

Demographic Distribution Pattern and Antiretroviral Therapy Status Among HIV Patients in Selected Tertiary Hospitals in Abeokuta, Ogun State

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Page | 4718

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ABSTRACT

The occurrence of human immunodeficiency virus (HIV) in Nigeria is relatively high and compromised with low antiretroviral therapy (ART) coverage. The study aimed at investigating the effect of ART on the CD4 cell count among seropositive individuals. Blood samples of HIV patients visiting three referral hospitals in Abeokuta were collected and CD4 cell count determined via flow cytometry method. Socio-demographic data of patients were also collected and analyzed using STATA/IC. A total of 615 seropositive blood samples were collected from three hospitals. The female to male ratio was found to be 2:1 of which age bracket 20-40 years had the highest infective number (63.3%) among other age categories. There was higher HIV occurrence among the married (52%) than the single (26.8%), while those with primary or secondary education had the highest (42.4%) compared to tertiary education (36.7%) and no formal education (9.1%). The CD4 count of infected cases showed that 51.2% had CD4 count between 100-200 cells/ μ L with 5.2% above 200 cells/ μ L. Also only 47.3% of the total infected cases placed on ART had a mean CD4 cell count (132.1 ± 4.23) higher than those not on ART (CD4 count = 98.67 ± 3.56). As a way of effectively managing HIV in Ogun State and meeting the 2030 set goal of USAIDS there is need for more HIV screening for early commencement of ART towards suppressing viral load.

Keywords: HIV; Antiretroviral therapy; CD4-cell; Immunocompromised

Introduction

Human Immunodeficiency Virus (HIV) is a single stranded, enveloped, RNA virus belonging to the genus Lentivirus that hampers immunity of healthy individuals by lowering CD4 T-cells (Nacher *et al.*, 2018; Carr *et al.*, 2019). The virus

is capable of transiting to Acquired Immunodeficiency Syndrome (AIDS) in infected individuals when detected late and/or inappropriately treated (Batorsky *et al.*, 2011). The transition further weakens the immunity, as it is an indication of severely compromised

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immunity having CD4 cell count below 200 cell/ μ L (Battistini and Guzman, 2020; Vogler *et al.*, 2018). This impact of reduced immunity paves way for susceptibility of the host to other infectious diseases (such as tuberculosis, cancer, malaria) that contributes to comorbidity and mortality of the virus (Gronborg *et al.*, 2017; Bell and Noursadeghi, 2018).

In 2017, 36.9 million HIV individuals were reported worldwide, with sub-Saharan Africa having 25.7 million infected cases (UNAIDS, 2017). An increment of 1.1 million seropositive individuals was observed globally in 2019 with 690,000 deaths (UNAIDS, 2019). Regional HIV incidence in Africa showed that 54% out of the global estimated value was from Eastern and Southern Africa in 2019, while 13% from Western and Central Africa. Cameroon, Cote d'Ivoire and Nigeria were actually the major contributors in the new infection rise in Western Africa (UNAIDS, 2019). The burden of this virus is of major public health challenge in sub-Saharan Africa largely due to poor economic status, late virus detection, stigmatization, misinformation and misconception about the transmission mode and prevention. These predisposing factors enhance the distribution pattern of the virus within sub-Saharan Africa (UNAIDS, 2017; Avert, 2018).

Nigeria is among the leading countries with high HIV infected cases globally and in sub-Saharan Africa (NACA, 2017; UNAIDS, 2017; Avert, 2018). UNAIDS (2017) estimated that two-third of newly infected cases in West and Central Africa came from Nigeria alone. States like Kano, Lagos, Oyo, Akwa-Ibom, Kaduna and Benue largely contributed 41% to the HIV surge in Nigeria (NACA, 2017; Avert, 2018). According to Nigeria HIV/AIDS Indicator and Impact Survey (NAIIS) fact sheet, HIV prevalence in Southwest Zone showed that Ogun and Lagos State had the highest prevalence of 1.6% and 1.4% respectively (NAIIS, 2019). Nevertheless,

effective management of the virus is carried out through the use of antiretroviral drugs which help to suppress viral replication and maintain plasma HIV-1 below detectable level within the host (Schuetz *et al.*, 2014). Currently, HIV is being managed by combination antiretroviral therapy (ART). The combine therapy has shown overtime to effectively suppress viral load and restore immunity, thus increasing the chances of patient survival. Despite the huge role of ART in HIV management, there is still disparity between those on ART and those not on ART especially within sub-Saharan Africa (Avert, 2018). Several studies have reported prevalence and co-infection of HIV in Nigeria, there is however a paucity of information on prevalence and effect of ART on CD4 cell of HIV patients in Ogun State. Therefore, constant monitoring and understanding of HIV epidemiology in the broader Ogun State region could lead to targeted interventions and support for hospitals caring for these patients. This study aims to investigate the effect of ART among HIV patients attending the three major HIV referral hospitals located within Abeokuta, the capital of Ogun State.

