

Genital ulcer diseases among HIV-infected female commercial sex workers in Ibadan, Nigeria

SA Fayemiwo¹, GN Odaibo², AA Oni¹, AA Ajayi¹,
RA Bakare¹ and DO Olalaye²

Departments of Medical Microbiology and Parasitology¹ and Virology²,
College of Medicine, University of Ibadan,
University College Hospital, Ibadan, Nigeria

Summary

We evaluated the prevalence and association of Genital Ulcer Diseases (GUDs) among HIV-1 infected female commercial sex workers (FCSWs) in Ibadan, Nigeria. A total of 250 FCSWs from brothels in Ibadan were tested for presence of antibodies to HIV and Syphilis. Pelvic examinations for signs of sexually transmitted infections (STIs) were carried out on the subjects. Endocervical and high vaginal swabs were collected from each of the subjects to establish laboratory diagnosis of STIs. Their age ranged from 15 to 55 years (Mean = 25.8yrs; SD = 3.74). Majority (246/250) were Nigerians, while 1.6% were from neighboring West African countries. Sixty four (25.6%) of the subjects were positive for HIV-1 while seven (2.8%) had dual HIV-1/2 infection. Analysis of the STIs showed that 49 (19.6%) of the CSWs had GUDs. Herpes genitalis was the commonest GUDs as it occurred in 25 (10%) of the subjects. Other STIs identified were chancroid (5.6%), syphilis (4.0%) and lymphogranuloma venereum (LGV) (4%). Sixteen (64.0%) of the CSWs with herpes genitalis had HIV-1 infection. The risk ratio of herpes genitalis for HIV acquisition was 3.0 (95% CI: 2.0 – 4.4). Syphilis and chancroid were also found to be significantly associated with increased risk of HIV infection ($p < 0.0001$). The adjusted odd ratios for Herpes genitalis, chancroid, and syphilis were 3.7 (1-13.0, $p < 0.05$), 19.8 (2.7-13.0, $p < 0.05$) and 19.1 (1-231.0, $p < 0.05$) respectively. There is need to educate FCSWs continually to adopt safer sexual behaviours, seek early diagnosis and treatment of GUDs to reduce their risk of transmitting HIV infection.

Keywords: Genital, ulcers, female, sex, workers

Résumé

Nous avons évalué la prévalence et l'association des maladies d'ulcère génitale (MUG) parmi les femmes prostituées à Ibadan, Nigeria. Un total de 250 femmes

prostituées de motels à Ibadan étaient testées à cause de la présence des anticorps au VIH et à la syphilis, l'examen du pelvis pour des signes d'infections sexuellement transmises (IST) était faite sur les sujets. Les sécrétions vaginales et endocervicales étaient collectées de chaque sujet et soumis à des diagnostics de IST. Leurs tranche d'âge variait entre 15 et 55 ans (Moyenne = 25.8ans; SD = 3.74). La majorité (246/250) étaient Nigériennes, alors que 1.6% était originaire des pays Ouest Africain voisins. Soixante quatre (25.6%) des sujets était positif au VIH-1 alors que (2.8%) avait une infection combine de VIH-1 / 2. Les analyses des IST ont montrées que 49 (19.6%) des prostituées avait des maladies d'ulcère Génitale. L'Herpès génitale était le plus commun des MUG vue qu'il était présent chez 25 (10%) des sujets. Les autres IST identifiées étaient le chancre mou (5.6%), la syphilis (4.0%) et le lymphogranulome venerum (LGV) (4%). Seize (64%) de ces femmes ayant l'herpès Génital était infectées du VIH-1. La proportion de risque de l'herpès génitale pour l'acquisition du VIH était 3.0 (95% CI: 2.0 – 4.4). La Syphilis et le chancre mou étaient aussi détectés comme étant significativement associé à l'augmentation des risques d'infection du VIH ($P < 0.0001$). Des proportions ajustées pour l'herpès génitale, le chancre mou, et la syphilis étaient 3.7 (1-13.0, $P < 0.05$), 19.8 (2.7-13.0, $P < 0.05$) et 19.1 (1-231.0, $P < 0.05$) respectivement. Il est nécessaire d'éduquer continuellement les prostituées à adopter des comportements sexuel sain, à faire des diagnostics et des traitements des MUG tôt afin de réduire leurs risque de transmission de l'infection du VIH.

