A Review of the Epidemiology, Prevention and Treatment of Human Immunodeficiency Virus Infection in Nigeria

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In order to amalgamate research findings on HIV/AIDS in Nigeria as well as the trend of the infection in a concise manner, we reviewed published articles on the HIV/AIDS situation in Nigeria. We categorized this review into several subheadings. The HIV prevalence rate has continued to rise steadily from less than 0.1% in 1987, to 5.8% in 2001, with a slight decrease in 2003 to 5.0%. Although the knowledge about HIV and its mode of transmission is widespread, it is however disheartening to note that this did not result into appreciable attitudinal change and behavior modification among Nigerians. Both HIV-1 and HIV-2 have been identified in Nigeria, with HIV-1 being the predominant type. Furthermore, several subtypes like subtypes A, B, C, G and J have been identified in Nigeria, with several recombinant forms like the CRF02_AG; the major ones being A, G and CRF02_AG. HIV-infected patients in Nigeria are also co-infected with other viral and bacterial infections, the commonly reported ones being co infections with hepatitis B and C. Although treatment of infected patients has increased recently, more effort is needed, especially in the area of patients monitoring, to maximize the benefits of ART in Nigeria. Finally, Nigeria has made appreciable efforts in vaccine development and candidate HIV DNA vaccines have been developed utilizing the sequences from predominant subtypes, and these candidates have been shown to be immunogenic in animal models. It is therefore clear that only the integration of prevention and antiretroviral research programmes into a coherent programme that is needed to address the public health needs that HIV/AIDS crisis represents for Nigeria.
Key-Words: HIV, review, Nigeria.

The discovery of what is now known as the human immunodeficiency virus (HIV), the causative agent for the dreaded acquired immunodeficiency syndrome (AIDS), dates back to June 5th, 1981, when the Center for Disease Control, CDC, reported five cases of *Pneumocystis carinii* pneumonia in active homosexual males, from three different hospitals in Los Angeles, California.

In 1983, Luc Montagnier and his group at the Pasteur institute, in France, isolated the virus, and in the following year, Dr Robert Gallo, of the United States, published some works affirming also that the acquired immunodeficiency syndrome was caused by the HIV virus [1]. Ever since then, the virus and its infection have been reported from all parts of the globe, reaching an epidemic level in a few years, in several countries, especially in sub-Saharan Africa.

The first case of HIV in Nigeria was reported in 1986, in a sexually active 13-year-old girl and soon afterward, HIV infection was identified among commercial sex workers (CSW), in Lagos and Enugu. Because of the widespread patronage of this group of people, cases of HIV infection were occasionally reported from various parts of the country [2], and have been growing steadily.

Nigeria is the tenth largest country in the world, and the most populous country in Africa. It is situated within the eastern strip of West Africa, with an area of 923,768 Km^2 and has an estimated population of 120 million (1999), representing over one fifth of the total population of the African continent [2]. It is a democratic Federal Republic consisting of 36 States and the Federal Capital Territory (FCT) (Figure 1). These States have been grouped on the basis of geographic proximity, ethnic homogeneity, and other political considerations, into six geo-political zones, North East, North West, North Central, South West, South East, and South South. It has been estimated that about 70% of its population are poor, with a literacy level of 55% [2].

Ever since it was reported, the infection rate has continued to rise steadily from less than 0.1% in 1987, 1.8% in 1991, to 5.8% in 2001, with a slight decrease in 2003 sentinel survey to 5.0% [2].

The AIDS epidemic in Nigeria is generalized, with infection primarily occurring through heterosexual transmission [3]. Some parts of the country are worse affected than others, but no State or community is free from its scourge. It affects people from all ways of life, both the young and the old, though the prevalence rate may differ. Out of over 42 million people living with HIV/AIDS (PLWAS), approximately 3.6 million reside in Nigeria, and it is home to one out of every 11 persons with the virus worldwide [4], representing the second more affected country in terms of absolute number. It is the leading course of morbidity and mortality in sub-Saharan Africa. Data from several parts of Nigeria point to an increasing sexual activity among single adolescents of both sexes, with progressive decrease in the age of sexual initiation, and poor contraceptive use [5]. The disease is known to affect all age groups, but generally speaking, youths between the ages of 20 and 29 are more affected.

Review Methodology

Many studies have been published on various aspects of the HIV epidemic in Nigeria by individuals, government

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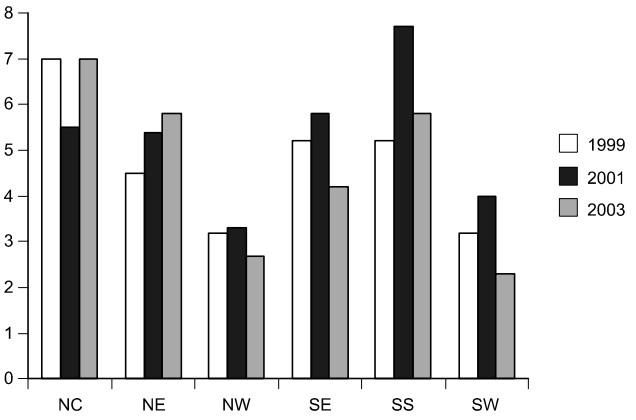
Figure 1. Map of Nigeria showing the 36 states and the FCT.

