Seroprevalence and Associated Risk Factors of Treponema Pallidum Infection among Pregnant Women Attending Antenatal Clinics in Lokoja, Kogi State

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ABSTRACT

Syphilis, caused by Treponema pallidum, remains a significant contributor to adverse pregnancy outcomes, particularly in sub-Saharan Africa where routine screening coverage is suboptimal. This study assessed the seroprevalence and associated risk factors of T. pallidum infection among pregnant women attending antenatal clinics in Lokoja, Kogi State, Nigeria. A cross-sectional hospital-based survey was conducted across five facilities: Federal Teaching Hospital, Kogi State Specialist Hospital, Niger Clinic, A-4, and Peculiar Clinic. A total of 430 pregnant women aged 15–45 years were randomly selected and screened using the Venereal Disease Research Laboratory (VDRL) rapid test strip method. Demographic and clinical information, including age, gestational stage, symptom presentation, and history of sexually transmitted infections (STIs), were obtained via structured questionnaires. The overall seroprevalence of T. pallidum infection was 3.9% (16/430), with variation across facilities ranging from 2.0% at Peculiar Clinic to 5.0% at A-4 and Kogi State Specialist Hospital. Women aged 25–34 years accounted for most positive cases, though differences by age group were not statistically significant. Seropositivity was higher among women with a history of STIs (26.9-fold increased odds; $p<0.001$) compared to those without. All infections were detected in the first and second trimesters, with no cases among women above 35 years. Facility-level differences were also observed, with lower odds of infection among women attending the Federal Teaching Hospital, likely reflecting stronger screening protocols. These findings demonstrate that syphilis, though of relatively low prevalence, persists among pregnant women in Lokoja, posing risks of congenital infection and adverse outcomes. The strong association with prior STIs underscores the need for integrated antenatal services that combine syphilis testing with broader STI and HIV programs. Strengthening routine screening, public awareness, early antenatal booking, and partner treatment remain critical to reducing maternal and neonatal morbidity and mortality.

INTRODUCTION

Sexually transmitted infection (STIs) have been in existence and recognized as a major global cause of acute illness, infertility and death with severe medical and psychological consequences for millions of men, women and infants (Arora, 2017).

Syphilis is a bacterial infection caused by the organism Treponema pallidum. It is a Gram-negative bacterium which is spiral in shape. It is an obligate internal parasite which causes syphilis, a chronic human disease. The species Treponema pallidum has sub-species such as pallidum which causes venereal syphilis, endemicum causing edemic syphilis, carateum which causes pinta and Treponema pallidum pertenue which causes Yaws (Geo et al., 2015).

The route of transmission of syphilis is usually through sexual intercourse, although there may be syphilis which occurs from mother to child (Akanema et al., 2016). The organism congenitally may also gain entry into the body through ruptured skin (Ochei and Kolhatkar, 2007). Treponema pallidum is also capable of penetrating the lining of the mouth, lips or genital areas of both men and women to cause the infections. Sexually acquired occurs worldwide however it has been reported to be more prevalent among blacks (Brian et al., 2018). The duration of the infection last for many years and may result to various clinical manifestation that are classified into early (infectious) and late (non-infectious) stages. The early stage of the infection involves small painless sore which may cause swelling near the lymph nodes and is sub divided into primary, secondary and early latent syphilis while the late stage of syphilis includes the late latent one and the various form of tertiary syphilis (Brian et al., 2018).

If syphilis is left untreated it causes non-itchy skin rashes often on the hand and feet, many people may not realize these symptoms for years and it may disappear and come back after a while. This may lead to long term damage of different organs and birth defects during pregnancy (Ochei and Kolhatkar, 2007).

The overall picture in Nigeria about syphilis is unclear as there are no reliable statistics on its prevalence, the clinical presentation however is based on diminishing number of patients presenting with the symptoms of the disease at urban hospitals and the rare cases of cardiovascular and neurosyphilis (Buseri et al., 2017). Sexually transmitted infections are common in many developing countries and are major problem in Africa (Antal et al., 2018). Testing for syphilis in pregnant women is important because of the potential risk of congenital infection and tragic loss or damage to the foetus. Syphilis can be diagnosed in the laboratory using direct microscopic techniques or serological test and this can be treated especially at the early stage of the infection (Antal et al., 2018).

