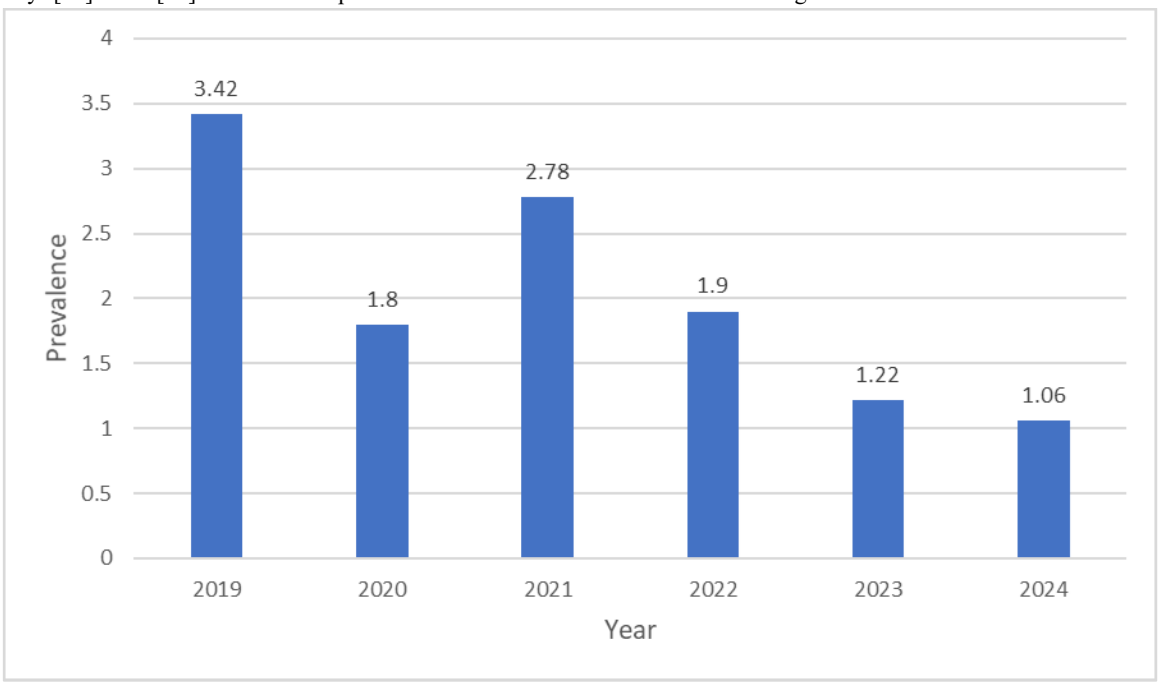

Figure 2. Yearly HIV prevalence among pregnant women attending ANC at Tetteh Quarshie Memorial Hospital, 2019–2024.

Association Between Socio-Demographic Factors and HIV Status

Table 3 presents the association between participants' background characteristics and HIV serostatus. Among all factors examined, age group and place of residence showed statistically significant relationships with HIV infection ($p = 0.001$ and $p = 0.004$, respectively).

Age

HIV infection was most common among women aged 20–24 years (38.9%) and 15–19 years (22.2%), while prevalence declined sharply with increasing age, reaching the lowest level among women aged 30–34 years (5.6%). This finding indicates that younger women were disproportionately affected, consistent with national and regional data showing heightened HIV vulnerability in adolescents and young adults. [26] and [16] both report that females aged 15–24 years account for nearly one-third of new HIV infections in Ghana. Similar age-related patterns were described [20] at Korle-Bu Teaching Hospital and [22] in Ho, where HIV prevalence was highest among women below 25 years. Possible explanations include early sexual debut, low condom use, and unequal power dynamics in relationships that limit young women's ability to negotiate safer sex [28].

Residence

A significantly higher proportion of infections occurred among rural residents (55.6%) compared with urban dwellers (44.4%) ($p = 0.004$). This rural predominance may reflect limited access to HIV education, testing, and antenatal services, as well as socio-economic disparities that influence health-seeking behavior. Earlier studies in the Volta and Northern Regions reported similar patterns, linking higher rural HIV prevalence to reduced PMTCT coverage and delayed ANC attendance [23, 21] Strengthening outreach and community-based testing programs could help narrow this urban-rural gap.