Materials and Methods

Study Design and Sample Size

The study was conducted in Abeokuta the state capital of Ogun State, Nigeria with coordinate 7°9'39"N 3°20'54"E having an estimated population of 500,000 people. The Federal Medical Center (FMC), State Hospital Ijaiye (SH) and Sacred Heart Hospital Lantoro (SHH) were selected for this study as they provide HIV/AIDS care for the residence of Abeokuta and its environ. The sample size for the study was calculated according to Krejcie and Morgan (1970).

Ethical Approval

Ethical clearance certificates were obtained from the Research and Ethical Clearance Committees of all three hospitals, with reference numbers SHA144/Vol.1179 and FMCA/238/05 from SH

and FMC respectively. However, where a patient was a minor, a written informed consent was also obtained from the parent(s) or guardian(s) before enrollment and confidentiality was assured.

Study Population

A total of 615 HIV/AIDS patients of all age groups were recruited for this study based on the calculated sample size. Samples were obtained from FMC and SH between September 2013-August 2014 and between June 2015 – May 2016 for SHH.

Data Collection and Analysis

A semi structured questionnaire (Proforma) was developed to capture socio-demographic information such as sex, age, educational qualification, occupation and whether patient is on ART or not. Data was subjected to statistical analysis using STATA/IC version 13 (StataCorp, 2013).

Sample Collection

A total of 615 blood samples were aseptically collected from seropositive patients attending the three hospitals. Three milliliters (3 mL) of blood was withdrawn from the patient into labeled Ethylene diaminetetraacetic acid (EDTA) tubes during their visit to the hospital for CD4 cell count.

Flow Cytometry method for CD4 count

Rohren tubes were used to run the CD4 count. Twenty microliters (20 μ L) of monoclonal antibody was dispensed, followed by 20 μ L of well mixed whole blood and proerythrin dye was added to coat CD4 cells (Nicholson, 1994). The samples were gently mixed and incubated in the dark for 15 minutes at room temperature (25-28 $^{\circ}$ C) for antigen/ antibody reaction. CD4 buffer (800 μ L) was added, mixed gently and tubes were thereafter plugged onto the counter.

Results and Discussion

Gender and Age Distribution of Human Immunodeficiency Virus (HIV) Patients

Of 615 HIV patients studied, SHH, FMC and SH provided 260, 195 and 160 patients respectively. The total percentage of female and male enrolled in the study was 66.8% and 33.2% respectively (Table 1), of which 144 females and 51 males were from FMC with a mean age of 30.8 years, 111 females and 49 males from SH (29.9 years), while SHH had 156 females and 40 males (30.8 years).

The age stratification of patients ranges from 5 weeks to 62 years with mean age of 30 years. Patients between the ages of 21 – 40 years were the most dominant age group among HIV-patients studied (63.3%) with the least found to be below 1 year having 1.3% while 16.7% were within the age range of 1 - 20 and 18.7 % were above the age of 40 years (Table 1).

Marital, Educational and Occupational Status of HIV Patients

The marital status of seropositive patients studied (Figure 1) showed that most were married (n=320; 52%), 26.8% were single (n=165), 3.6% were divorced (n=22), 2.9% were either widow or widower (n=18), while 14.6% were classified as minor (n=90). Majority of the study population had either primary or secondary education (n=261; 42.4%), 36.7% had tertiary education (n=226) and 9.1% had no formal education (n=56) (Figure 2). In terms of occupation, most patients were artisans (40.2%; n=247), 23.9% were civil servants (n=147), 21.8% were unemployed (n=134) while 14.1% were classified as not applicable (Figure 3).