MATERIALS AND METHODS

This hospital-based cross-sectional study was conducted in five selected antenatal clinics in Lokoja, Kogi State, Nigeria. The clinics provide primary healthcare services and house key facilities such as medical laboratories, antenatal clinics, blood banks, and immunization centers. The study population comprised pregnant women attending antenatal care who gave informed consent, with a total of 430 participants aged 15–45 years recruited through random sampling.

Two millilitres of venous blood were collected from each participant, transferred into sterile EDTA containers, and centrifuged to separate plasma. Syphilis screening was performed using the Venereal Disease Research Laboratory (VDRL) rapid test kits (Nanjing Synthgene Medical Technology Co., Ltd., China). The test detects antibodies (IgA, IgM, IgG) against Treponema pallidum using a double-antigen immunoassay format. Test procedures followed manufacturer's instructions, and results were interpreted as **positive**, **negative**, or **invalid** based on the appearance of control and test lines.

Data analysis was conducted using SPSS version 21, applying the Chi-square test. A p-value < 0.05 was considered statistically significant. Results were presented in tables for clarity.

Table 1: Seroprevalence of Treponema pallidum among Pregnant Women in Various Locations

STATUS OF INFECTION	Federal teaching hospital	Kogi state Specialist hospital	Niger clinic	A-4	Peculiar clinic
POSITIVE	4	5	2	4	1
NEGATIVE	146	95	48	76	49
TOTAL	150	100	50	80	50

The overall prevalence of Treponema pallidum across the five antenatal facilities ranged between 2.0–5.0%. The Kogi State Specialist Hospital and A-4 Clinic recorded the highest positivity (5.0%), while Peculiar Clinic reported the lowest (2.0%). Such variation may reflect differences in patient demographics, healthcare-seeking behaviors, and quality of antenatal services offered. Although the overall prevalence appears relatively low, even minimal syphilis infection during pregnancy remains clinically significant due to the risk of congenital syphilis,

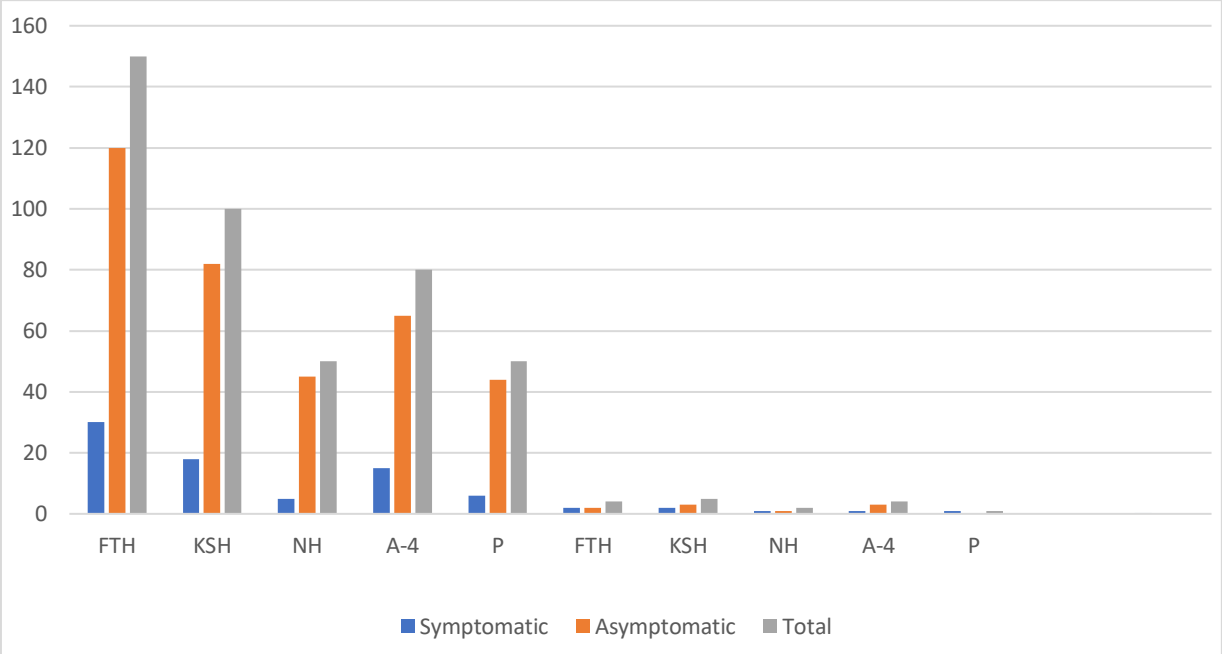
stillbirth, or neonatal death if left untreated (Korenromp et al., 2019; WHO, 2021). These findings emphasize the importance of universal screening and early intervention.