Gestational Age, Parity, and Gravidity

Although HIV positivity appeared somewhat higher in the third trimester (44.4%) than in earlier trimesters, this difference was not statistically significant ($p = 0.227$). Likewise, no meaningful associations were observed for parity ($p = 0.390$) or gravidity ($p = 0.149$). These findings align with prior Ghanaian research indicating that reproductive history alone does not significantly predict HIV status once age and residence are accounted for [25, 24].

HIV infection in this setting. These patterns emphasize the need for age-specific sexual-health education, targeted rural PMTCT interventions, and strengthened surveillance among adolescents and young women of reproductive age.

Table 3: Association between socio-demographic factors and HIV status of pregnant women

	HIV status (n)		
Variable	**Negative (%)**	**Positive (%)**	**P-value**
Age Group (Years)			
15-19	34 (3.80)	4 (22.22)	**0.001***
20–24	183 (20.47)	7 (38.89)	
25–29	218 (24.38)	3 (16.67)	
30–34	276 (30.87)	1 (5.56)	
35–39	159 (17.79)	2 (11.11)	
40 and above	25 (2.68)	1 (5.56)	
Residence			
Rural	226 (25.28)	10 (55.56)	**0.004***
Urban	668 (74.72)	8 (44.44)	
Gestational Age			
1st Trimester	372 (41.61)	5 (27.78)	0.227
2nd Trimester	289 (32.33)	5 (27.78)	
3rd Trimester	233 (26.06)	7 (44.44)	
Parity			
Nulliparous	49 (5.48)	2 (11.11)	0.390
Primiparous	469 (52.46)	9 (50.00)	
Multiparous	376 (42.19)	7 (38.89)	
Gravidity			
Primigravida	225 (25.17)	8 (44.44)	0.149
Multigravida	297 (33.22)	3 (16.67)	
Gravida 3–7	372 (41.61)	7 (38.89)	

Statistically significant associations are marked with *

DISCUSSION

This study assessed the prevalence and factors associated with HIV infection among 912 pregnant women attending antenatal care (ANC) at Tetteh Quarshie Memorial Hospital, Akuapem North Municipality, from 2019 to 2024. The overall HIV prevalence of 1.97% observed in this study is comparable to the 2.0% reported among pregnant women in Navrongo, Upper East Region of Ghana [11] (Hidaya et al., 2024). This finding indicates that the municipality falls within the national average HIV prevalence range reported for ANC populations by the [26].

However, the prevalence in this study is lower than figures reported in Uganda and Nigeria, where [29] and [30] found higher rates of 3.5% and 4.2%, respectively. The lower prevalence in the present study could be attributed to increased awareness campaigns, routine HIV testing, and counselling services integrated into ANC visits within the Akuapem North Municipality. These integrated services likely improved early detection, treatment adherence, and reduced vertical transmission risk.

In contrast, the prevalence observed here is higher than that reported by [31] in Senegal, where HIV prevalence among pregnant women was below 1%. The relatively lower rates in Senegal may reflect the early implementation of robust HIV prevention programs that targeted high-risk populations and emphasized consistent community-based testing and ART adherence.

Trend Analysis

Over the six-year period, HIV prevalence showed a steady decline, from 3.42% in 2019 to 1.06% in 2024. This downward trend aligns with findings from [32], who also reported a gradual reduction in HIV infections among pregnant women. The decline

observed in the present study may reflect the effectiveness of public health interventions, increased community sensitization, and expanded access to HIV testing and antiretroviral therapy (ART) within the municipality. Furthermore, Ghana's national PMTCT (Prevention of Mother-to-Child Transmission) programs and progress toward the UNAIDS "95–95–95" targets may have contributed to the improved outcomes seen over the study period.