Figure 2. National HIV prevalence by Zones (adapted from FMOH Sentinel Report, 2003).



NC = North Central; NE = North East; NW = North West; SE = South East; SS = South South; SW = South West.

agencies, health institutions and researchers in and out of the country. Over 400 of these articles pulled from various local and international journals as cited on www.pubmed.com, the national 2003 sentinel survey report and other studies published elsewhere were reviewed. The important findings are presented in this review.

In order to clearly highlight research findings on HIV/AIDS in Nigeria in a simplistic manner, we categorized this review into subheadings as follows: prevalence, knowledge, attitude and practice, spread and risk factors, discriminations, diagnosis, types and subtypes, co-infections, opportunistic infections, treatment and resistance, and vaccine development.

Prevalence of HIV in Nigeria

Several HIV seroprevalence sentinel surveys involving pregnant women attending antenatal clinics have been repeatedly conducted in Nigeria since 1991 by the Federal Ministry of Health in collaboration with some international donor agencies on a two year interval since 1991 till date [2]. Most, and recently all the States of the federations were covered, including the Federal Capital Territory. Other studies from several centers across the nation has also been reported, using pregnant women, emergency department patients, intending couples, patients attending special treatment clinics and others.

The adult HIV prevalence has increased from 1.8% in 1991, to 4.5% in 1996, 5.8% in 2001 and 5.0% in 2003, according to the national HIV seroprevalence sentinel survey conducted by the Federal Ministry of Health and released in 2004 [2]. The results from 2003 showed a national prevalence of 5.0% among 27,708 women, ranging from 1.2% in the State of Osun in the South West to 12% in the State of Cross River (South South). It was generally highest in the North Central zone, and in the urban areas compared to the rural areas, and in singles more than in married people, with youth between the ages of 20 and 29 years being the most affected. A breakdown of the prevalence per State and zone is shown in Figure 2 and Table 1.

It should be noted that AIDS case reporting has been characterized by under-reporting, delayed reporting and under recognition. Despite this trend, the number of reported cases has been increasing, especially since 1996. This can be attributed to unrestrained and increasing sexual activities which are often unprotected; lack of positive behavioral changes, despite increase knowledge about the disease; stigmatization, which drives the disease underground; transfusion of unscreened blood in some localities; inadequate measures to prevent mother to child transmission and others.

According to the national survey, HIV prevalence rate among female sex workers in Nigeria has remained high, and is on the increase from 17.5% in 1991, through 22.5% (1993), to 35.6% in 1995. This group constitutes an important reservoir of HIV infection for transmission to the general population, through their sexual network. Also, the growth in prevalence among tuberculosis patients has remained relatively high, 21% (1991), 13% (1995) and 17% (2002) with the attendant strain on the health system.

A study conducted by Esan et al., in 2003 [6], correlates well with the national study. Among 312 emergency department patients in Lagos, they reported a prevalence rate of 5.77%. This group of patients is a fair representation of the general population, and has been used to determine the HIV seroprevalence in some countries [6]. Also, Sagay et al., in 2005, showed a prevalence rate of 8.2% among 2,657 pregnant women attending antenatal clinic in Jos [7].

Among some people regarded as high risk groups, high prevalence rates were encountered in different parts of the

Table 1. HIV prevalence by state, 1991-2003 (adapted from FMOH sentinel report, 2003)