Introduction

Genital ulcer is a common problem both in the developed and developing countries with the annual global incidence exceeding 20 millions cases [1]. In Sub-Saharan Africa and the Caribbean, the most important epidemiological patterns of human immunodeficiency virus (HIV-1) transmission is characterized by heterosexual transmission with a nearly equal male-to-female ratio of patients [2,3]. Previous studies in Africa have shown that men with recent genital ulcerative diseases, mostly due to chancroid, syphilis and Herpes

Correspondence: Dr. SA Fayemiwo, Department of Medical Microbiology and Parasitology, College of Medicine, University of Ibadan, Ibadan, Nigeria. Email: dayteet@yahoo.com

simplex virus 2 (HSV-2) infections, were at a significant and substantially increased risk of acquiring new HIV infection from infected female partners [2,4]. Studies have also confirmed that the infection of the urethra (urethritis) or cervix (cervicitis) increase the infectiousness of HIV by increasing the viral load in genital secretion [5,6].

Research works evaluating the biological mechanism behind the findings suggested that secondary genital infections increase local cytokine production, which in turn regulates HIV replication through cytokine effects on the transcription factor NF-Kappa α [7]. These data had also shown that ulcerative sexually transmitted infections (STIs), such as chancroid, syphilis and herpes genitalis have stronger effect than non-ulcerative STIs, presumably because of greater disruptions of genital mucosa [6].

Because of the high prevalence of HSV-2 infection in many parts of Africa, the disease might account for a substantial proportion of HIV infection [8]. It is also known that there are significant delays in seeking treatment for STIs in most parts of Africa, especially in Nigeria, thus patients are likely to shed HSV-2 for sometime before treatment. High rates of STIs in Nigeria resulted from a combination of behavioural factors and poor health-service delivery [9]. Risky sexual behaviours are affected by a mixture of socio-economic and cultural factors and its effects are compounded by poor access to preventive measures. Since the beginning of the HIV/AIDS epidemics, the focus of preventive efforts has been on those at risk of HIV infection [9,10]. An alternative approach to prevention would focus on those already identified with HIV to prevent transmission to others. However, the success of the latter approach hinges on improving identification of those infected with HIV. Because of dearth of comprehensive data on the prevalence and incidence of genital ulcer diseases (GUDs) among HIV infected commercial sex workers in Nigeria; this study was carried out to determine the prevalence and association of GUDs among HIV infected female commercial sex workers in Ibadan, Nigeria.

Materials and methods

A cross-sectional study was conducted in a population at high risk for HIV infection from November 2002 and July 2003 in Ibadan, South Western Nigeria. A total of 250 female commercial sex workers (FCSWs) who are brothel-based in Ibadan and volunteered to participate in the study were enrolled after obtaining an

informed consent. The study protocol was approved by the University of Ibadan/ University College Hospital (UCH) ethical review committee. Subjects were excluded from enrollment if they were menstruating or have used antibiotics in the preceding two weeks or within six weeks post-abortion. Pre- and post HIV test counselling were offered to all the subjects. A semi-structured questionnaire was administered to all the participants who gave informed consents to elicit baseline information on their demographic characteristics and reproductive health history.

