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# Prevalence and Risk Factors Associated with Syphilis (*Treponema Pallidum*) among Blood Donors Attending Ahmad Sani Yariman Bakura Specialist Hospital, Gusau, Zamfara State

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**Abstract**
Syphilis, caused by the bacterium *Treponema pallidum*, remains a significant public health concern globally and poses a critical threat to blood safety through potential transfusion-transmitted infections (TTI). This study aimed to determine the prevalence and risk factors associated with *Treponema pallidum* among blood donors attending Yariman Bakura Specialist Hospital in Gusau, Zamfara State, Nigeria. A total of 100 blood samples were screened using the NOHTEC Syphilis test strip. The finding of this study revealed a prevalence rate of 18%. For demographic factors, there was no significant association with syphilis while for risk factors, there was no significant association between sexually active individuals, individual that use condom, those with history of blood transfusion, and previous history of syphilis except, for multiple sex partners. The findings highlight the persistent risk of syphilis transmission through blood donation, particularly among first-time donors and individuals with high-risk sexual behaviors. The study laid emphasis on the need for stringent screening protocols, targeted education on safe sexual practices, and consistent use of condom tomitigate transmission.

**Keywords**: Prevalence, Risk actors, Syphilis, Blood donors and *Treponema pallidum*

## INTRODUCTION

Blood donation is an important procedure that saves millions of lives. However, unsafe transfusion practices carry the risk of transfusion-transmissible infections (TTIs). An unsafe blood transfusion is very costly from both an economic and a human point of view, not only for the recipients themselves, but also for their families and their communities (Greinacher *et al.*, 2017). The CDC (2022) states that syphilis is a sexually transmitted illness (STI) that can cause serious health problems if left untreated. Sexual activity, including vaginal, oral, and anal intercourse, is the primary means of spreading the highly contagious disease syphilis (Schwartz, 2024).

Syphilis is a sexually transmitted disease (STD), caused by the spirochete *Treponema pallidum* subsp. *pallidum* (hereafter *Treponema pallidum*). It's a chronic infection affecting an estimated 36 million people worldwide, with 11 million new cases occurring annually (Lafond & Lukehart, 2016). Syphilis is a multistage disease punctuated by asymptomatic periods of latency. The primary and secondary stages of syphilis present with a painless chancre at the initial site of infection followed by a non-pruritic rash, respectively, both of which spontaneously resolve (Brigette *et al.*, (2019).

The risk factors for blood donors infected with syphilis are also risk factors for other blood borne diseases (Yang *et al.*, 2018). Screening for high-risk groups before blood donation currently depends entirely on pre-donation health consultation. They donate blood or need postpone, and the withdraw from blood donation depend on the report of blood donors on medical history and dangerous behavior (Manuel *et al.*, 2017). This study aimed to determine the prevalence and risk factors associated with *Treponema pallidum* among blood donors attending Yariman Bakura Specialist Hospital in Gusau, Zamfara State, Nigeria.

## MATERIALS AND METHODS

### Study Area

Gusau is a city in northwestern Nigeria. Zamfara State is located in the Northwestern Nigeria between latitudes 37° N to 12°42 N and longitudes 04° 23 E to 5° 52 E and covers a land area of 39,762 km2 (Mohammed *et al.*, 2015). The State has an estimated human population of 5,859,846 people (NPC, 2023), in which about 82% of the populace are engaged in agriculture with most farming families also owning livestock (ZASIDEP, 2017). Yariman Bakura Specialist Hospital is a multi-specialty hospital that provides a wide range of medical services to patients. The hospital is equipped with modern medical facilities and staffed by experienced healthcare professionals located in Gusau, Zamfara State. Yariman Bakura Specialist Hospital Gusau offers a comprehensive range of medical services, including general medicine, surgery, maternity and childcare, laboratory services, and imaging services. It is also one of the major referral hospital in Gusau (Aliyu & Lawal, 2020).



**Location of Gusau (Coordinates: 12°09′N 6°40′E)**

**Ethical Approval**

Ethical approval was obtained from Ahmad Sani Yariman Bakura Specialist Hospital Gusau, Zamfara State and the samples were collected in accordance with international safety rules and biosafety standards. Apparent consents of the patients and objectives of the study were also presented before the patients to keep transparency and avoiding biasness in the study.

**Sample Size Determination**

The sample size was statistically calculated using the formula by Niang *et al.,* (2013) at 0.05 level of precision based on single population proportional formula by taking 100 samples. Prevalence of *Treponema pallidum* infection from previous study was 0.7%. The formula below was used to determine the sample size of the study.

$$n = \frac{Z^2}{L^2}$$

Where;
n = sample size
Z = standard normal distribution of 95% confidence interval = 1.96
P = prevalence of 0.7 (0.07%) (Osimeh *et al*, 2019)
Q = 1-p = 1- 0.07 = 0.93
L = Allowable error = 5% or 0.05

Substituting the values in the formula therefore;
$n = 1.96^2 \times 0.07 \times 0.93 \div 0.05^2$
$n = 3.84 \times 0.0651 \div 0.0025$
$n = 0.249984 \div 0.0025$
$n = 99.99$
$n \sim 100$

However, 100 samples were collected for this research study.