S/N	State	1991/92	1993/94	1995/96	1999	2001	2003
1	Adamawa	0.3	1.3	5.3	5.0	4.5	7.6
2	Anambra	0.4	2.4	5.3	6.0	6.5	3.8
3	Benue	1.6	4.7	2.3	16.8	13.5	9.3
4	Borno	4.4	6.4	1.0	4.5	4.5	3.2
5	Cross River	0.0	4.1	1.4	5.8	8.0	12.0
6	Delta	0.8	5.1	2.3	4.2	5.8	5.0
7	Edo	0.0	1.8	3.0	5.9	5.7	4.3
8	Enugu	1.3	3.7	10.2	4.7	5.2	4.9
9	Kaduna	0.9	4.6	7.5(estimated)	11.6	5.6	6.0
10	Kano	0.0	0.4	2.5(estimated)	4.3	3.8	4.1
11	Kwara	0.4	2.4	1.7	3.2	4.3	2.7
12	Lagos	1.9	6.8	-	6.7	3.5	4.7
13	Osun	0.0	1.4	1.6	3.7	4.3	1.2
14	Oyo	0.1	0.2	0.4	3.5	4.2	3.9
15	Plateau	6.2	8.2	11.0	6.1	8.5	6.3
16	Sokoto	1.8	1.6	-	2.7	2.8	4.5
17	Abia	Not done	Not done	Not done	3.0	3.3	3.7
18	Akwa Ibom	ND*	ND	ND	12.5	10.7	7.2
19	Bauchi	ND	ND	ND	3.0	6.8	4.8
20	Bayelsa	ND	ND	ND	4.3	7.2	4.0
21	Ebonyi	ND	ND	ND	9.3	6.2	4.5
22	Ekiti	ND	ND	ND	2.2	3.2	2.0
23	Gombe	ND	ND	ND	4.7	8.2	6.8
24	Imo	ND	ND	ND	7.8	4.3	3.1
25	Jigawa	ND	ND	1.7	1.7	1.8	2.0
26	Katsina	ND	ND	ND	2.3	3.5	2.8
27	Kebbi	ND	ND	ND	3.7	4.0	2.5
28	Kogi	ND	ND	2.3	5.2	5.7	5.7
29	Nasarawa	ND	ND	ND	10.8	8.1	6.5
30	Niger	ND	ND	ND	6.7	4.5	7.0
31	Ogun	ND	ND	0.1	2.5	3.5	1.5
32	Ondo	ND	ND	ND	2.9	6.7	2.3
33	Rivers	ND	ND	1.0	3.3	7.7	6.6
34	Taraba	ND	ND	6.0	5.5	6.2	6.0
35	Yobe	ND	ND	ND	1.9	3.5	3.8
36	Zamfara	ND	ND	ND	2.7	3.5	3.3
37	Fct	ND	ND	ND	7.2	10.2	8.4

*ND= nor done.

country. Kehinde et al., in Ibadan (2001), reported a prevalence of 21.9% among 210 patients attending special treatment clinic [8]. In Port Harcourt, a study among intending couples reported a rate of 20.8% [9], while among infertile couples, a prevalence of 6.82% was reported in 2002 in Nnewi [10].

Kaposi's sarcoma and herpes zoster are commonly associated with HIV infection. A prevalence rate of 60% was found among Kaposi's sarcoma patients in Jos, 2005 [11], and of 69.2% among patients with herpes zoster, in Benin City, 2004 [12]. However, only a rate of 4.2% was recorded by Campbell et al., in 1999, among patients with cancer of the cervix receiving radiotherapy in Ibadan [13]. An overwhelming ten out of 11 children aged from four weeks to 11 months with acquired rectal fistulae were found to be HIV-positive in Jos. All their mothers were HIV-positive [14]. In Ile Ife, Adejuyigbe et al. screened 401 paediatric patients aged between three days and 17 years, presenting features of immunosuppression, and reported a prevalence rate of 20% [15].

A recent study released on Thisday Online Newspaper, in October 2005, being a study in the State of Plateau, conducted by the State's AIDS Control Agency (PLACA), between 1999

and 2004, reported a prevalence rate of 27% among 122,321 people screened in the State, with some local government areas having a prevalence as high as 48.8% and 100%[16]. This is indeed higher than the 6.3% recorded during the national survey for the State.

Knowledge, Attitude and Practice

Knowledge has been identified as a powerful tool for positive change in all aspects of human endeavor. This is also true in the fight against HIV/AIDS. AIDS-related activities aimed at creating awareness and behavioral changes have been undertaken by the government and non-governmental organizations to increase the awareness level of the general population about HIV/AIDS. In the 80's and early 90's, the people's knowledge about HIV was indeed low, and filled with several misconceptions, especially among those with no formal education. In Jos, it was documented that 80% of those with no formal education had not heard of HIV in 1987. Among the literate ones, those who knew about AIDS believed it was retribution from God for promiscuity, and believed that casual contacts could transmit the virus from an infected person to a healthy one [17].

This trend has however been reversed in this new millennium, with a high percentage of the population having good and accurate knowledge of all the aspect of the epidemic [18-20]. It is however disheartening to note that this high level of knowledge about the disease did not result into appreciable attitudinal change and behavior modification among Nigerians [20, 22]

Anochei and Ikpeme, in Port Harcourt (2003), showed that among 462 final year primary school students, 97.6% of them reported to have heard about the disease, though only 47.6% knew the correct meaning of AIDS, and 59% were aware of its sexual mode of transmission [18]. A study conducted by Lipase et al. on the awareness and attitude of antenatal client towards HIV voluntary counseling and testing (VCT), in Kano (2005), revealed a good level of awareness and knowledge of the disease in 57% of them. Eighty-one percent of them approved VCT, while 13% disapproved it for fear of stigmatization, isolation and effect on their marriage security. They also found that those having tertiary education were three times more likely to accept VCT than those with a low level of education. [17].