Physicians interviewed the FCSWs about symptoms suggestive of STIs such as abnormal vaginal discharge, genital sores and swellings; and performed a complete pelvic examination. During the examination, an un-lubricated sterile speculum was inserted into the vagina. Samples of the vaginal secretions were obtained by sterile cotton-tipped applicators from the high vaginal fornices and endocervix. These swabs were promptly transported in Amies transport medium to the Special Treatment Clinic (STC)'s Laboratory, University College Hospital, Ibadan. FCSWs with characteristics group vesicles lesions, chancres, superficial and large painful excavated ulcers were noted. In addition, 5-10mls of venous blood was taken aseptically by venepuncture from each of the FCSW into an EDTA specimen bottles and transported to the STC and Virology laboratories for processing.

Laboratory procedure

The high vaginal swabs were examined by wet preparation for the presence of clue cells, yeast cells and trichomonads. Endocervical swabs were inoculated on the chocolate agar and Modified Thayer Martins agar. These plates were incubated at 37°C in 5.0% CO₂ humidified extinction jar. Endocervical secretions were also Gram-stained for the presence of intracellular Gram-negative diplococci and suspected isolates were confirmed as *Neisseria gonorrhoeae* by standard laboratory methods [11].

Diagnosis of genital ulcer diseases

FCSWs with genital ulcers had the following diagnostic tests:

Syphilis

Aliquots of the serum of the FCSWs were tested for syphilis using the Rapid Plasma Reagin (RPR) card tests and by the *Treponema pallidum* Hemagglutination (TPHA) tests. Subjects with RPR titre \geq 1:8 were

considered to have current infection. A subject was considered to have current syphilis infection if both RPR and TPHA tests were positive.

Chancroid

Genital ulcers and ulcerated buboes were cleaned with gauze soaked with sterile saline. A sterile swab was applied to the base of the ulcer to obtain the sample. In the laboratory, the swabs were inoculated on chocolate agar incorporated with vancomycin (3-ug/ml) and 1% IsovitaleX. These plates were incubated at 37°C in 5.0 % CO₂ humidified candle extinction jar. *Haemophilis ducreyi* was isolated using previously described methods [12].

Genital herpes

The typical case of genital herpes simplex was noted clinically. The characteristics lesions which were grouped vesicles that irritate, itch or give tingling sensation were noticed on the vulva and vaginal mucosa. The diagnosis was however confirmed in some cases with the history of recurrent episodes and positive immunochromatographic IgM HerpeSelect tests [13].

Lymphogranuloma venerum (LGV)

The diagnosis was based on clinical findings, supported by the presence of a papule, ulcer around the anogenital area and an inguinal syndrome characterized by acute lymphadenitis with bubo formation. All patients with suspected LGV were tested for other STIs including syphilis, chancroid, Granuloma inguinale, genital herpes, HIV, other genital Chlamydia, gonorrhea, and trichomonas

Granuloma inguinale

The diagnosis was also based on clinical findings which revealed multiple beefy-red exuberant nontender round ulcers of various sizes on the mons pubis, vulva and perimeal area. The ulcers could have clean friable granulating bases and inguinal lymph nodes were not palpable. Giemsa-stained tissue smear was made and examined for demonstration of intra-mononuclear Donovan bodies.

HIV infection

Aliquots of sera from venous blood samples from each subject were tested for antibodies to HIV-1 and 2 using the Enzyme-Linked Immunosorbent Assay (ELISA) technique with commercially available HIV-1/2 EIA kit 'GENSCREEN[®] plus HIV Ag-Ab kit (by Bio-Rad, France). The presence of HIV specific antibodies found

in initially reactive samples were further confirmed by Western blot assay (LAV BLOT, Bio-Rad, France).

Data analysis

Data was analyzed using SPSS for widows' version 12.0. Association between groups was performed using the chi-square test for categorical variables and student-t test for continuous variables. Logistic regression was used to adjust for potential cofounders. Analysis of variance was calculated and statistical tests were carried out at 5% significance level.

