Detection of *Treponema pallidum* (Syphilis) Antibodies, HIV, HBV, and HCV co-infections among attendees of Two Health Facilities in Ibadan, Southwestern Nigeria

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Abstract: This study reports on the detection of *Treponema pallidum* (Syphilis) antibodies, HIV, HBV, and HCV co-infections among attendees of two health facilities in Ibadan, Southwestern Nigeria. The objective of the study was to assess the risk of co-infections with human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and syphilis among patients attending the two health care facilities in Ibadan. Screening for HIV, HBV, HCV, and syphilis was carried out in order to determine the prevalence levels of these infections, as biological markers of risk, modes, and time functions of their transmission. This study was carried out using a total of 417 attendees of two health facilities in Ibadan, Nigeria. A serological screening was carried out during the period of August—October, 2011 to assess the risk of infection with syphilis and co-infection with HIV-1/2, HBV, and HCV among these attendees. Unlinked and coded serum samples received from 417 subjects (260 females and 157 males) was screened by laboratory tests commonly used for laboratory diagnosis of HIV, HBV, HCV, and syphilis. Among the 417 samples serological reactivity was detected for HIV-1/2 in 27(6.5%), HBV in 15(3.6%), HCV in 4(1.0%), and syphilis in none (0.0%). The incidence of HIV-1/2, HBV and HCV was higher among males than females, i.e. 18/157 (11.5%) versus 28/260 (10.8%). None was found to have co-infection with HIV-HBV, HBV—HCV, HIV—syphilis, HIV—HCV, HBV—syphilis, and HCV—syphilis. Age, sex, marital status, history of vaccinations, and locality significantly influence the rate of HIV, HBV and HCV positivity. In conclusion, a substantial percentage of attendees of these two health care facilities in Ibadan, Nigeria harbored HIV and viral hepatitis infections, which otherwise would remain undiagnosed without serological screening.

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1. INTRODUCTION

Treponema pallidum is a Gram-negative bacterium which is spiral in shape. It is an obligate internal parasite which causes syphilis, a chronic human disease. Syphilis is a sexually transmitted disease (STD) caused by the bacterium *Treponema pallidum*. It has often been called "the great imitator" because so many of the signs and symptoms are indistinguishable from those of other diseases (Holmes et al., 1999; CDC, 2006, 2007). Syphilis is a sexually transmitted disease but transmission can also occur between mother and child in utero; this is called congenital syphilis. Syphilis was first discovered in Europe near the end of the fifteenth century. The virulent strain of *T. pallidum* was first isolated 1912 from a neurosyphilitic patient by Hideyo Noguchi, a Japanese bacteriologist. Although for the past decades treatment has been available, syphilis remains a health problem throughout the world (LaFond and Lukehart, 2006). The WHO (world health organization) "estimates that 12 million new cases of syphilis occur each year (Gerbase et al., 1998)." This is a major problem in developing countries where prenatal testing and antibiotics are not available. In such cases syphilis can be passed from mother to unborn child. In a recent study, congenital syphilis was reported as the cause of 50% of all stillbirths in Tanzania (Watson-Jones et al., 2002). Another major complication of syphilis is its ability to increase the likelihood of transmission of HIV (Greenblatt et al.,1988).

T. pallidum is an important organism because of its ability to cause disease in humans and in efforts to better understand it, its genome was sequenced in July of 1998. *T. pallidum* cannot be cultured in the lab and therefore cannot be investigated using conventional lab techniques. By sequencing its genome, scientists are able to better understand *T. pallidum*, however many things remain a mystery, most notably what exactly is the virulence factor of this bacteria (Fraser et al., 1998). Among the blood-borne viruses transmissible through the

parenteral route, by blood transfusion, as well as by sexual intercourse, human immunodeficiency viruses (HIV-1/2), hepatitis B virus (HBV) and hepatitis C virus (HCV) are important and have several implications (Hussain et al., 2006). Not only do they establish asymptomatic persistent infections with occasional sequelae, but they also cause significant morbidity and mortality when transmitted through transfusion of blood and blood products (De Paola and Carpenter, 2002). Chronic infections with HIV, HBV, and HCV are major public health problems (Hussain et al., 2006). Many risk behaviors as well as the routes of transmission for HBV and HCV infections are identical to those for HIV and other sexually transmitted diseases (STDs) (Hussain et al., 2006). Early diagnosis and effective treatment of STDs, especially those that cause ulcers and blood-borne infections, are an important strategy for the prevention of HIV transmission (Hussain et al., 2006).

