Original Research Article

Detection of *Treponema pallidum* (Syphilis) Antibodies among HIV-Infected Individuals and Sexually-active attendees of Two Health Facilities in Port Harcourt, Nigeria

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ABSTRACT

Aim: This study reports on the detection of *Treponema pallidum* (syphilis) antibodies in HIV infected patients in Port Harcourt, Nigeria. Screening for syphilis was carried out to determine the prevalence levels of these infections, as biological markers of risk, modes, and time functions of their transmission.
Study design: Cross-sectional study.
Place and Duration of Study: University of Port Harcourt Teaching Hospital (UPTH) and O.B. Lulu Briggs Medical Centre, University of Port Harcourt, both in Port Harcourt, Nigeria, between August 2012 and July 2015.
Methods: A total of 100 HIV-infected individuals and 100 sexually-active attendees were recruited for this study. Samples of blood were collected and re-screened for the presence of HIV antibodies using the Determine HIV-1/2 (Alere), HIV ½ Stat-Pak (Chembio), and HIV-1/2/P24/O ELISA kit (Dia.Pro). The same set of samples were screened for *Treponema pallidum* specific antibodies using the syphilis Ultra Rapid Test Strip (ACON(R), USA) and syphilis rapid strips (Global, USA) following the respective manufacturer's instructions.
Results: Among the 200 samples, serological reactivity was detected for syphilis in 3(1.5%). The incidence of syphilis was higher in males (2.0%) than in females (1.0%). Age, sex, and locality did not significantly (P>0.05) influence the rate of syphilis.
Conclusion: This study further confirms the presence of syphilis among the population studied. Routine screening of Syphilis among patients is therefore advocated.

***Keywords*:** HIV, HBV, TB, Candida albicans, Prevalence, Nigeria

1. INTRODUCTION

Sexually transmitted diseases STDs remain a public health problem of major significance in most of the world (Department of Health, 2000; Sellama *et al.,* 2003). The incident of acute STDs is high in many countries, although the precise magnitude of the problem is not clear (Golden *et al*., 2003). Some prevalent sexually transmitted illnesses include bacterial vaginosis, herpes, Chlamydia, trichomoniasis, gonorrhoea, HIV and syphilis (WHO, 2001; Usanga et al., 2010; Azuonwu and Timothy, 2020). More than 25 infectious pathogens are mainly transferred through sexual activity, and studies have shown that STDs are among the many associated variables that influence the reproductive health continuum (Okonko et al., 2012). Documented evidence indicates that STDs can be transmitted from a pregnant mother to the baby before, during or after the baby's birth and that some STDs (like syphilis) can cross the placenta and infect the baby in utero (WHO, 2006).

Syphilis is a sexually transmitted infection (STI) caused by *Treponema pallidum* subspecies *Pallidum*, a spirochaete bacterium well-known for its invasiveness and immune-evasiveness (Peeling et al., 2017; de Souza et al., 2020). Syphilis is transmitted from person to person mainly by sexual intercourse or through vertical transmission during pregnancy (de Souza et al., 2020). It is one of the STDs that are prevalent in developing countries and is of public health importance (Azuonwu and Timothy, 2020). Syphilis is listed as a "Rare Disease" by the office of rare diseases (ORD) of the National Institutes of Health (NIH). This means that syphilis, or a subtype of syphilis, affects less than 200,000 people in the US population (Right Diagnosis, 2015). Worldwide, the incidence and prevalence of syphilis differ due to region, ethnic factors, gender and socio-economic factors (WHO, 2001, 2006; Scherbaum et al., 2005; Okonko et al., 2012; Usanga et al., 2010; CDC, 2017; Azuonwu and Timothy, 2020).

Studies have however shown than developing and underdeveloped countries usually record higher prevalence compared with that of developed countries (Opone et al., 2020; Azuonwu and Timothy, 2020). Sexually-active persons such as female sex workers (FSWs) are exposed especially to syphilis infection. Among pregnant women, it is reported to cause foetal defects if not treated (Azuonwu and Timothy, 2020), and besides all the efforts to control the spread of STIs, syphilis prevalence is still rising, mainly occurring in low-income countries (de Souza et al., 2020). This study aimed to detect the presence of *treponema pallidum* specific antibodies in sera of blood donors and sexually active patients in Port Harcourt, Nigeria.