**Collection of Risk and Demographic Data**

A structured questionnaire containing dichotomous questions were designed and presented to each donor at the time of sample collection. The purpose of the questionnaire was to gather information regarding personal details, demographic data and supposed risk factors such as number of spouses, number of sexual partners, and use of condom (Ali *et al.,* 2018).

**Specimen Collection and Preparation**

Five millimeters (5ml) of blood sample was aseptically collected from each donor by venipuncture into sterile anti-coagulant free blood sample tubes. The clotted blood was

centrifuged for about 10 minutes at 3000rpm to separate the serum from the plasma. The sera were stored at 2-8°C until screening for antibodies specific against *T. pallidum* (Geremew *et al.*, 2017).

**Procedure for Specimen Analysis**

Each serum sample was screened for *T. pallidum* specific antibodies at room temperature using syphilis ultra-rapid assay test kit (NOHTEC). The test strips were correspondingly labeled prior to the test. The syphilis test strips were removed from the pouch, each strip per blood sample (serum), the strip were immersed into the serum vertically for 10-15 seconds without exceeding the maximum line on the strip. Afterwards, the strip was placed on a non-absorbent surface, and the test strips were observed after 10 minutes. The result was reported as positive, negative, or invalid against the appropriate patient's identification number (Geremew *et al.*, 2017).

**Statistical Analysis**

The data obtained were analyzed using SPSS version 10.0. Descriptive statistics were presented in table. P value of ≤0.05 were considered statistically significant.

**Results**

A total of 100 blood samples from blood donors attending Yariman Bakura Specialist Hospital were screened for syphilis using NOHTEC Syphilis test strip. Eighteen (18) of the screened blood samples were positive for Syphilis while eighty-two (82) were negative resulting to a calculated prevalence of 18%.Association between demographic factors and prevalence of Syphilis infection is presented in Table 1. Participants within the age range of 30 and above had the highest infection of syphilis 55.6% (10/49), followed by 24-29 years 38.9% (7/45) and age 18-23 years with 5.5% (1/6). Based on Marital Status, single donors had the highest prevalence 61.1% (8/56), followed by married donors 38.9% (1/6), no divorced donors were tested positive for syphilis. Participants based on education level showed that, those at tertiary level had the highest prevalence (83.3%), followed by those at secondary level with 16.6% and no single donor was tested positive at primary level. For both age, marital status and education, there was no significant association between these demographic factors and syphilis.

**Table 1: Prevalence of Syphilis (*Treponema pallidium*) amongst blood donor attending Yariman Bakura Specialist Hospital in relation to Socio-Demographic Information (n=100)**

| Characteristics | No. of Tested | Positive, (%) | Negative, (%) | P-value |
|---|---|---|---|---|
| **Age Group** | | | | |
| 18-23 | 6 | 1 (5.5) | 5 (6.1) | |
| 24-29 | 45 | 7 (38.88) | 38 (46.3) | 0.9934 |
| 30 and Above | 49 | 10 (55.5) | 39 (47.6) | |
| **Marital Status** | | | | |
| Married | 56 | 7 (38.9) | 48 (58.5) | |
| Single | 38 | 11 (61.1) | 27 (32.9) | 0.5821 |
| Divorced | 6 | 0 (16.6) | 6 (7.3) | |
| **Education level** | | | | |
| Primary | 4 | 0 | 4 (4.9) | |
| Secondary | 23 | 3 (16.6) | 20 (24.4) | 0.9323 |
| Tertiary | 73 | 15 (83.3) | 58 (70.7) | |

**KEY:**
No. = Number, % = Percentage.

Association between risk factors and prevalence of Syphilis infection is presented in Table 2. Donors with multiple sex partners had the same prevalence of (50%) compared to those with single or no partner (50%). Donors with no history of blood transfusion had a highest prevalence of (88.9%). Donors who don't use condom had a highest prevalence of (72.2%) compared to those donors who uses condom (27.8%). Donors with no previous history of syphilis tested had the highest prevalence of (55.6%) while those with previous history had a prevalence of (44.4%). There was no significant association between use of condom, history of blood transfusion, and previous history of syphilis except for multiple sex partners.