CD4 Lymphocytes among HIV Patients

The mean CD4 cell count of seropositive patients studied was lower (114.4 cells/ μ L) compared with that of seronegative patients (1345.7 cells/ μ L) (Figure 4). The CD4 cell count of HIV patients studied was grouped into three: below 100 cells/ μ L, between 100 – 200 cells/ μ L and above 200 cells/ μ L (Table 2). Most of HIV patients were between the CD4 count range of

100 – 200 cells/ μ L (51.2 %; n=315), followed by those below 100 cells/ μ L (43.6%; n=268) while the rest had CD4 count above 200 cells/ μ L (5.2%; n=32). This trend was observed across the three hospitals.

Usage and Effect of ART on CD4 Count of HIV Patients

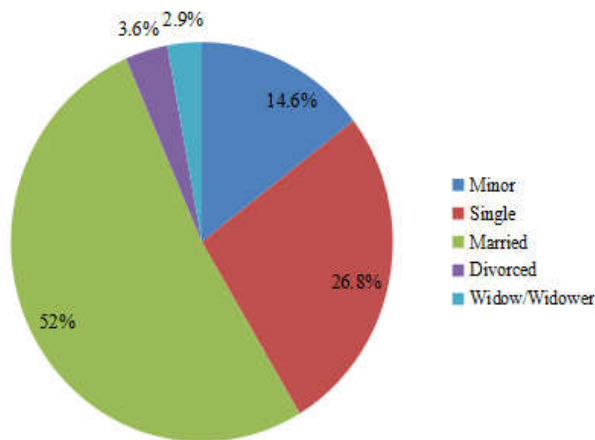
Among seropositive patients, 47.3% were on ART while 52.7% were not on any antiretroviral drug at the time of the study. It was observed that

patients attending FMC had the highest number of patients on ART (48.2%) with the least at SH (30.6%) (Table 3). Patients on ART had higher CD4 cells count across the three HIV care centers with an average CD4 count of 132.1 cells/ μ L compared to 98.67 cells/ μ L of patients not on ART. Statistical analysis revealed that effect of ART on CD4 cells of HIV patients attending both FMC and SH was significant (p-value = 0.001) but insignificant for those attending SHH (p-value 0.55) (Table 4).

Table 1: Gender and age distribution of human immunodeficiency virus (HIV) patients

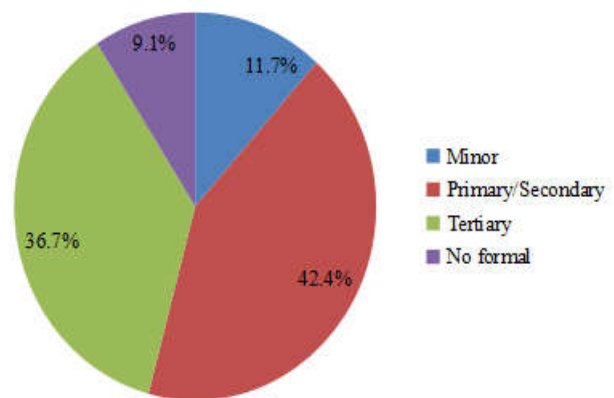
Anthropometry	FMC	SH	SHH	Total	%
Number of patients	195	160	260	615	
Sex					
Male	51	49	40	204	33.2
Female	144	111	156	411	66.8
Age range (years)	2 – 48	6 mth -58	2 – 48	5 weeks – 62	
Mean age (years)	30.8	29.9	30.82	30	
Age group					
Below 1	0	3	5	8	1.3
1 -20	24	25	54	103	16.7
21 – 40	138	109	142	389	63.3
Above 40	33	23	59	115	18.7

Key: FMC: Federal Medical Center, Idi-Aba; SH: State Hospital, Ijaiye; SHH: Sacred Heart Hospital Lantoro, mth: month



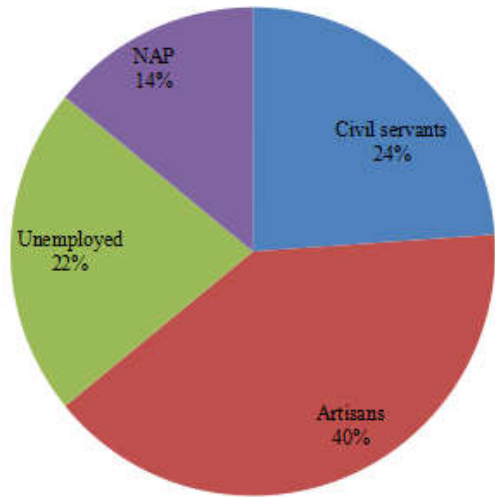
Key: Minor: Children

Figure 1: Percent marital status of HIV-patients in Abeokuta



Key: Minor: Children

Figure 2: Percent educational status of HIV-patients in three HIV/AIDS care centres in Abeokuta