Globally, the HIV sentinel surveillance system has been recognized as an optimal mechanism to monitor trends of HIV infection in specific high-risk groups as well as low-risk groups (Hussain et al., 2006). In Nigeria, high-risk populations include patients attending STD clinics, men who have sex with men (MSM) clinics, and drug addiction centers, while mothers attending antenatal clinics are regarded as a proxy for the general population. This study was carried out to assess the risk of coinfections with HIV, HBV, HCV, and syphilis among attendees of two health facilities in Ibadan, Nigeria. Screening for HIV, HBV, HCV, and syphilis was carried out in order to determine the prevalence levels of these infections, as biological markers of risk, modes, and time functions of their transmission.

2. MATERIALS AND METHODS

2.1. STUDY AREA

The study area is the Oni Memorial Children Hospital, located at the municipal area of Ibadan, which is made up of five local government areas and the Association for Reproductive Health (AFRH) Centre, both located at the municipal area of Ibadan, which is made up of five local government areas. Ibadan is the capital city of Oyo State located in the forest zone of southwestern Nigeria. Ibadan city lies on the longitude 3°5' East of Greenwich meridian and latitude 7°23' North of the Equator. Besides being the largest indigenous city in Africa south of Sahara, the city is an important trade and educational centre. It also houses one of the largest and foremost teaching hospitals in Africa. However, the city is characterized by low level of environmental sanitation, poor housing, and lack of potable water and improper management of wastes especially in the indigenous core areas characterized by high density and low income populations.

2.2. STUDY POPULATION

Blood samples were collected from two hundred and seventeen children at Oni Memorial Children Hospital, Ibadan, South-Western, Nigeria and two hundred (200) patients of different ages and socioeconomic status, who attended the STI clinic of Association for Reproductive Health (AFRH) Centre in Ibadan, with one or more of the complaints as enunciated by WHO in its syndromic approach for the diagnosis of STI (WHO, 1991; Choudhry et al., 2010) were included as subjects.

2.3. DEMOGRAPHIC INFORMATION

Demographical data were recorded from all the patients. Other relevant information of all participants was obtained using a Performa specially designed for this purpose. All participants were screened for syphilis, HIV, HBV and HCV by standard microbiological methods (Collee et al., 1989; Cheesbrough, 2006; Choudhry et al., 2010). Table 1 shows demographic profiles of the sexually active attendees of Association for Reproductive Health (AFRH) Centre, Ibadan, Southwestern Nigeria and the characteristics of Nigerian Children used in this study.

2.4. SAMPLE COLLECTION

The method of sample collection employed was venepuncture technique (Cheesbrough, 2006). Soft tubing tourniquet was fastened to the upper arm of the patient to enable the index finger feel a suitable vein. The puncture site was then cleansed with methylated spirit (methanol) and venepuncture made with the aid of a 21 g needle attached to a 5 ml syringe. When sufficient blood had been collected, the tourniquet was released and the needle removed immediately while the blood was transferred into an EDTA bottle. This was centrifuged and the plasma was then pipetted into sterile ependorf tubes and stored at -20^{0}C until ready for use.

2.5. ASSAY FOR TREPONEMA PALLIDUM SPECIFIC ANTIBODIES

Each serum sample was screened for *T. pallidum* specific antibodies at room temperature using The Syphilis Ultra Rapid Test Strip (Whole Blood/Serum/ Plasma) [ACON(R) Laboratories Incorporated USA Lot No: SYP 70800H5 and Global Device, USA]. The test strip was labeled correspondingly to the sample. The Syphilis Ultra Rapid Test Strip (Whole Blood/Serum/ Plasma) 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 Ultra Rapid Test Strip (Whole Blood/Serum/Plasma) has a relative sensitivity of 99.7% and relative specificity of 99.6%.