Maternal Age and HIV Infection

Maternal age was found to be significantly associated with HIV status ($p = 0.001$). The highest prevalence (38.9%) was recorded among women aged 20–24 years, whereas the lowest was observed among those aged 30–34 years (5.6%) and 40 years and above (5.6%). This age disparity is consistent with findings from [33], who reported that younger women bear a disproportionate burden of HIV infection. Several factors contribute to this pattern, including biological susceptibility, limited access to reproductive health information, and socio-economic vulnerabilities that expose younger women to age-disparate or transactional sexual relationship [16]. The findings underscore the need for targeted HIV education and prevention interventions for adolescent and young adult females, particularly those in lower-income or rural communities.

Residence and HIV Prevalence

A significant association was also found between place of residence and HIV infection ($p = 0.004$). Women residing in rural areas (55.6%) had a higher likelihood of HIV infection compared to their urban counterparts (44.4%). This rural predominance mirrors observations by [34] in India and similar Ghanaian studies, which attribute higher rural HIV prevalence to limited access to HIV testing and treatment services, poverty, and restrictive socio-cultural norms. Rural communities often face challenges such as fewer health facilities, transportation barriers, and lower awareness of HIV prevention programs, which collectively contribute to their elevated risk. Expanding rural outreach and community testing services could help bridge this gap. Other Factors (Gestational Age, Parity, and Gravidity)

Although gestational age, parity, and gravidity were not significantly associated with HIV infection, higher positivity rates were observed among women in their third trimester and those with higher parity and gravidity. These trends, though not statistically significant, may indicate late ANC registration and reduced testing opportunities among multiparous women. This pattern aligns with reports by Mensah et al. (2021) and Asante & Afriyie (2020) [25] and [24], who found that late ANC attendance and high parity can modestly influence HIV screening outcomes. Continuous sensitization on early ANC registration and repeated testing throughout pregnancy remains essential for effective PMTCT implementation.

Implications

the study highlights encouraging progress in reducing HIV prevalence among pregnant women in the Akuapem North Municipality. The low prevalence and its steady decline suggest that local HIV interventions are effective, but also reveal the persistent vulnerabilities among young and rural women.

Sustained multi-sectoral collaboration, improved health education, and enhanced rural health infrastructure are recommended to maintain the downward trend and achieve HIV elimination targets.

Conclusion and Recommendations

This study revealed a low and steadily declining prevalence of HIV (1.97%) among pregnant women attending antenatal care at Tetteh Quarshie Memorial Hospital between 2019 and 2024. The consistent reduction over the six-year period reflects substantial progress in the control of maternal HIV transmission within the Akuapem North Municipality. This finding aligns with national trends reported by the [26] and [16], both indicating reductions in HIV prevalence among women of reproductive age. Maternal age and place of residence were significantly associated with HIV infection, with younger women (20–24 years) and those residing in rural areas being disproportionately affected. These patterns are consistent with previous studies in Ghana and other sub-Saharan African countries [20, 22, 33], emphasizing persistent demographic disparities that warrant targeted preventive interventions.

To sustain and accelerate the gains achieved, the study recommends strengthening HIV prevention and education initiatives among adolescents and young adult women, particularly in rural communities, where access to healthcare and testing services remains limited [34]. Continued integration of routine HIV testing and counselling into ANC services, complemented by community outreach and follow-up programs, will enhance early detection and linkage to care [25, 26]. Regular monitoring and evaluation of PMTCT strategies should also be prioritized to ensure sustained program effectiveness. Finally, collaborative efforts among the Ghana Health Service, local authorities, and non-governmental organizations are essential to achieving the UNAIDS 95–95–95 targets and ultimately eliminating mother-to-child transmission of HIV in Ghana [16, 32].

Conflict of interest

There's no conflict of interest.

Acknowledgment

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Author contributions

Aquel Rene Lopez conceptualized and designed the study and supervised data collection. Bless Hanyabui and Aquel Rene Lopez performed the data analysis and contributed to the interpretation of results. Gladys was responsible for data collection and organization. Aquel Rene Lopez and Albert Dayor Piersson prepared the first draft of the manuscript, and Albert Dayor Piersson provided critical review and substantial revisions to improve the intellectual content of the paper. All authors contributed to the interpretation of findings, reviewed the manuscript for accuracy, and approved the final version for publication.

Availability of data

Data is available upon request.

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