2. MATERIAL AND METHODS

2.1. Study area

This study was carried out using HIV positive patients attending University of Port Harcourt Teaching Hospital (UPTH) located at Alakahia and sexually active attendees of O.B. Lulu Briggs Medical Centre of the University of Port Harcourt located at Choba, both along East-West road, Obi-Akpo Local Government Area of Rivers State, Port Harcourt, Nigeria. Port Harcourt lies along the Bonny River in the Niger Delta region of Nigeria with its Coordinates: 4°53'23"N 6°54'18"E and covers an area of 360 km^2. Port Harcourt metropolis consists of Obio/Akpor Local Government Area and Port Harcourt Local Government Area (Ogbonna *et al*., 2007), which comprise of largely Ikwere ethnic with several other ethnic groups from all around Nigeria. According to census 2006 Port Harcourt city local government area and Obio/Akpor local government area population of 1,382,592 and 878,890 respectively (NPC, 2006) and a landmass of 360 km^2 and 260 km^2 respectively.

2.2. Study design

This is a cross-sectional study involving a cohort of 100 HIV positive patients attending University of Port Harcourt Teaching Hospital (UPTH) and sexually active attendees of O.B. Lulu Briggs Medical Centre of the University of Port Harcourt, both in Port Harcourt, Nigeria. The method for this study consists of informed consent, blood withdrawal by venipuncture. Screening for suspected syphilis, clinical evaluation and recording of demographic information's such as the age of the participants; marital status occupation, address etc.

2.3. Determination of sample size for the study

The sample size for this study was determined using the established formula (MacFarlane, 1997; Niang *et al*., 2006): $N= [Z^2 (PQ)]/d^2$. Where N is the desired sample size. **Z** = standard normal deviation at a 95% confidence interval (which was 1.96). **p** = proportion of target population (prevalence estimated at 6.0%, reported for Rivers State as at HIV Sentinel Survey of 2010); this implies 6.0/100 = 0.06. **q** = alternate proportion (1-p), which was calculated as: 1 – 0.06 = 0.94. **d** = desired level of precision (degree of precision/significance). This was taken as 0.05. Then, the desired sample size (N) = 87. Hence, the estimated sample size was 87 individuals with an additional 10.0% sample (which is 8.7) to take care of study participants that may be lost to follow-up (Macfarlane, 1997; Niang *et al.*, 2006), providing a total sample size of 96 approximated to 100 from each of hospital.

2.3. Study population

A total number of 200 participants comprising 100 HIV positive patients attending University of Port Harcourt Teaching Hospital (UPTH) and 100 sexually-active attendees of O.B. Lulu Briggs Medical Centre of the University of Port Harcourt, both in Port Harcourt, Nigeria. Blood samples were collected from the 200 participants of different ages, sex and socioeconomic status, who attended the STI clinic of UPTH, with one or more of the complaints as enunciated by WHO in its Syndromic approach for the diagnosis of STI (WHO, 1991) were included as subjects. The demographic details relevant to the study were obtained.

2.4. Ethical Considerations

Ethical considerations and approval for the study was sorted from the Hospital Research Ethics committee of University of Port Harcourt Teaching Hospital (UPTH) and the University of Port Harcourt Research Ethics Committee following the ethics for research involving human subjects. This study was carried out in line with the World Medical Association (WMA) Declaration of Helsinki on the principles for medical research involving human subjects, animal subjects and identifiable human/animal material/data.

2.5. Inclusion and exclusion criteria

All HIV-infected patients and sexually-active hospital attendees were eligible for the study. HIV-infected patients and sexually-active hospital attendees who had full documentation in the registration book were included, whereas HIV-infected patients and sexually-active hospital attendees who had incomplete data like age, sex and duplicate records were excluded from the study. Those on any form of antibiotics were also excluded from the study.

2.6. Specimen Selection, Collection, and preparation

The method of sample collection employed was venipuncture technique (Cheesbrough, 2006). About 3 ml of venipuncture blood was collected in EDTA BA Vacutainer TM anti-coagulant tubes (BD, Franklin Lakes, USA). Plasma specimens were separated by centrifugation at 300 rpm (revolution per minute) for 5 min. The plasma was stored at -20°C and used for the laboratory analyses. Specimens were brought to room temperature before testing. The frozen specimen was completely thawed and mixed well before testing. Specimens were not frozen and thawed repeatedly.