Table 1: Demographic profiles of the subjects used in this study

General population under study			
Profiles	No. Tested (%)	No. AFRH (%)	No. ONI (%)
Age Group (years)			
Less than 17	216(51.8)	0(0.0)	216(100.0)
17 and above	201(48.2)	200(99.5)	1(0.5)
Sex			
Males	157(37.6)	49(31.2)	108(68.8)
Females	260(62.4)	151(58.1)	109(41.9)
Marital status			
Married	141(33.8)	141(100.5)	0(0.0)
Single	276(66.2)	59(21.4)	217(78.6)
History of vaccination			
Yes	176(42.2)	0(0.0)	176(100.0)
No	241(57.8)	200(82.9)	41(17.0)
Total	417(100.0)	200(48.0)	217(52.0)
Sexually active adults at AFRH Centre, Ibadan			
Age Group (years)	No. Tested (%)	No. males (%)	No. females (%)
16-29	98(49.0)	18(18.4)	80(81.6)
30 and above	102(51.0)	31(30.4)	71(69.6)
Sex			
Males	49(24.5)	49(100.0)	0(0.0)
Females	151(75.5)	0(0.0)	151(100.0)
Marital status			
Married	141(70.5)	15(10.6)	126(89.4)
Single	59(29.5)	34(57.6)	25(42.4)
Total	200(100.0)	49(24.5)	151(75.5)
Children at Oni Memorial Children Hospital, Ibadan			
Age Group (years)	No. Tested (%)	No. males (%)	No. females (%)
Less than 1	29(13.4)	15(51.7)	14(48.3)
>1 – 17	188(88.6)	93(49.5)	95(50.5)
Sex			
Males	108(49.8)	108(100.0)	0(0.0)
Females	109(50.2)	0(0.0)	109(100.0)
History of vaccination			
Yes	176(81.1)	87(49.4)	89(50.6)
No	41(18.9)	21(51.2)	20(48.8)
Total	217(100.0)	108(49.8)	109(50.2)

2.6. SEROLOGICAL TESTS FOR HIV, HBsAg and HCV

Samples were screened for the presence of HIV, HCV, and Hepatitis B surface Antigen (HBsAg). HIV antibody assay was carried out using Determine HIV 1/2 rapid test strips (Abbott laboratories-USA) and HIV 1/2 Stat-Pak assay (Chembio diagnostics – USA) methods according to the standard national HIV screening algorithm in Nigeria (WHO, 2005; FMoH, 2005). These tests are qualitative membrane-based immuno assay techniques. Hepatitis B surface antigen test was done using Hepatitis B surface antigen test strips (IND^R Diagnostica, USA and Global Diagnostics, USA). Hepatitis C antibody was tested using HCV-Ab test strips (IND^R Diagnostica, USA and Global Diagnostics, USA).

2.7. DATA ANALYSIS

The data generated in this study were analyzed at 5% level of significance by Chi-square statistical test using SPSS 13.0 for windows. Data was presented using descriptive statistics for syphilis, HIV, HCV and HBsAg.

3. RESULTS ANALYSIS

A total of 417 patients were tested for HBsAg and antibodies to syphilis, HIV, and HCV. The age range of the subjects used in this study was 3 days to 64 years. Majority of the subjects were females [260(52.0%)] while 48.0% (n = 157) were males. The female:male ratio was 2:1 (Table 1, 2, 3 and 4). The results of 417 samples collected from two health care centers in Ibadan, which were screened for syphilis and other co-infections (HIV, HCV and HBV) are shown in Table 2-4.

3.1. Syphilis Status with other co-infections among subjects used in this study

Tables 2-4 shows that of the 417 patients, 27(6.5%) were HIV positive, 15(3.5%) were positive for hepatitis B virus by rapid assays, 4(1.0%) were positive for antibodies to the hepatitis C virus by rapid assays, none (0.0%) had antibodies to syphilis (reactive for syphilis by the simple RPR card test) and none (0.0%) was positive for HIV- HBV, HIV-HCV, HBV-HCV or HIV-HBV-HCV co-infections by rapid assays (Tables 2-4).