Results

A total of 250 female commercial sex workers (FCSWs) recruited with complete questionnaire and clinical specimens were enrolled for this study. The socio-demographic characteristics and reproductive health history of the FCSWs are shown in Table 1. The mean age of the FCSWs was 28.8 years (Range 15-55 yrs; SD = 7.35). Seventy-three (39.2%) of the seronegative subjects and 43.8% of the HIV- infected ones were within the age of 20-24 years old respectively. More than two-third of the uninfected FCSWs (71.5%) were single while 11.8 % were married, others were divorced, separated or widowed. Majority (98.4%) were from different parts of Nigeria while 1.6% were from Republic of Benin, Togo, Ghana and Cote d'Ivoire. Forty-one (64.1%) of the HIV – infected FCSWs had their first sexual debut between the ages of 16-20 yrs and more than half (57.8%) usually attended to 1-5 sexual partners per day.

Out of the 250 FCSWs that participated in the study, a total of 64 (25.6%) of the subjects were confirmed to have HIV-1 antibodies and 2.8% had dual HIV-1/HIV-2 infections. Analysis of the Sexually Transmitted Infections (STIs) showed that 59 (23.6%) of the FCSWs had symptomatic genital ulcer diseases (GUDs). Herpes genitalis was the commonest GUDs as it occurred in 10% of those screened, while others were chancroid (5.6%), syphilis (4.0%) and lymphogranuloma venerum (4.0%). Other STIs identified among them were bacterial vaginosis (32.0%), vaginal candidiasis (22.0%), gonorrhea (18.4%), trichomoniasis (15.2%), genital warts (5.2%), tinea cruris (3.6%) and scabies (0.4%). Among the HIV-infected FCSWs, herpes genitalis was the commonest genital ulcer disease as it occurred in 25% of them, while others were chancroid (14.1%), syphilis (14.1%) and Lymphogranuloma venerum (1.6%)

Table 1: Demographic characteristics and reproductive health history of the commercial female sex workers

Characteristics	frequency N=250	percentage %	HIV positive N=64	percentage %
<i>(a) Age</i>				
- 20	32	12.8	4	6.2
20-24	101	40.4	28	43.8
25-29	56	22.4	17	26.5
30-39	45	18.0	12	18.8
40-49	13	5.2	2	3.1
> 50	3	1.2	1	1.6
<i>(b) Marital status</i>				
Single	174	69.6	41	64.1
Married	30	12.0	8	12.5
Divorced	37	14.8	13	20.3
Separated	7	2.8	2	3.1
Widowed	2	0.8	0	0.0
<i>(c) States/Zone/</i>				
Nationality				
Edo/Delta	148	59.2	32	50.0
South East	41	16.4	13	20.3
South West	32	12.8	5	7.8
Middle Belt	16	6.4	8	12.5
South South	8	3.2	3	4.7
Other National	4	1.6	3	4.7
<i>(d) level of education</i>				
No formal	15	6.0	3	4.7
Primary education	87	34.8	22	34.4
Secondary	142	56.8	36	56.2
Post secondary	6	2.4	3	4.7
<i>(e) Age of first sexual exposure (yrs)</i>				
< 11	3	1.6	1	1.6
11-15	66	33.2	17	26.5
16-20	109	60.0	41	64.1
>20	8	5.2	5	7.8
<i>(f) Duration of work as CSWs (yrs)</i>				
< 1	2	1.1	2	3.1
1-5	112	60.2	37	57.8
6-10	54	29.0	19	29.7
11-15	15	8.1	5	7.8
16-20	3	1.6	1	1.6
<i>(g) Number of sexual partners/day</i>				
< 5	119	64.0	41	64.1
6-10	60	32.2	22	34.4
> 10	7	3.8	1	1.5
Total	186	100.0	64	100.00

Association of GUDS genital ulcer diseases with HIV infection showed that 16 (64%) of the FCSWs with herpes genitalis had HIV-1 infection while nine