Key: NAP- Not Applicable

Figure 3: Percent occupational status of HIV-patients in three HIV/AIDS care centres in Abeokuta

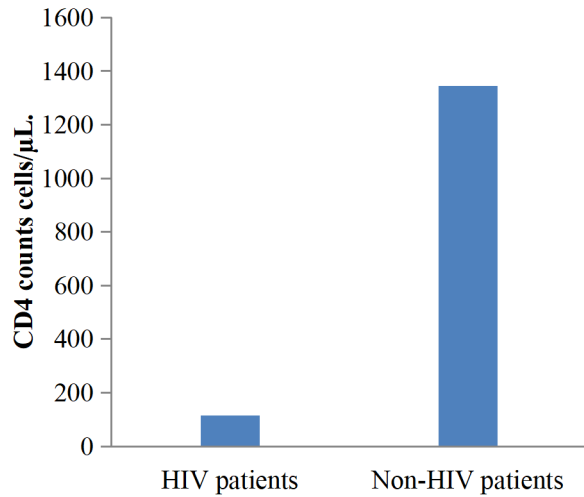


Figure 4: Comparison of the average CD4 cell counts of HIV and non-HIV patients attending the hospitals

Table 2: Mean (\pm SD) CD₄ cell counts of human immunodeficiency virus (HIV) patients

	FMC	SH	SHH	Total	%
CD₄ Count					
Below 100 cells/μL	86	68	114	268	43.6
100 – 200 cells/μL	96	83	135	315	51.2
Above 200 cells/μL	13	9	11	32	5.2
Mean	117.8	114.2	111.9	114.4	
Median	115	120	115.5	116	
Range	3 – 402	6 - 696	3 – 402	3 – 696	
CV	55.08	71.72	58.69	61.16	

Key: FMC: Federal Medical Center, Idi-Aba; SH: State Hospital, Ijaiye; SHH: Sacred Heart Hospital Lantoro; CV: Coefficient of variation

Table 3: Anti-Retroviral therapy usage among HIV-Patients in Abeokuta

	FMC		SH		SHH		Total	
Anti-Retroviral therapy	N	(%)	N	(%)	N	(%)	N	(%)
YES	94	48.2	49	30.6	148	43.1	291	47.3
NO	101	51.8	111	69.38	112	56.9	324	52.7
Total	195	100	160	100	260	100	615	100

Key: FMC: Federal Medical Center, Idi-Aba; SH: State Hospital, Ijaiye; SHH: Sacred Heart Hospital Lantoro

Table 4: Effects of Anti-Retroviral therapy on CD₄ count of human immunodeficiency virus (HIV) patients

	Mean CD ₄ cells count ± SE							
	FMC		SH		SHH		Total	
Anti-retroviral therapy	N	CD ₄ count	N	CD ₄ count	N	CD ₄ count	N	CD ₄ count
YES	94	141±5.48	49	169.8±14.9	148	114±5.24	291	132.1±4.23
NO	101	96.3±6.73	111	90.29±5.17	112	109±6.46	324	98.67±3.56
T-test		-5.16		-5.08		-0.61		-6.10
P value		0.001*		0.001*		0.55		0.001*

Key: FMC: Federal Medical Center, Idi-Aba; SH: State Hospital, Ijaiye; SHH: Sacred Heart Hospital Lantoro; (*P value < 0.05 is significant); SE: Standard error