2.7. Serological analysis

Blood samples of HIV positive individuals were collected by venipuncture method and re-screened for HIV antibodies using the Determine HIV-1/2, HIV ½ Stat Pak and ELISA Kit. Plasma was tested at the Virus Research Unit, Department of Microbiology, University of Port Harcourt, for the presence of antibodies to HIV following the respective manufacturer's instructions. HIV testing was done according to the national algorithm recommended by the Federal Ministry of Health of Nigeria. Rapid HIV tests: HIV (1 + 2) rapid test strips (Determine, Alere Co, LTD, Japan) as the screening test; and Stat-Pak (Chembio Diagnostic Systems, Inc., New York, NY, USA) as a confirmatory test for positive samples. These HIV testing methods were immuno-chromatographic assays. All samples with non-reactive results to HIV kits were considered negative. A commercially available HIV-1/2/P24/O ELISA kit (ELISA; Dia.Pro, Milano, Italy), was used as a tie-breaker. Positive and negative standard sera, accompanying the kit were included in each assay. Laboratory testing was carried out according to the manufacturers' instructions, and all tests were run using quality controls according to standard operating procedures.

2.8. Serological Analysis for *Treponema pallidum* (Syphilis)

Each sample serum was screened for *Treponema pallidum* specific antibodies at room temperature using two syphilis Ultra-rapid test strips (by ACON(R) Laboratories Incorporated USA) and another (by Global Device, USA). The test strip was labelled correspondingly to the serum. The Syphilis Ultra-rapid test strip is a rapid chromatographic immunoassay for the qualitative detection of antibodies (IgG and IgM) to *Treponema pallidum* (TP) in whole blood, serum or plasma to aid in the diagnosis of Syphilis. The syphilis test strip was removed from the pouch. Each strip per blood sample, the strip was immersed into the plasma vertically for at least ten to fifteen seconds, afterwards, the strip was placed on a mono-absorbent surface, and the test strip was observed for red colour appearance indicating the presence of *Treponema pallidum* specific antibody in the serum. The result was read immediately after ten minutes. If the specimen contains *Treponema pallidum* antibodies, a red line will appear in the test line region, indicating a positive result. If the specimen does not contain *Treponema pallidum* antibodies, a red line will not appear in this region, indicating a negative result. To serve as a procedural control, a pink line appeared in the control line region indicating that proper volume of specimen has been added and membrane wicking has occurred. The result was reported as positive, negative, and invalid against the appropriate patient's identification number.

2.9. Data Analysis

The seroprevalence was calculated. Chi-square test was used to establish relationships between demographic factors and prevalence using Microsoft Excel spreadsheet (Microsoft Corporation). Significance level was set at $P \leq 0.05$.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Participants characteristics

A total of two hundred subjects (one hundred from UPTH and one hundred from Lulu Briggs patients) were tested for syphilis. The age range of the subjects used in this study was 16 to 64 years (average age = 32.4 years). The male to female ratio was 1:1 (Table 1).

Table 1: Age and Sex distribution of Syphilis among the study participants

Variables	No. Tested (%)	No. Positive (%)
Locations		
UPTH	100 (50.0)	2 (2.0)
Lulu Briggs	100 (50.0)	1 (1.0)
Study Group		
HIV-infected individuals	100 (50.0)	2 (2.0)
Sexually-actives hospital attendees	100 (50.0)	1 (1.0)
Age group (years)		
16-39	152 (76.0)	2 (1.3)
40 & above	48 (24.0)	1 (2.1)
Sex		
Males	100 (50.0)	2 (2.0)
Females	100 (50.0)	1 (1.0)
Total	**200 (100.0)**	**3 (1.5)**

3.1.2. Overall Prevalence of Syphilis among subjects

Of the 200 subjects screened in this study, 3(1.5%) had antibodies to syphilis, 2.0% among HIV-infected subjects and 1.0% among sexually-actives hospital attendees (Table 1).

3.1.3. Syphilis status of the subjects concerning the location of study

Two (2.0%) of the subjects from UPTH showed positivity for syphilis infection while one (1.0%) among the Lulu Briggs subjects, showed syphilis positivity (Table 1).

3.1.4. Prevalence of syphilis of subjects concerning sex

Table 1 shows the prevalence of HIV and syphilis co-infection status of subjects used in this study concerning sex. Of the three subjects who tested positive to Syphilis antibodies, one was a female (33.3%) and the other 2 (66.7%) were males. Sex-specific prevalence revealed a higher prevalence of Syphilis antibodies in males (2.0%) than their female counterparts (1.0%).