(3.6%) were seronegative. The association between herpes genitalis and HIV acquisition is statistically significant ($p=0.0001$). The risk ratio of herpes genitalis

for HIV acquisition was 3.0 ($CI_{95\%} = 2.0-4.4$). Nine (64.3%) of the CSWs with chancroid were seropositive for HIV ($P < 0.002$) while nine (90%) of the FCSWs with syphilis were seropositive for HIV infection ($P < 0.0001$). Thus, there is significant association between chancroid, syphilis and HIV-1 infection. On the other hand, LGV was not found to be significantly associated with HIV infection ($P = 0.5$) (Table 2)

Table 2: Genital ulcer diseases and HIV Infection

STI	HIV Negative	HIV Positive	P-Value
Herpes genitalis	9(36.0%)	16 (64.0%)	0.0001
Syphilis	1(10.0%)	9(90.0%)	0.0001
Chancroid	5(35.7%)	9(64.3%)	0.002
LGV	9(90.0%)	1(10.0%)	0.50

After multivariate logistic regression analysis of the risk factors for HIV it was found that adjusted odd ratio for herpes genitalis was 3.7 ($CI_{95\%} = 1.004 - 13.766$); Chancroid 19.05 ($CI_{95\%} = 2.7 - 132.26$) and syphilis 19.8 ($CI_{95\%} = 1.70 - 231.03$). Recurrent vaginal discharge was also found to be significantly associated with increased risk of acquiring HIV-infection (Table 3).

Table 3: Risk Factors for HIV infections among FCSWs with genital ulcers diseases

Variables	P-Value	Odd Ratio (EXP \hat{a})	95% C: for EXP (\hat{a})	
			Lower	Upper
Gonorrhoea	0.406	0.969	0.315	2.98
Vaginal Candidiasis	0.748	0.724	0.263	1.993
Trichomoniasis	0.769	0.712	0.216	2.349
Herpes Genitalis	0.0001	3.717	1.004	13.76
Syphilis	0.0001	19.78	1.70	231.0
Chancroid	0.0001	19.051	2.74	132.3

Discussion

Genital ulcer diseases (GUDs) such as chancroid, syphilis and herpes genitalis have been shown to have a stronger association than non-ulcerative sexually transmitted infections (STIs) on HIV-1 infection. Presumably because of greater disruption of the genital mucosa [5,14-15]. Data on the rate of STIs in commercial sex workers (CSWs) vary around the world depending on the reliability of the diagnostic tests used and readiness to undertake medical examination

[7,9,14]. The spectrum of STIs among the CSWs in Nigeria has widened since the era of previous studies in Nigeria [16-17]. While gonorrhoea, syphilis and trichomoniasis were the only STIs diagnosed in the past [18], a wider spectrum of STIs among the CSWs investigated had been demonstrated in the present report due to the facts that they were investigated in their various brothels.

The prevalence of genital ulcer diseases in this study was found to be 23.6%. Herpes genitalis was the commonest (25.0 %) among the HIV-infected FCSWs followed by chancroid (5.6%), syphilis (4%) and lymphogranuloma venereum (4.0%).

The rate of STIs found in this study was low compared to the earlier studies in Nigeria [19,20]. This might be due to the fact that the CSWs in this study were examined and investigated in their brothels while the subjects in the earlier studies were those who visited the STI clinic after they must have been inadequately treated by near-by chemist. Similarly, national surveillance data from the STI clinics generally show higher STIs rates than community-based studies [18,21].

Genital ulcer diseases have a stronger effect than non-ulcerative STIs in HIV infection. This fact was established in our study as no significant relationship was found between gonorrhoea, vaginal candidiasis,

trichomoniasis and HIV infection. The presence of genital ulcers is associated with an increased risk of HIV infection ranging from 1.5 to 7.0 in both men and women [22].