Discussion

The demographic data obtained from the study showed that high numbers of female participants were HIV positive than the males with ratio 2:1, and this affirms high occurrence of HIV among females from previous studies (Harling *et al.*, 2014; NAIIS, 2019). Akinbami *et al* (2012) reported similar female to male HIV prevalence ratio of 1.6:1. The high occurrence of HIV among females can be attributed to associated risk factors: high number of sex workers, early marriage, polygamous relationships and pelvic inflammation and genital ulcers (Dosekun and Fox, 2010). Similarly, gender inequalities particularly in societies that encouraged free will of men engaging in extra marital affairs and/ or polygamy makes women vulnerable to contacting the virus (Shisana *et al.*, 2015). It can also be suggested that women are likely to know their HIV status than the men due to the added need to go for antenatal visit where HIV screening is carried out as part of the antenatal routine test. In terms of age stratifications, the study showed patients within age bracket 21-40 years as the dominant age group having 63.3% among the infected age groups. This is similar to a report made by UNAIDS (2019) stating 1.4% of total HIV incidence in Nigeria were within the age bracket of 15 -49 years. This was attributed to their high sexual activity as they are more prone

to unprotected sexual intercourse, polyamorous, drug abuse and acts associated with youthful exuberance. Such age group therefore needs to be a focus point towards HIV elimination and/or reduction as it appears to be among the risk factors in HIV prevalence (Ramjee *et al.*, 2016).

The percent marital status among seropositive individuals in this study showed a relationship exist between marital status and HIV prevalence, as 52% of the seropositive participants were married contrast to single individuals having 26.8%. The high occurrence among married individuals can be due to involvement in polyamorous despite being married, reduced condom use and history of previous marriage (Nabukenya *et al.*, 2020). This is contrary to findings where higher occurrence of HIV was found among cohabiting individuals, divorced and widowed (Ramjee *et al.*, 2016; UNAIDS, 2019).

CD4 cells play significant role in immune response and serve as one of the best indicators and predictors of immediate state of immune-competence and HIV-related complications (Ondoa *et al.*, 2005). Low CD4 count in HIV patients may be due to cell disruption and destruction by the virus or immunological clearing of infected CD4 cells. The number of these cells in the blood progressively declines when CD4 cell count falls below 200 cells/ μ L.

4724

This decline makes HIV person becomes vulnerable to opportunistic infections that are commonly associated with AIDS (Ondoa *et al.*, 2005). From the study, HIV patients' CD4 cell counts were found to be below 200 cells/ μ L while non-HIV patients had higher CD4 above 1200 cells/ μ L. Oladepo *et al.* (2009) reported a CD4 range of 365 – 1571 cells/ μ L in immunocompetent Nigerian adults while WHO in 2007 reported a CD4 count of less than 200 cells/ μ L as an indication of AIDS (WHO, 2007). Therefore, reduced CD4 count in this study also means patients were immunocompromised. Hence, for effective HIV management and reduction in death rate in Nigeria, there is need for larger percentage of people living with HIV to be placed on ART. From the study it was observed that 47.3% of the seropositive patients were on ART as contrast to 52.7% not on ART. The provision of potent antiretroviral medications to seropositive patients may cause the viral load to drop bringing about increase in the CD4 cell count (Oguntibeju *et al.*, 2009). This was observed in the study, as patients placed on ART had a significant higher CD4 count of 132.1 cells/ μ L contrast to those not on ART (98.67 cells/ μ L). It can be assumed from this study that people on ART though not having a CD4 of above 500 cells/ μ L were likely to have commenced ART lately when the CD4 had drastically reduced as observed with those yet to be on ART. Simms *et al.* (2018) reported that an immediate treatment of seropositive patient irrespective of the CD4 count was more impactful than commencing treatment after the CD4 falls below 500 cells/ μ L. The rapid rise in CD4 cell counts following administration of effective ART results in the shut-down of HIV replication in lymph nodes, and redistribution of CD4 cells back into blood circulation (Oguntibeju *et al.*, 2009). Nevertheless, WHO recommended the enrollment of seropositive individuals on ART irrespective of the CD4 cells count (WHO, 2015).

ART coverage in line with the USAIDS 2020 goals in Nigeria suffers lapses due to long distance of the ART facilities, stigmatization, outright refusal of infected people to treatment, social prioritization such as work and self-medication, poor consultation with the medical health practitioners, low testing etc. (Yehia *et al.*, 2015).

Conclusion

This study revealed that Abeokuta, Ogun state is faced with triple threat of low ART coverage, low viral reduction and inadequate testing. Therefore, as a way of meeting the USAIDS 90-90-90 goal for 2030, there is need for more intensive screening, testing and treatment with more public sensitization and enlightenment on HIV in Ogun State and Nigeria.

Acknowledgement

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Conflict of Interest

The authors wish to declare no conflict of interest

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