3.2. Prevalence of HIV, HBV, HCV, and syphilis co-infections status of subjects used in this study in relation to sex

Table 2 shows prevalence of HIV, HBV, HCV, and syphilis co-infections status of patients used in this study in relation to sex. Of the 417 patients, 9(5.7%) males and 18(6.9%) females were infected with HIV, 3(1.9%) males and 1(0.4%) female were infected with HCV and 6(3.8%) males and 9(3.5%) females were infected with HBV. Generally, more males [18(11.5%)] than females [28(10.8%)] had viral STIs. The difference in HBV, HCV and HIV positive status was not significant ($p>0.05$) between male and female subjects.

Table 2: HIV, HBV, HCV, and syphilis co-infections status of subjects used in this study in relation to sex

Subjects		No. Tested (%) n= 417	Males (%) n= 157	Females (%) n= 260
HIV Status	Reactive	27(6.5)	9(5.7)	18(6.9)
	Non-reactive	390(93.5)	148(94.3)	242(93.1)
HCV Status	Reactive	4(1.0)	3(1.9)	1(0.4)
	Non-reactive	413(99.0)	154(98.1)	259(99.6)
HBV Status	Reactive	15(3.6)	6(3.8)	9(3.5)
	Non-reactive	402(96.4)	151(96.2)	251(96.5)
Syphilis Status	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	157(100.0)	260(100.0)
HIV-HBV	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	157(100.0)	260(100.0)
HIV-HCV	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	157(100.0)	260(100.0)
HIV-Syphilis	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	157(100.0)	260(100.0)
HIV-HBV-HCV-Syphilis	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	157(100.0)	260(100.0)
HBV-HCV	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	157(100.0)	260(100.0)
Total for HIV, HBV, HCV		46(11.0)	18(11.5)	28(10.8)

3.3. HBV, HIV, and HCV Status among subjects used in this study in relation to their demographic profiles

Table 3 shows the socio-demographic characteristics, HBV, HIV and HCV status among subjects under study. Of 417 patients, 27 (6.5%) were HIV positive, 4(1.0%) were positive for HCV and 15(3.6%) were positive for HBV. This suggests that HBV and HIV affect a large percentage of clinic patients. Of the 417 patients, 14(6.9%) subjects in the less than 17 years age group and 1(0.5%) in the 17 years and above age group were HBV positive. The difference in HBV status was significant ($p<0.05$) between ages of subjects. Their marital status showed that 7(5.0%) married subjects and 8(2.9%) singles were infected with HBV. However, the difference in HBV positive status was significant ($p<0.05$) between the singles and married status of the subjects under study. Prevalence according to their history of vaccination showed that 1(0.6%) of the subjects with history of vaccination and 14(5.8%) of those without such history were infected with HBV. However, the difference in HBV positive status was significant ($p<0.05$) between the subjects with history of vaccination and those subjects without history of vaccination (Table 3).

Also among the 417 patients, 11(5.5%) subjects in the 17 years and above age group and 9(4.2%) in the less than 17 years age group were HIV positive. The difference in HIV positive status was significant ($p<0.05$) between ages of subjects. Their marital status showed that 7(5.0%) married subjects and 20(7.2%) singles were infected with HIV. However, the difference in HIV positive status was significant ($p<0.05$) between the singles and married status of the subjects under study. Prevalence according to their history of vaccination showed that 6(3.4%) of the subjects with history of vaccination and 21(8.7%) of those without such history were infected with HIV. However, the difference in HIV positive status was significant ($p<0.05$) between the

subjects with history of vaccination and those subjects without history of vaccination (Table 3).

Also among the 417 patients, 1(0.5%) subjects in the 17 years and above age group and 4(1.9%) in the less than 17 years age group were HCV positive. The difference in HCV positive status was significant ($p<0.05$) between ages of subjects. Their marital status showed that 4(1.4%) singles were infected with HCV and none (0.0%) of the married subjects were infected with HCV. However, the difference in HCV positive status was significant ($p<0.05$) between the singles and married status of the subjects under study. Prevalence according to their history of vaccination showed that 2(1.1%) of the subjects with history of vaccination and 2(0.8%) of those without such history were infected with HCV. However, the difference in HCV positive status was significant ($p<0.05$) between the subjects with history of vaccination and those subjects without history of vaccination (Table 3). However, their educational status, occupations and clinical history was not defined. The results revealed that none of the variables— sex, age, marital status, history of vaccination and locality — were found to significantly influence HBV and HIV positivity (Table 3).