Syphilis was found to be more significantly associated with increased risk of HIV infection in this study as documented in previous studies [22-24]. Reported cases of active syphilis ranged from 25% in Burkina Faso to 12.5% in Nigeria [23]. The prevalence of syphilis in our study was 4.0% and 14.1% among

the FCWS and HIV-infected FCSWs respectively. This figure was lower than 57% found in a brothel-based study in Bangladesh [25]. Studies have shown that *Treponema pallidum* lipoprotein increases the number of cells receptive to HIV-1, and/or the number of receptors expressed per cells [14, 22]

Genital herpes was the commonest GUD found in this study as it occurred in 25% of the HIV-infected FCSWs. This rate seemed to be lower than 70-80% by the age of 30 years reported in some parts of Eastern and Southern Africa [26-27]. There is significant statistical relationship between herpes genitalis and increased risk of HIV infection (OR= 3.0 (95%CI: 2.0-4.4). More recent studies have suggested the relative importance of herpes simplex virus type 2 (HSV-2) in HIV infections [28,29]. The risk of acquiring HIV-1 was found to be doubled in HSV-2 seropositive individual in another study [30]. There are significant delays in seeking STI treatment in most parts of this country, thus patients are likely to shed HSV-2 for sometime before treatment.

The prevalence of chancroid which was found to be 5.6% among the seronegative FCSWs and 14.1% among HIV-infected FCSWs was significantly associated with HIV infection (OR =19.0; P = 0.002). In a related study, chancroid and the development of any other new STIs during follow-up were found to be independent risk factors for HIV-1 seroconversion [31].

Haemophilus ducreyi was found to cause majority of the GUD cases in some African cities e.g. Dakar, Senegal [32] but there is every need to re-evaluate the sensitivity and specificity of available laboratory tests for the confirmation of *H. ducreyi* as the etiology of chancroid especially in Africa.

Serological tests for *H. ducreyi* had been used to determine the prevalence of chancroid in several settings, including trading company workers in Kenya (27%), female sex workers in Lagos, Nigeria (86%) and STI clinics patients in Jackson, Mississippi, USA (48% and 53% with two different EIA assay) [33-35]. In our study, diagnosis of chancroid was based mainly on the culture positive for *H. ducreyi* which appeared to be less sensitive. However the molecular diagnosis which appears to be more sensitive and specific is yet to be fully established in our laboratory. The relative decline in the prevalence of chancroid and higher prevalence of herpes genitalis in this study is in agreement with findings from other African studies [28,29]. This may be due to syndromic treatment approach which has been targeted to bacterial, but not viral agents.

Public health workers interacting with FCSWs should stress techniques that can help prevent the spread of STIs and HIV infection. Hence, apart from the promotion of safer sexual behaviours and condom use, improved STIs diagnosis and treatment remain an important component of HIV prevention programmes. There is a need for public health enlightenment to educate FCSWs to adopt safer sexual behaviours, seek early diagnosis and treatment of genital ulcerative diseases to reduce the risk of acquiring HIV infection.

Government also needs to improve the facilities at different levels of health care deliveries to include STIs molecular diagnostic tests to be able to monitor the true prevalence and changing aetiology of GUDs in Nigeria.

The main limitation in this study was found to be lack of molecular laboratory facilities for diagnosis of GUDs in this centre. Since this is a cross-sectional study, temporal sequence may not be established. However, genital ulcers, in particular caused by herpes genitalis could be worsened or made more frequent by the presence of HIV.

Acknowledgments

The authors would like to appreciate all resident doctors, public health nurses and laboratory staff of Special Treatment Clinic and Virology Department, University College Hospital, Ibadan for assistance and encouragement during the study. The AIDS Prevention Initiatives in Nigeria (APIN), Harvard School of Public Health, USA, study participants and directors of the selected brothels are also thankfully acknowledged.

References

1. Simonsen JN, Cameron DW, Gakinya MN, et al. Human immunodeficiency virus infection among men with sexually transmitted diseases: Experience from a centre in Africa. *New England Journal of Medicine*. 1988; 319: 274-278.
2. Quinn TC, Mann JM, Curran JW and Piot P. AIDS in Africa: an epidemiologic paradigm. *Science*. 1986; 234:955-963.
3. Piot P, Plummer, FA, Mhalu, FS, et al. AIDS: an international perspective. *Science*. 1988; 239:573-579
4. Cameron, DW, Simonsen JN, D'Costa LJ et al. Female to male transmission of human immunodeficiency virus type 1: risk factors for seroconversion in men. *Lancet*, 1989; 2 (8660); 403-407.