3.1.5. Syphilis status among subjects concerning their age

Of the 3 subjects who tested positive to Syphilis antibodies, 2 (66.7%) subjects were in the age group 16-39 years and 1(33.3%) were in the age group 40 years and above. Age-specific prevalence revealed a higher prevalence of Syphilis antibodies in the age group 40 years and above (2.1%) compared age group 16-39 years (1.3%). The age-specific difference in syphilis positive status was not significant ($p>0.05$) among the subjects (Table 1).

3.1.6. Prevalence of Syphilis in HIV-infected individuals

Of the 100 HIV-infected subjects screened in this study, 2(2.0%) had antibodies to Syphilis (Table 2). Higher prevalence of Syphilis antibodies was observed in the age group 40 years and above (3.1%) than in the age group 16-39 years (1.5%). Also, a higher prevalence of Syphilis antibodies was observed in females (2.6%) than in males (1.6%). Table 2 showed the age- and sex-specific prevalence of Syphilis in HIV-infected individuals.

Table 2: Age- and Sex-Specific Prevalence of Syphilis in HIV-infected individuals

Variables	No. Tested	No. Positive (%)
Age group (years)		
16-39	68	1 (1.5)
40 & above	32	1 (3.1)
Sex		
Males	62	1 (1.6)
Females	38	1 (2.6)
Total	**100**	**2 (2.0)**

3.1.7. Prevalence of Syphilis in Sexually-Active Hospital Attendees

Of the 100 sexually-active hospital attendees screened in this study, 1(1.0%) had antibodies to Syphilis (Table 3). Prevalence of Syphilis antibodies was observed only in the age group 16-39 years and in male sexually-active hospital attendees (2.6%). Table 3 showed the age- and sex-specific prevalence of Syphilis in sexually-active hospital attendees.

Table 3: Age- and Sex-Specific Prevalence of Syphilis in Sexually-Active Hospital Attendees

Variables	No. Tested (%)	No. Positive (%)
Age group (years)		
16-39	84	1 (1.2)
40 & above	16	0 (0.0)
Sex		
Males	38	1 (2.6)
Females	62	0 (0.0)
Total	**100**	**1 (1.0)**

3.2. Discussion

Syphilis is still a public health problem worldwide and low-income countries have endemic rates of syphilis among their general populations while middle- or high-income countries have concentrated epidemics of syphilis in specific populations (Kojima et al., 2018; de Souza et al., 2020). The World Health Organization (WHO) estimates that around 6 million new cases of syphilis occur every year among adults aged between 15 and 49 years (Newman et al., 2015; de Souza et al., 2020). Thus, this study was undertaken to detect the presence of syphilis among HIV-infected and sexually-active attendees of two health facilities in Port Harcourt, Nigeria.

Using VDRL test reactive strips in this study, the overall prevalence of syphilis was found to be 1.5% while HIV-infected subjects had 2.0% and sexually-active hospital attendees had 1.0%. VDRL test reactive strip found significant *Treponema* antibodies in 3 of the 200 subjects in this study. Absence of significant *Treponema* antibodies in other samples test with VDRL strips may suggest a non-Syphilitic reagin antibody production or cross-reaction with endemic *Treponema* infection such as yaws, (*Treponema pertenue*), pinta (*Treponema carateum*) or Bejel (*Treponema endemicum*) (Noris, 2003).

Syphilis and HIV have the same mode of transmission and the same risk factors (Mutagoma et al., 2016). Higher prevalence of syphilis reported among HIV-infected subjects (2.0%) than the non-HIV infected subjects (1.0%) in this study is comparable to what has been previously documented. Mutagoma et al. (2016) documented in their study in Rwanda that HIV-infected people were 6 times higher (4.8%) than in HIV-negative study participants (0.8%). Prevalence of syphilis in HIV-positive in Kigali (11.7%) was substantially higher than other provinces and on multivariate analysis.

The 1.5% overall prevalence reported in this study is lower than the 2.63% reported in the urban areas of Akwa Ibom State, Nigeria (Opone et al., 2020), 3.0% recorded in Abakaliki, Nigeria (FMoH, 2001), 3.6% reported in Maiduguri (Chikwem et al., 1997), 5.0% and 10.0% reported in Yenagoa and Osogbo, respectively (Ojo and Oyetunji, 2007; Buseri et al., 2010), 6.0% reported in Ibadan, Nigeria (Donbraye et al., 2010), 12.4% reported in Ilorin, Nigeria (Nwabuisi et al., 2005), the 7.5% seroprevalence reported in Ghana (Adjei et al., 2003) and the 3.3% reported in Germany (Scherbaum et al., 2005).