Ogbuji (2005) analyzed the knowledge about HIV/AIDS and sexual practice among university students in Ibadan, and found out that over 90% of them had good knowledge about the disease and its transmission. Twenty-nine percent of the 217 students assessed were sexually active, but only 16.6% of them had used condom for protection in the three months before the study, although 88% knew that condom could be used to prevent HIV transmission. He concluded that although they were knowledgeable about HIV/AIDS, many did not practice what they knew [20]. Sunmola [21], in the same institution, found out that students believe that condom hinders their sexual satisfaction, causes health problems for them, and reduces their sexual interest; and therefore were not willing to use it.

A similar study among undergraduates in Enugu (2004) reported that all the 505 participants had a high knowledge about the infection. Sixty-eight point nine percent reported to have engaged in sexual intercourse in the past, but the mean number of their sexual partners did not differ even after they became aware of the infection. There was however a significant tendency towards a more consistent use of condom [22]. The situation is similar in Olabisi Olabanjo University Teaching Hospital, in the State of Ogun, where 67.5% of 498 clinical students (student doctors) had already had sexual intercourse. Out of these, 49.8% used contraceptives, (condom = 54.6% and rhythm method = 39.5%), and of this number, only 21.1% used contraceptive in their last sexual exposure. Eleven point nine percent of the students disapproved the use of contraceptives by singles [23].

In a school of health technology, Yaba (2004) found out that 64% of the students had good knowledge about the disease. Seventy-five percent of them were single while 25% were married, but as much as 72% were sexually active. Forty-eight percent of them engaged in casual sex, while 9% had multiple sexual partners. Condom use was reportedly high in this group, with 53% using condom. Complaints like partner and personal dislike, as well as reduction in sexual pleasure, were reasons for non-condom use [24].

This pattern of high sexual exposure among the youths is also seen among our secondary school students. Owolabi et al., in a study of sexual behavior of secondary school adolescents in Ilesa, showed that 63% of 450 students interviewed had already had sexual intercourse, especially the males. The median age of sexual exposure was 12 years (6-9 years). Many of them had many sexual partners, but their knowledge of sexually transmitted diseases (STD) and AIDS was low [25]. In fact, it was showed by another group that about 86.7% of these students did not use contraceptives [5].

Oshi et al. (2005) reported that secondary school teachers in Eastern Nigeria have good knowledge of HIV/AIDS, but were not passing the information to their students because of cultural and social inhibitions. They also have not been trained adequately, nor motivated to teach sex education to their students [26]. This situation can be seen in several communities in Nigeria. In Ile Ife, it was reported that 92% of parents, 90% of teachers, and 78% of students of secondary school support the introduction of sex education into the school's curriculum, and believed that it would help prevent unwanted pregnancies, enhance healthy relationships between opposite sexes, and prevent the transmission of HIV/AIDS [27]. Therefore, sex education should be introduced into secondary schools curriculum in order to curb this ugly trend among this population.

Of 896 adolescents in the State of Niger, 33% had already had first sexual experience, with one half having more than one sexual partner. Ninety-one point nine percent had heard

of HIV/AIDS and STD, while contraceptive use varied from 0.7% to 12.5%. They discovered that more Gwari and Hausa respondents did not use any form of protection during their first sexual experience, compared to Yoruba and Igbo respondents [28]. This may be related to the cultural values of the various ethnic groups.

The situation is worse among adolescents, working in markets and motor parks, as up to 80% of the males and 66% of the females have had sexual experience, with 71% of the males and 51% of the women having multiple concurrent sexual partners. Means of preventing pregnancies or STD were rarely employed. Seventy percent were knowledgeable about HIV, though only 12% were aware that infected people could be asymptomatic [29]. Among commercial bus drivers, it was found by Ekenem et al. [30] that 74.3% of 395 said that had multiple sexual partners, having a strong sexual network, and with previous histories of STD. Condom ever use was 65.5%, while consistent use was only 11.6% among them. About 96.4% agreed that they were a high risk group for STD, while surprisingly, 87.6% thought they could not be infected with HIV.

The situation among naval staff is also disturbing. Nwokoji and Ajuwon (2004) reported that of 480 naval personnel interviewed, 25% of them still had poor knowledge about HIV transmission. Eighty-eight point one percent of them, a rather high figure, had a life time multiple sexual partners, ranging from 1-40, with mean of 5.1. Thirty-two percent of the officers have had sex with female sex workers, 19.9% of them occurring within six months of the study, and 41 reported condom use. Very high risky behaviors were observed in officers on outside postings [31].

A number of married men engage in extramarital affairs, and also patronizes sex workers. Eleven percent of 1,153 men interviewed across Nigeria had extramarital affairs, this being affected by religion, wealth, and age of sexual debut [3]. This is similar to the findings of Lawoyin in 2004, who reported 10% of 3,178 married men visiting sex workers in the past six months, while 46% used condom in their last contact, in Ibadan metropolis [32]. Condom use in marriage is quite low, as only 30% of monogamous men had reported that always use condom, with only 15% using it currently, and mainly for protection against pregnancies, and not necessarily for the prevention of HIV/AIDS [33].