5. Cohen MS, Hoffman IF, Royce RA, *et al.* Reduction of concentration of HIV-1 in semen after treatment of urethritis: implications for prevention of sexual transmission of HIV-1. AIDSCAP Malawi Research Group. *Lancet*, 1997; 349 (9096):1868-1873.
6. McClelland, RS, Wang, CC, Mandaliya, K, *et al.* Treatment of cervicitis is associated with decreased cervical shedding of HIV-1. *AIDS*, 2001; 15(1):105-110.
7. Anzala, AO, Simonsen, JN, Kimani, J, *et al.* Acute sexually transmitted infections increase human immunodeficiency virus type 1 plasma viremia, increase plasma type 2 cytokines, and decrease CD4 cell counts. *Journal of Infectious Diseases* 2000;182(2):459-466.
8. World Health Organization (WHO). Herpes simplex virus type 2; programmatic and research priorities in developing countries (WHO/HIV technical report AID/2001.05), Geneva: WHO, 2001.
9. Fayemiwo, SA, Bakare, RA, Odaibo, GN *et al.* Patterns of Sexually Transmitted Diseases among HIV-infected commercial sex workers in Ibadan. XV International AIDS Conference; Medimond International Proceedings. July 2004; 61-66.
10. U.S. Preventive Services Task Force. Behavioural counselling to prevent sexually transmitted infections: U.S. preventive Services Task Force. *Ann Intern Med*. 2003; 149: 491-496. W95
11. Amsel R, Totten PA, Spiegel, CA, Chen KCS, Eschenbach, D and Holmes, KK. Non Specific Vaginitis: Diagnostic Criteria and microbial and epidemiologic association. *American Journal of Medicine* 1983, 74; 14-22.
12. Hammond, GW, Lian, CJ, Wit, JC, Albritton WL *et al.* Determination of the hemin requirement of *Haemophilis ducreyi*. : Evaluation of the porphyrin test and media used in the satellite growth test. *Journal of Clinical Microbiology*, 1978; 7: 243-246.
13. Ashely-Morrow, R., Krantz, E. and Wald A. Time course of seroconversion by HerpeSelect ELISA after acquisition of genital Herpes Simplex virus type 1 (HSV-1 or HSV-2) .*Sexually Transmitted Diseases*, April 2002, Vol. 3(4); 310-310.
14. Ghys, PD, Fransen, K, Diallo, MO *et al.* The association between cervicovaginal HIV shedding, sexually transmitted diseases and immunosuppression in female sex workers in Abidjan, Cote d'ivoire. *A.I.D.S* 1997; 11:F85-F93.
15. Moss, GB, Overbaugh, J, Welch, M *et al.* Human immunodeficiency virus DNA in urethral secretions in men: association with gonococcal urethritis and CD4 cell depletion. *Journal of Infectious Diseases*. 1995; 172: 1469-1474.
16. Osoba, A.O. Epidemiology of urethritis in Ibadan. *British Journal of Venereal Diseases*. 1972; 48:116-120.
17. Bello, CSS, Elegba, O.Y. and Dada J.D. Sexually transmitted diseases in Northern Nigeria: Five years experience in a University Teaching Hospital. *British Journal of Venereal Diseases*.1983; 59:202-205.
18. Odugbemi Tolu, Onile, BA, Adetoro, OO, Ayorinde, O and Alausa, OK. Sexually Transmitted Disease: a 19 month clinic experience at the Ilorin University Teaching Hospital. *Nigeria Medical Practitioner*. 1986; Volume II (4); 95-98.
19. Bakare, RA, Ashiru, JO, Adeyemi-Doro, FAB *et al.* Non-gonococcal urethritis (NGU) due to *Trichomonas vaginalis* in Ibadan. *West African Journal of Medicine*. 1999;18(1):64-68.
20. Okesola, A.O and Fawole, O.I. Prevalence of Human Pappiloma Virus genital infections in sexually transmitted diseases clinic attendees in Ibadan. *West African Journal of Medicine*. 2000; 19(3):195-199.
21. "UNAIDS/WHO epidemiological fact sheets on HIV/AIDS and Sexually Transmitted Infections, 2004 Update
22. Royce, RA, Avelene Sera, Willard Cates, Myron, S and Cohen MS. Sexual transmission of HIV. *New England Journal of Medicine*.1997; 336:1072-1077.
23. Onile, BA, and Odugbemi T: Genital ulcer disease in Ilorin, Nigeira. *Africa Journal of Clinical and Experimental Microbiology*. 2002; 3(1): 21-23.
24. Kehinde, A.O., Lawoyin, T.O. and Bakare, R. A. Risk factors for HIV infection among special treatment clinic attendees in Ibadan,