The prevalence of syphilis among HIV-infected people is a public health concern, but there is limited literature to describe the true burden of syphilis in resource-limited settings (Mutagoma et al., 2016). However, the 2.0% reported among HIV-infected infected individuals is comparable to the 2.0% prevalence of syphilis found in India (Chad et al., 2015), 2.28% reported previously in Rivers State, Nigeria (Azuonwu and Timothy, 2020), the 2.2% and 1.98% reported in similar studies Uyo, Nigeria in 2014 and 2019, respectively (Onwezube et al., 2011; Opone et al., 2020) and the 2.0% reported in Rwanda in 2011 (Rwanda Ministry of Health, 2011). It is lower than the 2.5% prevalence of syphilis reported in Rwanda in 2007 (Rwanda Ministry of Health, 2011). Also, the 2.0% reported among the HIV-infected subjects is higher than the 0.9% reported among HIV patients in a similar study in Rwanda (Mutagoma et al., 2016), and 1.8% of prevalence of syphilis found, respectively, in Kenya (Otieno-Nyunya et al., 2011) and Uganda (MOH and ICF, 2012).

Similarly, the 1.0% reported among the sexually-active hospital attendees are comparable to the 1.1% reported in Osogbo, Nigeria (Buseri et al., 2009) and the 0.9% reported in Rwanda (Mutagoma et al., 2016). It is lower than the 1.5% and 1.7% recorded in Benin and Ilorin, respectively (Ibadin et al., 2009; Olokoba et al., 2009), 1.42% reported in the rural area of Akwa Ibom State, Nigeria (Opone et al., 2020) but is higher than the 0.1% reported by Ejele *et al.* (2005) in Port Harcourt, Nigeria, 0.4%, recorded in Yola (Aboyeji and Nwabuisi, 2003) and 0.13% reported in Ibadan, Nigeria (Adesina and Oladokun, 2010).

High prevalence of syphilis has also been reported among different study populations in other countries of the world. Prevalence of syphilis among female sex workers (FSWs) has been reported in low-income countries, such as the Dominican Republic (5.1–11.1%), Honduras (1.3–6.0%), Guatemala (1.1–11.8%), El Salvador (2.7–15.0%) and Peru (2.2–4.1%) (Zoni et al., 2013; de Souza et al., 2020). In African countries, the prevalence of syphilis has been reported to be 2.0% in Cotonou, 4.0% in Kisumu (Kenya), 6.0% in Yaounde (Cameroon) and 14.0% in Ndola (Zambia) women (Azuonwu and Timothy, 2020). In a study by Rahlenbeck et al. (1997) in Ethiopia, 12.8% prevalence was reported. A similar prevalence rate (12.7%) of syphilis antibodies was reported in Tanzania (Matee et al., 2006). A study in Brazil reported an overall prevalence of syphilis to be 14.1% (de Souza et al., 2020). Another study in Brazil showed an increase from 2.4% in 2009 to 8.5% in 2016 on the prevalence of syphilis (Szwarcwald et al., 2018). As well as other studies in Brazil (Schuelter-Trevisol et al., 2013), revealed an even higher prevalence among FSWs (19.7%). In Mozambique, the prevalence of high prevalence rate of 18.3% was reported in antenatal care attendees, 5.0% seroprevalence was reported in pregnant women in Malawi (Hira et al., 1982; Kwiek et al., 2008). In India, the seroprevalence of syphilis was reported to be 1.8%

which shows a value closely related to our study (Kosambiya et al., 2009). In Botswana, the seroprevalence of 4.3% was reported (Creek et al., 2005) and 2.5% seroprevalence was cited by other researchers in Burkina Faso in pregnant women (Assefa, 2014).

Also, the finding of our study is not comparable to what was reported in the USA among drug abusers in treatment facilities (Gourevitch et al., 1996; Muga et al., 1997; Hwang et al., 2000), and among injecting drug users (IDU) in Bangladesh (23.0%) (Azim et al., 2002). This demonstrates that besides all health public policies and access to information available, the prevalence of syphilis is rising. The reason(s) for the relatively lower rate of seroprevalence, compared with the higher prevalence rates reported in other previous studies, cannot be discerned in this study. However, it is conceivable that some individuals may have a higher than normal risk of contracting syphilis (Buseri et al., 2009).