The knowledge of HIV was also found to be high in pregnant women interviewed in Calabar, but the knowledge of mother to child transmission was poor, as only 23% knew that HIV could be transmitted by breast milk [34].

Transmission/Risk Factors

The mode of spread of the human immunodeficiency virus has been clearly documented. Heterosexual contacts with infected persons that lead to the sharing of seminal and vaginal fluids are said to be responsible for the greatest number of infections, especially in sub-Saharan Africa. Other means of transmission include transfusion of infected blood and blood products, homosexual relationship among men, sharing of needles and sharp piercing instruments with infected persons, and also from an infected mother to her child [35].

As seen from the foregoing, there is an increasing high rate of sexual practice in the country, ranging from students in the secondary schools to the tertiary institutions, youths in the garage and motor parks, the drivers, uniformed men, and even among married men. This has led to a high number of people with multiple sexual partners and to an increase in the number of visits to sex workers.

Vertical transmission of the virus can occur from an infected mother to her child via placenta in utero, during labour and delivery, and also through the breast milk. With the high prevalence rate of HIV in Nigeria, it was projected using the Estimation and Projection Package (EPP), in 2003, that the total number of people living with the virus at the end of that year would be between 3.2 and 3.8 million. In the low prevalence scenario, this is expected to rise to 3.5 million by the end of 2005, and 3.7 million by 2008, while in the high scenario, the number will rise to 4.0 million by 2005, and 4.3 million by 2008. There would be a cumulative death of 3.6-4.2 million from AIDS [2] (Table 2). By the end of 2002, there were about 849,000 orphans resulting from AIDS and about 755,000 paediatric AIDS in the country. Interventions for the prevention of mother to child transmission include VCT, use of antiretroviral drugs (ARV), and modification of obstetric practices with infant feeding options [36].

Iliyasu et al., in Kano, set out to determine the sociodemographic characteristics and risk factors among HIV/AIDS patients. Of the 205 positive patients seen, the male to female was 2.1:1. Thirty-eight point five percent had secondary education, 36.1% had tertiary education and 10.2% had only primary education. Fifty percent of them were Hausas. Muslims accounted for 60% of the cases, while Christians accounted for 40% (Kano is a predominantly Hausa and Muslim population). Sixty-four percent of them were married, 23% single and 11.0% divorced, with 17% having multiple sexual partners. Sixty-seven percent of them reported occasional use of condom, while 8.3% never used it, with only 18% using it regularly [37]. Similarly, it was showed in Jos that maternal age of 20-29 years and multiple marriages were risk factors for HIV infection, the infection rate being higher here among Christians [7].

A study conducted in Ile Ife (2003) among paediatric patients aged between three days and 17 years showed that 20% of the studied population were HIV-positive (n = 401); 80% of them got it from their mothers, 14%by blood transfusion, while 4% by sexual intercourse. Symptoms like weight loss, failure to thrive, diarrhea and skin disease were the most common. About 46.3% of the children died within four months of the study from pneumonia or septicemia [15]. Rufus, in 2000, identified blood transfusion and mother to child transmission as the major modes of transmission of HIV among paediatric patients [38].

Among induced abortion seekers in Benin City, 95.2% of the total of 1,051 had multiple sexual partners, while 68.8%

Table 2. HIV Prevalence and projections (adapted from FMOH sentinel report, 2003)

		2003	2004	2005	2006	2007	2008
1	HIV population (millions)						
	Male	1.45-1.73	1.51-1.78	1.55-1.82	1.59-1.87	1.64-1.92	1.68-1.97
	Female	1.75-2.06	1.8-2.11	1.84-2.16	1.88-2.2	1.93-2.25	1.98-2.31
	TOTAL	3.22-3.79	3.31-3.89	3.39-3.98	3.48-4.07	3.56-4.17	3.66-4.28
2	New AIDS cases (thousands)						
	Male	144.19-170.61	151.25-178.71	157.27-185.57	162.44-191.43	166.97-196.53	171.15-201.24
	Female	160.63-190.26	169.12-200.02	175.76-207.57	180.74-213.1	184.63-217.35	187.73-220.66
	Total	304.82-360.87	320.36-378.73	333.02-393.14	343.18-404.52	351.6-413.88	358.87-421.9
3	Annual HIV+ births (thousands)						
	Total	75.13-88.44	75.52-88.78	75.8-89.02	76.07-89.28	76.53-89.78	76.86-90.15
	Percent	1.47-1.74	1.46-1.72	1.45-1.71	1.44-1.7	1.43-1.69	1.42-1.68
4	Annual AIDS death (thousands)						
	Male	135.95-162.05	143.9-171.38	150.68-179.28	156.46-185.56	161.44-191.68	172.37-196.61
	Female	149.99-179.01	160.06-190.93	168.28-200.5	174.69-207.87	179.5-213.27	190.81-217.37
	TOTAL	285.93-341.06	303.96-362.32	318.97-379.78	331.15-393.83	340.95-404.95	363.18-413.985
Cumulative AIDS death (mill)							
	Male	0.95-1.13	1.1-1.31	1.25-1.49	1.41-1.67	1.57-1.86	1.74-2.06
	Female	0.97-1.15	1.13-1.34	1.3-1.54	1.47-1.75	1.65-1.96	1.84-2.18
	Total	1.92-2.29	2.23-2.65	2.55-3.03	2.88-3.42	3.22-3.83	3.58-4.24