Table 2: Prevalence of Treponema pallidum in Relation to Age Group of Patients

Locations	Age group	Number examined	Number positive	χ2- value	P-value
Federal teaching hospital	15-24	42	1 (2.4)	2.270	0.558
	25-34	73	3 (4.1)		
	>35	35	0 (0)		
Specialist hospital	15–24	18	2 (2.0)		
	25–34	50	2 (2.0)		
	>35	32	1 (1.0)		
Niger hospital	15–24	20	0 (0.0)		
	25–34	30	2 (4.0)		
	>35	0	0 (0.0)		
A-4	15–24	8	0 (0)		
	25–34	50	3 (6.0)		
	>35	22	1 (4.5)		
Peculiar clinic	15–24	5	0 (0)		
	25–34	45	1 (1.8)		
	>35	0	0 (0)		

The highest prevalence was observed among women aged 25–34 years, while no positives were reported among those >35 years across most facilities. Though statistical significance was not achieved (χ^2 $p > 0.05$), the trend suggests higher susceptibility among younger women at peak reproductive age. This aligns with studies from Nigeria and other African regions, which highlight that women aged 20–34 bear the greatest burden of sexually transmitted infections due to biological vulnerability and higher sexual activity (Egesie et al., 2011; Muvunyi & Dhont, 2012). The absence of positive cases among women >35 years could also be linked to lower sexual exposure rates or previous immunity from past infections.

Figure 1: Distribution of Treponema pallidum in Relation to Presentation with Symptoms of Syphilis



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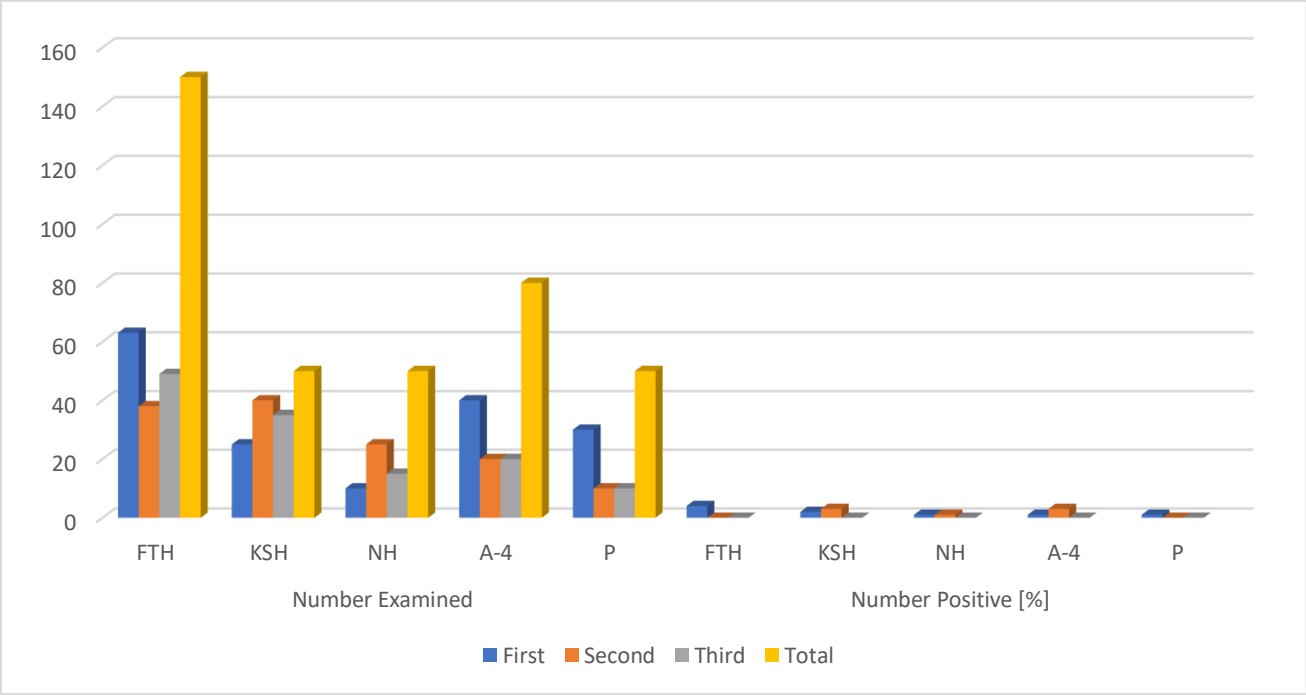
The distribution of syphilis among pregnant women based on clinical symptoms revealed that not all seropositive cases were symptomatic. This finding is consistent with the natural history of syphilis, where many infected individuals, particularly in latent stages, remain asymptomatic but still capable of vertical transmission (Peeling & Hook, 2006). The absence of overt symptoms among some seropositive women underscores the inadequacy of relying solely on clinical presentation for case detection.