**Table 2: Prevalence of Syphilis (*Treponema pallidium*) amongst blood donor attending Yariman Bakura Specialist Hospital in relation to risk factors (n=100)**

| Characteristics | No. of Tested | Positive, (%) | Negative, (%) | P-value |
|---|---|---|---|---|
| **Use of Condom** | | | | |
| Yes | 12 | 5 (27.8) | 7 (8.5) | 0.5970 |
| No | 88 | 13 (72.2) | 75 (91.5) | |
| **Multiple sex partners** | | | | |
| Yes | 25 | 9 (50) | 16 (19.5) | *0.0027 |
| No | 75 | 9 (50) | 66 (80.5) | |
| **History of blood transfusion** | | | | |
| Yes | 35 | 2 (11.1) | 33 (40.2) | 1.00 |
| No | 65 | 16 (88.9) | 49 (59.8) | |
| **Previous history of syphilis** | | | | |
| Yes | 8 | 8 (44.4) | 0 (0) | 0.3092 |
| No | 92 | 10 (55.6) | 82 (100) | |

***Statistically significant**

## Discussion

A prevalence of 18% of syphilis was recorded among blood donors attending Yariman Bakura Specialist Hospital Gusau in this study. This is higher than the finding of Okonko *et al.* (2012) who recorded 1.5% prevalence among patients attending Lead City University of Port Harcourt Teaching Hospital in Rivers State, Nigeria and the 1.7% reported in another previous study in Uyo, Nigeria Okonko *et al*. (2020). The finding of this study is similar to the findings of Sule *et al.* (2010), who reported a prevalence of 19.3% in Abuja, Nigeria. These varying prevalence rates can be attributed to variations among the study population and several factors affecting syphilis distribution, including condomless sex, environmental elements (such as dry hot climates), poor economic status, education and personal hygiene. The finding of this study showed that those within the age range of 30 above had the highest frequency of syphilis. This is consistent with reports of Okonko *et al.* (2020) that those within the range of 30 and above had a greater prevalence of syphilis. Ogiogwa *et al.* (2012) in Abeokuta, Nigeria reported the prevalence of syphilis among the age group 30-35 and 36-40 years only. According to Adewuyi-Oseni *et al.* (2019), there is a greater incidence of syphilis in the 31–40 age groups in Port Harcourt, Nigeria and that observation correlate from the present study. Singles (61.1%) had the highest prevalence regarding marital status, and this agrees with the study by Okonko *et al.* (2012) study where singles had the highest prevalence of syphilis. The findings of this current study deviated from the observations made by Okonko *et al.* (2012) in Ibadan, Nigeria and Okonko *et al.* (2020) in Uyo, Nigeria where a higher prevalence of syphilis occurred among the married group. The high prevalence of syphilis among single participant may be due to vulnerability of singles to have more than one sexual partner.

The study also showed that those with a higher education qualification had a higher syphilis seroprevalence, the findings of this study is consistent with the finding of Li *et al.*, (2019). The high prevalence among those with higher education may be due to nature of the studied

population. The study indicated that first-time blood donors were more likely to have *T. pallidum* seropositivity than those who frequently donate blood. First-time donors were thought to offer a better estimate of infectious risk than that of the general population given that, unlike those who frequently donate blood, they have not been tested previously and were less affected by selection bias Kane *et al.,* (2012). Although after consultation and preliminary screening, first-time donors also showed a higher incidence of syphilis. The existence of asymptomatic period of syphilis might account for it.

Multiple sex partners had a high prevalence of syphilis (50.0%). The result aligns with the sexual transmission route of syphilis Benzaken *et al.,* (2017). The finding of this study strongly supports established epidemiological knowledge that having multiple sexual partners is a major risk factor for acquiring syphilis and other sexually transmitted infections (STIs) (CDC, 2021; WHO, 2023). This also aligns with literature linking partner multiplicity to increased STI risk Workowski *et al.,* (2021). Among condom users, a prevalence of (27.8%) was recorded compared to (72.2%) prevalence of non-users. This contrasts with studies emphasizing condoms as effective barriers against sexually transmitted infections (STIs) (CDC, 2021).

The finding of this study showed no significant association between a history of blood transfusion and syphilis positivity. The prevalence among donors with a history of transfusion was low (11.1%) and even lower among those with no transfusion history (88.9%), suggesting that transfusion-transmitted syphilis is currently rare. This finding aligns with the study by Owusu-Ofori *et al*. (2010), which emphasized the effectiveness of modern blood donor screening procedures in significantly reducing the risk of transfusion-transmitted infections, including syphilis. Their research in Ghana showed that syphilis seroprevalence among transfused patients remained low due to improved serological testing and donor selection protocols.

The finding of this study found that all donors who reported a previous history of syphilis (8/8) with a prevalence of (44.4%) tested positive again. This is consistent with findings from Ghanem *et al*. (2016), who reported persistent seropositivity and reinfection among previously treated individuals, especially in high-risk populations. It raises concerns about incomplete treatment, reinfection due to untreated partners, or failure to modify risky sexual behavior post-treatment.

## Conclusion

The findings of this study indicated a prevalence of 18%. For demographic factors, there was no significant association with syphilis while for risk factors, there was no significant association between sexually active individuals, individual using condom, those with history of blood transfusion, and previous history of syphilis except for multiple sex partners.

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