regularly practiced unprotected sex, although all were aware of HIV/AIDS. Only 13% of them accepted to be tested for HIV [39]. In the same city, Offor et al. reported a mother to child transmission in 33.3% of 246 women reporting for delivery [40]. Teenage pregnancy was identified as a major risk factor for HIV acquisition, as one out of three teenage mothers were positive (15-19 years), against none in mothers above 39 years [41].

HIV transmission via transfusion of an infected blood is also a major factor in Nigeria. Dorosinmi et al., in Ile Ife, found out that, between 1993 and2000, about 6.7% of the blood units donated to the blood banks by 16,080 individuals were positive, this being higher among paid donors, than in voluntary donors [42]. Twenty-nine point nine percent and 23.2% out of 2,067 and other 3,016, respectively, blood units donated in the State of Plateau were HIV-positive. These could have been transfused to innocent patients without the benefit of screening. Donated blood is also used for assessing HIV prevalence sometimes as shown by the fact that 88.1% and 86.7% of the 4,361 and 4,952, respectively, blood units screened in LUTH were from blood donors [43]. Out of 18 children that were positive for HIV (n = 263), 12 of them were transfused, and only two of them had positive mothers [44]. Blood donation is usually done for various reasons, ranging from antenatal registration benefit (67.1%) to monetary gain (13%) in Lagos [45].

Sexually transmitted infections (STI) are poorly recognized and inadequately treated in Nigeria, in spite of the fact that they constitute a major risk factor in HIV transmission [8]. HIV prevalence of 12.9% was reported among women with vaginal discharge in a gynaecological clinic in LUTH. Candida was the commonest cause of vaginal discharge in this group [46].

Kehinde and Lawoyin in Ibadan studied STI/HIV co-infection in 210 patients. Nine point five percent of them had laboratory diagnosis of STI, with a HIV prevalence of 21.9%. Gonorhoea and candidiasis topped the list (40% each). Sixty-two point five percent of the patients with gonorhoea had HIV, while 25% of those with trichomoniasis also were HIV-positive. The STI/HIV co-infection rate stood at 30% [8]. This situation was a little different in the special treatment clinic where 85.7% had STI, while 29.1% tested positive to HIV. Co-infection was established in 19.5% [57].

Out of 700 clients in another study, 21.5% had confirmed STI, while 15.8% were positive for HIV. Syphilis was the most prevalent STI here (25.3%), while 54.65% of those positive for STI had co-infection with HIV [48]. If intervention measures in the form of peer education, training of STI treatment providers, health clubs in schools and public lectures are provided in communities, positive change in attitude can be seen with early treatment among Nigerian youths [49].

Occupational risk is also a means whereby HIV can be acquired among health workers. Obi et al. assessed the occupational risk, attitude and behavior of surgeons in South East Nigeria. Of the 264 surgeons interviewed, 40.2% reported needle stick injury in the past five years, while 26% have had a blood splash. Ninety-two percent of them support preoperative screening of patients. The use of protective measures was high among them, as 100% used aprons, 65.2% double gloves and 30% used protective goggles. However, 89% reported operating on patients with uncovered wound;

5% were contaminated. Seventy-nine point five percent believed that infected patients should not be discriminated, regarding the management of provided protective measures [50]. In Calabar, however, it was shown that among three tertiary institutions, material and equipments needed for protective and hygienic practices were inadequate. Where they were available, they were found to be inconsistently used, exposing the staffs to potentially infectious materials [51]. Among student nurses and midwifes, it was shown that they have poor knowledge of WHO recommended universal precaution for the prevention of HIV transmission and are not well supervised, though they perform high risk behavior [52].

The role of traditional healers in the spread of HIV/AIDS needs to be looked into, since 60% of the population patronizes them. Peters et al. (2004) looked into this problem in South East Nigeria. It was noted that continuous usage of unsterilized instruments and cross contamination with blood and body fluids were prevalent in their practices. Patient knowledge about HIV/AIDS was poor, only about 30% [53].

Opportunistic Infections

This era of HIV epidemic has witnessed the resurgence of previously silent or controlled infections, mainly because of the immune suppression caused by HIV. Diseases like *Pneumocystis carinii* pneumonia, coccidioidomycosis, cryptosporidiosis, histoplasmosis, tuberculosis, *Mycobacterium avium* complex and others, which were hitherto suppressed, having now emerged in full force among infected individuals.