Table 3: HBV, HIV and HCV Status among subjects used in this study in relation to their demographic profiles

Profiles		No. Tested (%) (n=417)		Males (%) (n=157)		Females (%) (n=260)	
HBV Status		**No**	**HBsAg Positive**	**No**	**HBsAg Positive**	**No**	**HBsAg Positive**
Age group	>17 years	216(51.8)	1(0.5)	108(50.0)	0(0.0)	108(50.0)	1(0.9)
	17 yrs & above	201(48.2)	14(6.9)	49(24.4)	5(10.2)	152(75.6)	9(5.9)
Sex	Males	157(37.6)	5(3.2)	157(100.0)	5(3.2)	0(0.0)	0(0.0)
	Females	260(62.4)	9(3.5)	0(0.0)	0(0.0)	260(62.4)	9(3.5)
Marital status	Married	141(33.8)	7(5.0)	15(9.6)	1(6.7)	126(48.5)	1(0.8)
	Single	276(66.2)	8(2.9)	142(90.4)	4(2.8)	134(51.5)	9(6.7)
Location	AFRH	200(48.0)	14(3.4)	49(31.2)	5(3.2)	151(58.1)	9(6.0)
	ONI	217(52.0)	1(0.2)	108(68.8)	0(0.0)	109(41.9)	1(1.0)
Vaccination	Yes	176(42.2)	1(0.6)	87(55.4)	0(0.0)	89(34.2)	1(1.1)
	No	241(57.8)	14(5.8)	70(44.6)	5(7.1)	171(65.8)	9(5.3)
Total		417(100.0)	15(3.6)	157(37.6)	5(3.2)	260 (62.4)	10(3.8)
HIV Status		**No Tested**	**HIV Positive**	**No Tested**	**HIV Positive**	**No Tested**	**HIV Positive**
Age group	>17 years	216(51.8)	9(4.2)	108(50.0)	4(3.7)	108(50.0)	5(4.6)
	17 yrs & above	201(48.2)	11(5.5)	49(24.4)	5(10.2)	152(75.6)	13(8.6)
Sex	Males	157(37.6)	9(5.7)	157(100.0)	9(5.7)	0(0.0)	0(0.0)
	Females	260(62.4)	18(6.9)	0(0.0)	0(0.0)	260(62.4)	18(6.9)
Marital status	Married	141(33.8)	7(5.0)	15(9.6)	2(6.7)	126(48.5)	5(4.0)
	Single	276(66.2)	20(7.2)	142(90.4)	7(4.9)	134(51.5)	13(9.7)
Location	AFRH	200(48.0)	18(9.0)	49(31.2)	5(10.2)	151(58.1)	13(8.6)
	ONI	217(52.0)	9(4.1)	108(68.8)	4(3.7)	109(41.9)	5(4.6)
Vaccination	Yes	176(42.2)	6(3.4)	87(55.4)	3(3.4)	89(34.2)	3(3.4)
	No	241(57.8)	21(8.7)	70(44.6)	7(10.0)	171(65.8)	15(8.8)
Total		417(100.0)	27(6.5)	157(37.6)	9(5.7)	260 (62.4)	18(6.9)
HCV Status		**No Tested**	**HCV positive**	**No Tested**	**HCV positive**	**No Tested**	**HCV positive**
Age group	>17 years	216(51.8)	4(1.9)	108(50.0)	3(2.8)	108(50.0)	1(0.9)
	17 yrs & above	201(48.2)	1(0.5)	49(24.4)	1(2.0)	152(75.6)	0(0.0)
Sex	Males	157(37.6)	3(1.9)	157(100.0)	3(1.9)	0(0.0)	0(0.0)
	Females	260(62.4)	1(0.4)	0(0.0)	0(0.0)	260(62.4)	1(0.4)
Marital status	Married	141(33.8)	0(0.0)	15(9.6)	0(0.0)	126(48.5)	0(0.0)
	Single	276(66.2)	4(1.4)	142(90.4)	4(2.8)	134(51.5)	4(2.9)
Location	AFRH	200(48.0)	0(0.0)	49(31.2)	0(0.0)	151(58.1)	0(0.0)
	ONI	217(52.0)	4(1.8)	108(68.8)	4(3.7)	109(41.9)	4(3.7)
Vaccination	Yes	176(42.2)	2(1.1)	87(55.4)	1(1.1)	89(34.2)	1(1.1)
	No	241(57.8)	2(0.8)	70(44.6)	2(2.9)	171(65.8)	1(0.6)
Total		417(100.0)	4(6.5)	157(37.6)	3(1.9)	260 (62.4)	1(0.4)