Further analysis of the results revealed that none of the variables-sex, age, and locality-significantly influence the rate of syphilis positivity among the population under study. This deviates from what has been previously reported by some authors (Hussian *et al*., 2006). Location-specific prevalence revealed higher prevalence in subjects from UPTH (2.0%) compared to those from O.B. Lulu Briggs (1.0%). But this prevalence was not significantly different. This is consistent with some previous studies. Mutagoma et al. (2016) also reported that the prevalence of syphilis in an urban location in their study was not significantly different the rural locations. In Zambia, the prevalence of syphilis was the same, 4.2%, in rural and in urban (CSO/MOH, 2009). In Kenya, the observation was quite the same even when stratified by men and women (Otieno-Nyunya et al., 2011). However, Mutagoma et al. (2016) reported the prevalence of syphilis in HIV-positive in Kigali (11.7%) was substantially higher than other provinces in their study. Hence, signifying locational differences.

Syphilis is more prevalent among sexually-active persons (Azuonwu and Timothy, 2020). This is contrary to what was obtained in this study both generally and specifically among HIV-infected subjects. Our study revealed that the prevalence of syphilis was increasing with age from 1.3% in young people (age 16-39 years) to 2.1% in older people (age 40 years and above). Age-specific prevalence among HIV-infected persons revealed a higher prevalence of syphilis in the age group 40 years and above (3.1%) compared age group 16-39 years (1.5%). This is also comparable to previous findings from similar studies. Mutagoma et al. (2016) also reported that the prevalence of syphilis was increasing with age from 0.6% in young people to 1.1% in older people. Otieno-Nyunya et al. (2011) who reported something similar in Kenya where the prevalence of syphilis varied from 0.9% in young women to 2.5% in older women and from 0.4% in young men to 4.4% in older men. Our finding is also similar to what was reported in Uganda, where the prevalence of syphilis increased from 1.2% in youth to 3.7% in older women and 4.8% in older men (MOH and ICF, 2012).

However, the prevalence of syphilis among sexually-active persons were observed only in the age group 16-39 years. This is comparable to the findings by de Souza et al. (2020) who reported that the majority of FSWs who tested positive to syphilis in Brazil were between 15 and 25 years of age. And Azuonwu and Timothy (2020) who reported that syphilis is more prevalent among sexually-active persons aged 19-29 years. This also deviated from the findings of Mutagoma et al. (2016) who reported that prevalence of syphilis is higher in those aged 25–49 years (1.1%) compared to those aged 15–24 years (0.6%).

Generally, sex-specific prevalence revealed that more males (2.0%) had syphilis than their female counterparts (1.0%). Besides, the prevalence of syphilis among sexually-active persons were observed only in males (2.6%). This is contrary to the findings by Scherbaum et al. (2005) in Germany who reported that female patients were 4.56 times more likely to

have positive syphilis than males. While among the HIV-infected subjects, higher prevalence of syphilis was observed in females (2.6%) than in males (1.6%). This is collaborated the findings by Scherbaum et al. (2005) in Germany and Mutagoma et al. (2016) who reported higher syphilis prevalence among women (1.0%) than among men (0.8%) in Rwanda. However, the values reported for males and females in this study is not consistent with the 3.5% among females and 3.9% among males in a population-based survey in the African region (WHO, 2012).

This disparity in the prevalence of syphilis reported in several studies as this may be attributed to factors such as the difference in the number of persons visiting the health facilities, testing used and well as time or period of sampling (Azuonwu and Timothy, 2020). The differences in sexual behaviours and practices of persons in the study areas may have contributed to the different prevalence rate reported (Azuonwu and Timothy, 2020). Also, access to STIs diagnosis and treatment, duration and size of studies, educational background, geographical differences and cultural and traditional practices may have contributed to this discrepancy (Azuonwu and Timothy, 2020). It is also possible that improvements in technology might have made current screening reagents more specific and reliable. Finally, there could be true geographical differences in prevalence (Scherbaum et al., 2005; Buseri et al., 2009).

4. CONCLUSION

The present study has confirmed the prevalence of syphilis among HIV-infected persons and sexually-active attendees of two health facilities in Port Harcourt, Nigeria. Screening the high-risk population for Syphilis would aid early detection of the infection and hence early treatment, which if initiated, would help to decrease the further spread of these blood-borne infections. There is a need, therefore, to support an approach of targeted screening of all these viral infections, integrating viral hepatitis testing, counselling and referral services into the existing STD prevention and treatment services.

CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this study. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the Hospital Research Ethics Committee of University of Port Harcourt Teaching Hospital (UPTH) And University Research Ethics committee of University of Port Harcourt, Nigeria and have, therefore, been performed following the ethical standards laid down in the 1964 Declaration of Helsinki.

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