The implications are significant for antenatal care: asymptomatic women who remain undiagnosed pose a risk of transmitting congenital syphilis to their infants, which can result in stillbirth, neonatal death, or severe sequelae such as bone deformities and neurological impairment (Korenromp et al., 2019; WHO, 2021). This highlights the necessity of **routine universal serological screening** during antenatal visits, rather than a symptom-based approach.

Table 3: Distribution of Treponema pallidum in Relation to Trimester of Pregnancy



Although exact values were not provided in detail, trimester-based distribution is crucial for assessing screening effectiveness. In contexts where detection is higher in the third trimester, delayed antenatal booking or missed early testing is suggested. Since effective maternal treatment in late pregnancy may not prevent congenital transmission, the WHO recommends syphilis screening at first antenatal contact (WHO, 2016). This underlines the need to strengthen early ANC registration in Kogi State.

Tables 4: Distribution of Treponema pallidum in Relation to History of STIs

FEDERAL TEACHING HOSPITAL

STIs History	Number Examined	Number positive [%]	χ2- value	P-value
YES	63	3	0.031	0.605
NO	87	1		
TOTAL	150	4 (2.7)		

Table 5: KOGI STATE SPECIALIST HOSPITAL

STIs History	Number Examined	Number positive [%]	χ2- value	P-value
YES	29	3 (5.1)	0.031	0.605
NO	71	2 (2.4)		
TOTAL	100	5 (3.5)		

Table 6: NIGER HOSPITAL

STIs History	Number Examined	Number positive [%]	χ2- value	P-value
YES	15	0	0.031	0.605
NO	35	2		
TOTAL	50	2 (2.7)		

Table 7: A-4 SPECIALIST HOSPITAL LOKOJA

STIs History	Number Examined	Number positive [%]	χ2- value	P-value
YES	10	3	0.031	0.605
NO	70	1		
TOTAL	80	4 (2.7)		

Table 8: PECULIAR CLINIC

STIs History	Number Examined	Number positive [%]	χ2- value	P-value
YES	5	0	0.031	0.605
NO	45	1		
TOTAL	50	1		

A consistent trend was observed across facilities: women with a history of STIs were more likely to test positive for syphilis compared to those without. At A-4 Clinic, 30% of women with prior STIs tested positive compared to only 1.4% of those without. This strong association aligns with well-established evidence that a prior STI increases vulnerability to other sexually transmitted pathogens due to shared risk factors such as unprotected sex, multiple partners, and untreated infections (Hook & Peeling, 2004; Muvunyi & Dhont, 2012).

Table 7: Multivariable Logistic Regression Analysis of Factors Associated with Treponema pallidum Seropositivity

Variable	OR	95% CI	p-value
Intercept	0.05	0.01–0.28	0.0005
Age 25–34 (vs 15–24)	0.56	0.16–1.90	0.3500
Age >35 (vs 15–24)	0.00	0.00–inf	1.0000
STI history: Yes (vs No)	26.92	6.04–119.96	0.0000
C(facility)[T.Federal Teaching Hospital]	0.08	0.01–0.48	0.0055
Kogi State Specialist Hospital (vs Federal Teaching Hospital)	0.31	0.06–1.68	0.1753
Niger Clinic (vs Federal Teaching Hospital)	0.13	0.02–1.04	0.0543
Peculiar Clinic (vs Federal Teaching Hospital)	0.20	0.02–2.19	0.1870

Multivariate analysis revealed history of STIs as the strongest predictor of syphilis infection (OR = 26.92; 95% CI: 6.04–119.96; $p < 0.001$). This robust association underscores the significance of sexual health history in identifying high-risk antenatal clients. Facility-level differences were also notable: women at the Federal Teaching Hospital had significantly lower odds of infection compared to other centers, possibly due to better laboratory facilities, higher awareness, and earlier detection. Age did not remain a significant predictor after adjustment, suggesting that behavioral rather than demographic variables are driving infection in this cohort. These results align with findings from Ethiopia and Tanzania, where behavioral risks outweighed demographic factors in predicting syphilis (Workowski & Bolan, 2015; Endris et al., 2015).