3.4. Prevalence of HIV, HBV, and HCV co-infections status of the subjects in relation to location of study

Table 4 shows the HIV, HBV, HCV, HIV/HBV and syphilis status of the subjects in relation to location of study. HIV positivity was 9.0% among the patients from AFRH, 3.4% for HBV, and 0.0% for HCV. No positivity for syphilis infection was reported for patients in AFRH, Ibadan. Among the ONI subjects, HIV positivity was 4.1%, HBV was 0.2%, and HCV was 1.8%. No positivity for syphilis infection was found among patients from ONI. However, no co-infections of HIV-HBV, HIV-HCV, HBV-HCV, or HIV-HBV-HCV positivity were

reported among the subjects from the two locations. These calls for serious concern as children were considered to be the low-risk group. The results revealed that location of study significantly influence HBV, HCV and HIV positivity.

Table 4: HIV, HBV, HCV, and syphilis co-infections status of the subjects in relation to location of study

Subjects		No. Tested (%) n= 417	ONI (%) n= 217	AFRH (%) n= 200
HIV Status	Reactive	27(6.5)	9(4.1)	18(9.0)
	Non-reactive	390(93.5)	208(95.8)	182(91.0)
HCV Status	Reactive	4(1.0)	4(1.8)	0(0.0)
	Non-reactive	413(99.0)	213(98.2)	200(100.0)
HBV Status	Reactive	15(3.6)	1(0.5)	14(7.0)
	Non-reactive	402(96.4)	216(99.5)	186(93.0)
Syphilis Status	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	217(100.0)	200(100.0)
HIV-HBV	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	217(100.0)	200(100.0)
HIV-HCV	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	217(100.0)	200(100.0)
HIV-Syphilis	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	217(100.0)	200(100.0)
HIV-HBV-HCV-Syphilis	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	217(100.0)	200(100.0)
HBV-HCV	Reactive	0(0.0)	0(0.0)	0(0.0)
	Non-reactive	417(100.0)	217(100.0)	200(100.0)
Total for HIV, HBV, HCV		46(11.0)	14(6.5)	32(16.0)

4. Discussion

Sexually transmitted infections (STIs) are major health problems in developing countries where access to adequate diagnostic and treatment facilities are very limited. Human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV), the three most common chronic viral infections all over the world, share similar transmission routes including sexual, blood-blood contact, and injecting drug usage (Saravanan et al., 2007; Koziel and Peters, 2007). Co-infection with HIV and HCV and/or HBV is very common in certain population, such as intravenous drug users (IDUs) who often share the contaminated needles/syringes for intravenous drug injection. It has been reported that the prevalence of HIV-HCV co-infection among IDUs can surpass 90% (Maier and Wu, 2002; Aceijas and Rhodes, 2007). Besides, the rates of HIV-HBV co-infection are reported as high as 10–20% in countries with intermediate and high HBV endemic (Thio, 2009). An increasing number of studies have suggested HIV can accelerate the natural course of chronic hepatitis C or hepatitis B. Previous studies have indicated that patients with chronic viral hepatitis co-infected with HIV will experience more rapid progression and are more likely to die of liver-related diseases compared with those without HIV infection. Inversely, the effect of HCV and/or HBV on HIV infection is less clear (Sulkowski, 2008; Thio, 2009; Rotman and Liang, 2009). Co-infection with HIV and hepatitis viruses has significantly increased morbidity and mortality of the HIV/AIDS patients (Sulkowski, 2008; Thio, 2009; Rotman and Liang, 2009). Therefore, it is critical to investigate the prevalence of co-infection with HIV and HCV and/or HBV, especially among those considered to be a high-risk population of co-infection.