- Nigeria. African Journal of Medicine and Medical sciences. 2004; 33, 229-234
25. Sarker, SN, Islam F, Durandin, N, Siddique *et al.* Low HIV and high STDs among commercial sex workers in a brothel in Bangladesh: Scope for prevention of larger epidemic. International Journal of STD/AIDS 1998; 9:45-47.
26. Weiss HA, Biwe A, Robinson, NJ *et al.* The epidemiology of HSV-2 infection and its association with HIV infection in four urban African populating A.I.D.S. 2001; 15 (supplements 4):S97 – S108.
27. Kamali A, Nunn AJ, Mulder DW *et al.* Seroprevalence and incidence of genital ulcer infections in a rural Uganda populations. Sexually Transmitted Diseases. 1999; 75: 98-102.
28. Oni AA, Adu FD, Ekweozor CC and Bakare RA. Genital Herpes Simplex Virus infection in females in Ibadan, Nigeria. West Africa Journal of Medicine, 1996; 15(2):107-110.
29. Nagot N, Ouédraogo A, Foulongne V, *et al.* Reduction of HIV-1 RNA levels with therapy to suppress herpes simplex virus. N Engl J Med 2007; 356:790-799. [Abstract] 17.
30. Wald A and Lunki K. Risk of human immunodeficiency infection in herpes simplex virus-2 seropositive persons: a meta-analysis. Journal of infectious diseases. 2002; 185:45-52.
31. Telzak EE,, Chiason MA and Bevier PJ *et al.* HIV-1 seroconversion in patients with or without genital ulcer diseases. Annals of Internal Medicine 1993; 119(12):1181-1186.
32. Patricia A. Totten, Jane M. Kuypers and Cheng-Yen Chen *et al.* Etiology of Genital Ulcer Disease in Dakar, Senegal, and Comparison of PCR and Serologic Assays for Detection of *Haemophilus ducreyi*. Journal of Clinical Microbiology, 2000, 38(1): 268–273
33. Chen C, Mertz KJ, Spinola SM and Morse SA. Comparison of enzyme immunoassays for antibodies to *Haemophilus ducreyi* in a community outbreak of chancroid in the United States. Journal of Infectious Diseases.1997; 175:1390-1395.
34. Dada AJ, Ajayi AO, Diamondstone IO, Quinn TC, Blatter WA and Biggar RJ. A sero-survey of *Haemophilus ducreyi*, syphilis and herpes simplex virus type 2 and their association with human immunodeficiency virus among female sex workers in Lagos, Nigeria. Sexually Transmitted Diseases. 1998; 25: 237-242.
35. Rakwar J, Jackson D, Maclean I *et al.* Antibody of *Haemophilus ducreyi* among trucking company workers in Kenya. Sexually Transmitted Diseases.1997; 24: 262-271.

Received: 31/12/09

Accepted: 24/11/10