The world, for instance, has witnessed the resurgence of tuberculosis (TB). It was reported that TB-related deaths occurred in 1995 more than in any other year before then in history, almost 3 million, compared to 2.1 million for the TB epidemic around 1990. In the next 50 years, as many as 500 million people may develop TB if current rate continues, especially, multidrug-resistant TB [54]. This return of an old enemy has been attributed to a number of factors, among which HIV infection has emerged as the strongest risk factor, as observed in Ibadan, where 32.8% of 50 HIV-positive patients had active pulmonary TB (PTB) [55], and 269 patients newly diagnosed with PTB had a HIV prevalence rate of 14.9% [56]. In Zaria, 30% of HIV-positive patient had PTB [57]. The use of modified short course therapy in newly diagnosed cases of PTB in HIV patients using 2EHRZ/6EH was shown to be very effective, with 90% sputum conversion in two months and no relapse after 18 months (E = ethambutol, H = isoniazide, R = rifampicin, and Z = pyrazinamide) [58].

More than 40 oral manifestations of HIV infection have been recorded, and between 70% and 90% of patients with HIV infection will have at least one oral manifestation at some time during the course of their disease [59]. In one study in Lagos, out of 53 patients with oral lesion suggestive of HIV infection, 38 (72%) consented to HIV screening, of which 92% of them were confirmed as HIV-positive. Oral candidiasis was the commonest lesion seen (43%), followed by herpes zoster (23%). Erythema multiforme was seen in 6% of these patients [60]. In Zaria it was shown that among diseases complicating HIV, TB accounted for 30%, and active bacterial infection for 24%, candidiasis for 14%, and Kaposi's sarcoma for 2%. Other symptoms of presentation included weight loss, pyrexia, diarrhea, lymphadenopathy, anemia, and pruritic dermatosis [57]. Okeke et al., in Jos, also showed that the incidence of esophageal candidiasis was higher among HIV-infected patients compared to negative individuals [61]. Apart from the above, there has also happened a wide spread increase in the incidence of malignancies, including non-Hodgkin lymphomas, cervical cancers, and Kaposi's sarcoma, following the HIV epidemic [62]. It has been identified as a risk factor for pre-malignant and malignant conditions of the cervix. Thirty-one point three percent of HIV-infected women, compared with 7.8% of negatives, showed evidence of cervical dysplasia (from Pap smear). This abnormality was higher in patients with lower CD4 count. The studied population was generally promiscuous, with 90% having multiple sexual partners, a risk factor for cervical dysplasia [63].

Similarly, Mohammed et al., in Kano, showed that in 32 patients with histological diagnosis of Kaposi's sarcoma, 60% were HIV-positive, and these patients tended to have multiple lesions, compared to negative individuals [11]. About 69.2% of 52 patients with herpes zoster in Benin City were HIV-positive. They tended to have multi dermatomal involvement with trigeminal nerve affectation, and more systemic symptoms than the HIV-negative individuals [64]. A study in Ibadan however reported a low prevalence of 6% among patients with malignancies in 2004 [62]. Other infections like toxoplasmosis, a rare infection, has a prevalence of 38% in HIV-positive individuals [65], while another study reported pseudo-membranous oral candidiasis and angular cheilitis to be more frequent in HIV-positive individuals compared to non-infected people (33.3% and 21% compared with 4.3% and 1.8%, respectively) [66].

HIV Types/Subtypes

It has been shown that there are two types of the human immunodeficiency virus, types 1 and 2, both of which are the etiological agents of AIDS. Both types have similar ways of transmission, but differ in terms of origin, rate of transmission, disease progression, and geographical distribution. Type 1 is the commonest type worldwide, accounting for the majority of HIV infections, while type 2 is restricted majorly to West Africa, accounting for a small percentage of infections. It exhibits a longer latency period, slower progression towards disease, lower viral burden, and decreased transmissibility than HIV 1. Both types are present in Nigeria [67].

HIV-1 strains from around the world can be placed into two major genotypic subgroups: the M (main) and O (outlier) group. Within the M group, there are discrete genotypic clusters (genotypes or clades), being given a letter designation to them; subtypes from **A** to **I** were identified. These subtypes are generally confined to specific geographical regions [43], some of these subtypes have been characterized in Nigeria.

Partial sequencing of four HIV-1 isolates demonstrated the presence of subtype G viruses in Nigeria [68]. A new strain of HIV-1, designated HIV-1 IbNg, was isolated in Ibadan, Nigeria [69]. A full genome sequence of HIV-1 IbNg was later shown to cluster with subtype A, but with unique genetic features [70]. The presence of subtypes G and IbNg were further documented in Nigeria [71]. A molecular epidemiology of HIV-1 covering some parts of Nigeria (252 samples) established the predominance of subtypes G and CRF02_AG in Nigeria [72]. In one study, 14 out of 18 samples were subtype G, and four were grouped in the CRF02_AG subtype [73]. Furthermore, a national molecular epidemiological study covering the entire country documented the predominance of subtypes G and CRF02_AG in Nigeria [74]. Montavon C et al. had also showed that 12 of 17 (70.6%) subtype A viruses in Nigeria were recombinant AG-IBNG viruses [75].