In this study, the overall prevalence rate was 6.5% for HIV, 3.6% for HBV, 1.0% for HCV, 0.0% for syphilis and 0.0% for HIV-HBV, HIV-HCV, HBV-HCV and HIV-HBV-HCV co-infections. This study showed a high prevalence rate for HIV among the subjects under study. It is higher than the <4.1% reported for Oyo State in the last national sentinel survey for HIV/STI. Nigeria's epidemic is characterized as one of the most rapidly increasing rates of HIV and AIDS. The prevalence rate of 6.5% recorded for HIV in this study deviates from that of the Federal Ministry of Health (2005) Sentinel Study on HIV in Nigeria. Elsewhere, higher seroprevalence rate among different populations have been reported, for instance, 14.7% in Iquita-Oron in Akwa Ibom State; 13.0% in Makurdi (Benue State) and 10.0% in Saminka (Kaduna State) (FMoH, 2005).

Sexually transmitted diseases (STDs) remain a public health problem of major significance in most parts of the world (Department of Health, 2000; Levine, 2003; Sellami et al., 2003). The incidence of acute STDs is high in many countries; although the precise magnitude of the problem is still not clear (WHO/ SEARO, 2000; Banta, 2003; Golden et al., 2003). Failure to diagnose and treat STDs at an early stage results in serious complications and sequelae, including infertility, fetal wastage, ectopic pregnancy, cancer, and death (Department of Health, 2000). The explanation for the increase in STDs is multifactorial,

heterosexual promiscuity being one of them (Erbelding et al., 2003). VDRL test reactive strip samples found no significant treponemal antibodies in any of them, absence of significant treponemal antibodies in these samples tested with VDRL strips may suggest a non syphilitic reagin antibody production or cross reactions with endemic treponemal infections such as yaws, (*T. pertenue*), pinta (*T. carateum*) or bejel (*T. endemicum*) (Noris, 2003).

Analysis of the results revealed that of the variables—sex, age, marital status, history of vaccination and locality — significantly influenced the rate of HIV, HBV and HCV positivity among the populations under study. This deviate from what has been previously reported by some authors (Hussain et al., 2006). More males [18(11.5%)] than females [28(10.8%)] had viral STIs. but this could be due to the larger number of females, 260 as compared to 157 males screened during the study. With regards to HIV, more females [18(6.9%)] were affected by HIV than males [9(5.7%)]. This agrees with what was reported by Hussain et al. (2006). More males, i.e., 3(1.9%) had HCV than females, 1(0.4%) but this could be due to the larger number of females, 260 as compared to 157 males screened during the surveillance. With regard to HBV, males 6(3.8%) were only affected than females, 9(3.5%) in this study.

There were no co-infections of HIV-HBV, HIV—HCV, HBV—HCV, HIV—syphilis, and HIV-HBV-HCV-syphilis infections. This agrees favourably with what was reported by Hussain et al. (2006). Although the percentage of patients with co-infections is zero, the combination of viral infections such as HIV and HBV or HBV and HCV is a dangerous co-existence (Thio et al., 2002; Mosunjac et al., 2003; Ramia et al., 2003) and may have a detrimental effect on the patient and the treatment outcome. Moreover, it has been indicated that the co-infection of HIV-infected patients with hepatitis viruses especially HCV or/and HBV is very common, although the co-infection ratios vary depending on the geographic regions, risk groups, and the type of exposure involved (Zhang et al., 2002; Wang et al., 2006; Saravanan et al., 2007; Bao and Liu, 2009).

The results reveal that patients from AFRH, 32(16.0%) in Ibadan harbor blood-borne viral infections like HIV, HBV, and HCV, which would otherwise remain undiagnosed in the absence of screening. Further, they are unaware of the underlying co-infection because this was an unlinked anonymous testing of coded samples (Hussain et al., 2006). Many studies showing the varying rates of HCV, HIV and HBV infections among different populations have been reported by several authors in Nigeria, India and abroad. Kaur and Marshalla screened 233 serum samples for HIV, HBV, HCV, and syphilis and found that 21.0% were positive for syphilis, 3.0% for HBsAg and HIV-1 and 0.8% for HCV, and no correlation was observed in the transmission of two or more pathogens (Kaur and Marshalla, 1998). Garg et al. (2001) evaluated blood donors for HIV, HBV, HCV, and syphilis and the incidence of HIV was 0.44%, HBV was 3.44%, HCV was 0.29%, and VDRL was 0.22% (Garg et al., 2001).