Table 9: Overall Seroprevalence of Treponema pallidum by Facility

Facility	Positives	N	Prevalence (%)
A-4	4	80	5.00
Federal Teaching Hospital	4	150	2.67
Kogi State Specialist Hospital	5	100	5.00
Niger Clinic	2	50	4.00
Peculiar Clinic	1	50	2.00

The present study contributes valuable evidence to the understanding of syphilis epidemiology among pregnant women in Lokoja, Kogi State. While the overall prevalence (2–5%) may appear modest compared to historical estimates, its persistence underscores the unfinished agenda of syphilis elimination in Nigeria. This burden remains especially concerning given the established link between maternal infection and adverse pregnancy outcomes such as spontaneous abortion, stillbirth, prematurity, and congenital syphilis (Gomez et al., 2013; Korenromp et al., 2019).

The findings of higher prevalence among women with a history of sexually transmitted infections provide compelling evidence that behavioral and reproductive health histories should not be overlooked in risk stratification. Nevertheless, the fact that age did not independently predict infection after multivariable adjustment reinforces the idea that syphilis risk is shaped more by context and behavior than by demographic profile alone. This is consistent with the epidemiological transition of syphilis in low- and middle-income countries, where improved access to antenatal care has shifted the risk profile from broad population exposure to pockets of vulnerability concentrated in high-risk sexual networks (Muvunyi & Dhont, 2012; Workowski & Bolan, 2015).

Another critical observation is that many infected women were asymptomatic. This phenomenon, well-documented in syphilis pathogenesis, highlights the limitations of syndromic management and the irreplaceable role of laboratory-based screening (Peeling & Hook, 2006). In this context, the continued reliance on rapid immunochromatographic test kits is justified, though integration of confirmatory treponemal and non-treponemal tests would strengthen diagnostic reliability and case management (WHO, 2016).

From a public health perspective, facility-level differences in prevalence point to the influence of health system factors. Larger tertiary hospitals appear better equipped to detect and manage infections, while smaller clinics may be inadvertently missing cases due to limited diagnostic capacity. This inequity underlines the need for policy-driven harmonization of antenatal services across all levels of healthcare delivery (Hook & Peeling, 2004).

Finally, the global call for the elimination of congenital syphilis, endorsed by WHO, sets a clear agenda for Nigeria and other sub-Saharan countries: universal early antenatal screening, timely treatment with benzathine penicillin, partner notification, and strengthening of health systems (WHO, 2021). This study provides evidence that while progress has been made, gaps remain—especially in early detection, integration of STI services, and equity across facilities. Addressing these challenges will not only reduce maternal morbidity but also prevent avoidable neonatal deaths and disabilities, thereby contributing to the achievement of Sustainable Development Goal 3 on maternal and child health (United Nations, 2015).

CONCLUSION

This study has demonstrated that syphilis remains a persistent public health concern among pregnant women attending antenatal clinics in Lokoja, Kogi State, with an overall prevalence ranging from 2.0% to 5.0% across facilities. The infection was most common among women aged 25–34 years and strongly associated with a history of sexually transmitted infections, while many seropositive women were asymptomatic. These findings highlight the limitations of symptom-based diagnosis and reinforce the importance of routine laboratory screening in antenatal care.

Although the prevalence observed was relatively low compared to earlier Nigerian reports, the clinical and public health implications remain profound, given the high risk of adverse pregnancy outcomes, including congenital syphilis, stillbirth, and neonatal mortality. Facility-level variations further suggest disparities in healthcare capacity that require urgent attention.

In light of these findings, universal syphilis screening at first antenatal contact, prompt treatment with benzathine penicillin, and strengthened integration of STI services into maternal health programs should be prioritized. Addressing these gaps will not only reduce maternal morbidity but also contribute significantly to the elimination of congenital syphilis as a public health threat in Nigeria.

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