Nanu et al. (1997) screened blood donors and reported that HBsAg rates remained below 2.5%, HIV 0.55%, syphilis 0.52%, and HCV 1.49% among donors, and those with multiple infections were uncommon. Patel (2004) screened blood donors in Mumbai over a 6-year period, from 1994 to 1999, and found that 0.78% had antibodies to HCV, 0.26% had antibodies to HIV, and 1.7% had antibodies to HBsAg. Gupta et al. (2004) screened blood units in Ludhiana, during the period 2001—2003 and reported 0.08% had antibodies to anti-HBc, 1.09% were HCV positive, and 0.85% had antibodies to syphilis. Ruan et al. (2004) reported 71.0% of intravenous drug abusers (IDAs) in China had antibodies to HCV and 11.3% had antibodies to HIV. HCV—HIV co-infection among IDAs was 11.3% in a study by Ruan et al. (2004). Taketa et al. (2003) screened 98 IDAs, 100 commercial sex workers (CSWs) and 50 males with STDs in Thailand and reported that HCV is transmitted primarily by blood contact, HIV primarily by blood contact and secondarily by sexual contact, but HBV by both blood and sexual contact (Taketa et al., 2003). Galvin and Cohen (2004) reported that one in every 1000 episodes of sexual intercourse leads to HIV infection thereby suggesting slow efficiency of HIV spread.

Gordin et al. (1990) screened 616 patients in the USA and found that 23(3.7%) were HIV positive and 2.0% (12/612) were positive for HBsAg. Segurado et al. (2004) screened HIV-infected individuals in Brazil and reported that exposure to blood and sexual partnership with IDUs constitutes the main risk factors for HCV acquisition among HIV-positive patients. Choy et al. (2003) screened for HCV infection in STD-infected patients in New Jersey, USA and reported that inner-city obstetric patients are at high risk for HCV infection when compared with the general population. Increasing age and HIV, HBV and HCV positive status are the risk factors that are significantly associated with acquisition of infection. In clinics, integrating risk-based screening into routine clinic services is an efficient way to identify HIV-infected persons (Bednarsh and Eklund, 2002; Gunn et al., 2003; Parker, 2003). The increased risk of HBV, HCV, and HIV infection among STD patients warrants specific preventive action (De Zoysa et al., 1996; Hightow et al., 2003; Tao et al., 2003). HIV,

HCV, and HBV may promote each other and be related to different cultures and living habits though this does not appear to be the case in our study population (Pinkerton et al., 2003).

5. Conclusion

A substantial percentage of the attendees of these two health facilities in Ibadan, Oyo State, Southwestern Nigeria harbor HIV and viral hepatitis infections, which otherwise would remain undiagnosed without serological screening. The results indicate relatively declined prevalence of multiple STIs in Ibadan, and call for the need to strengthen the exiting health education program and screening of all population especially pregnant women and children for HIV, HBV, HCV infections and syphilis to prevent transmission of the infections in women, their children and the population at large. HBV and HCV infection is more serious in HIV-infected persons. It leads to liver damage more quickly. Co-infection with HBV or HCV may also affect the treatment of HIV infection. Therefore, it is important for HIV-infected persons to know whether they are also infected with HCV and, if they are not, to take steps to prevent infection. The implication of HCV and/or HBV co-infection in apparently healthy HIV positive patients is of utmost importance as they mostly lie within the reproductive age group of 21-40 years. The knowledge of the co-infection in such cases is vital due to the increased risk of the sexual and perinatal transmission of the hepatitis virus along with increased hepatotoxicity with antiretroviral therapy and rapid progression to cirrhosis and hepatocellular carcinoma. Screening the high-risk population for these viral infections would aid early detection of co-infections 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, counseling and referral services into the existing STD prevention and treatment services.

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