The presence of HIV-2 in Nigeria has been confirmed serologically [76]. HIV-2 was identified in 14% of 80 samples, 43.5% were HIV-1 and the remaining 42% had dual infection, in a study conducted in Zaria (2002) [57]. Blood samples of patients from West Africa, analyzed in the United Kingdom, showed that 69% were type 1 and 6% were type 2 or type 1 and 2 co-infected (Nigeria = 0-1%, Gambia 11.9%-15.2%) [77]. Eighteen HIV-2 isolates were recently characterized genetically; 16 were subtype A and associated with heterotypic infections and two were subtype B and were associated with monotypic infections [67].

It can therefore be said that subtypes A, G, B, C and J, have been identified in Nigeria, with several recombinant forms, though in varying proportion.

Co-Infection

Sometimes, HIV does not exist alone, and cases of co-infection with other viruses have been encountered. In Niger Delta region, hepatitis B virus (HBV) was found in 9.7% of 342 HIV-positive patients, being highest among unmarried individuals aged between 33 and 39. It was also higher in commercial sex workers (13.3%) [78]. Among paediatric patients, HIV/HBV co-infection was seen in 2.5% of healthy and 1.9 % of malnourished children, while HBV alone was seen in 20% and 26% in both groups respectively [79]. Out of 5,737 blood donors screened in Benin, 7% were positive for HIV, 11% for HBV, while 0.64% had co-infection [80].

Hepatitis C virus (HCV) is another infection commonly associated with HIV infection. This co-infection is associated with higher incidence of liver injury, hepatic decompensation, and decreased survival time than in monoinfections. Agwale et al. showed that in 146 patients HIV-positive, 8.2% were positive for HCV, with genotypes 1 prevailing (nine out of 12) [81]. Forbi et al. recently found among 180 confirmed HIV-1-infected samples, co-infection rates of HBV/HIV, HCV/HIV and HBV/HCV/HIV of 20.6%, 11.1% and 7.2%, respectively. HIV alone was present in 61.1% [82].

Olaleye and Ekweozor demonstrated the presence of the human T-lymphotropic virus (HTLV) type I or II in association with HIV in eight out of 4,153 (0.2%) samples, with one patient being positive for four of the retroviruses [83].

Diagnosis

Serological methods based on ELISA and Western blot test for the detection of HIV antibodies are used for the diagnosis of HIV, though they may not be effective in the window period of infection. Antigen detection ELISA, and polymerase chain reactions should be used in such situations [84], although these means are still not common in Nigeria.

Good education and counseling would cause appreciable number of people to consent to screening. Seventy-eight percent of 262 women who were counseled during pregnancy accepted to be tested [85]. Ninety-six point one percent, in another group of pregnant women, were also willing to undergo testing if it helped in preventing their children from getting the infection [86]. Some people however are afraid of testing for several reasons. This was seen in a study that showed only 13% of women accepting to be tested, among 1,051 induced abortion seekers in Benin City [39]. Good counseling before testing would greatly reduce this trend, apart from psychologically preparing the patient.

Other tests like CD4 count and viral load are also conducted to monitor patients, especially those on treatment. Njoku et al. determined the mean CD4 T cell count among healthy Nigerians. They found that healthy Nigerians in a study of 1,232 patients had a mean CD4 cell count of 821 +/-12 cells/uL, while HIV-positive asymptomatic patients had a mean CD4 cell count of 369 +/-14 cells/uL, and symptomatic patients had 163 +/-13 cells/uL [87]. In another study with 200 HIV-positive patients and controls, the findings were as follows: 35% had CD4 count of less than 200 cell/uL, 600 cells/uL for controls, CD3+ 0.51 +/- 0.24.10^9/L for patients, and 1.04 +/- 0.71.10^9/L for controls. CD8+ 0.29 +/- 0.19.10^9/L for patients and 0.44.10^9/L for controls [57]. Others found CD4 count of 602 cells/uL, SD 151, for HIV-negative subjects [66].

Several hematological parameters are found to be deranged in HIV-positive patients, with high rate of anemia (80%), leucopenia (10%), thrombocytopenia and raised ESR, as reported in one study [88], with low trace elements [89]. These parameters need to receive adequate attention for possible correction in this group of patients.

Treatment

Although no complete cure exist for HIV infection, highly active antiretroviral therapy (HAART) has been used to reduce the morbidity and mortality of HIV world wide. Nigeria has adopted the use of lamivudine, nevirapine and stavudine as first line drugs, and they have been showed to be very effective. The government has been involved in the provision of free ARV to infected patients, as well as other donor agencies like the AIDS Prevention Initiative in Nigeria (APIN), President's Emergency Plan for AIDS Relief (PEPFAR) and others in Nigeria. Their activities however have been limited to a few centers,

especially in the urban areas, with only a small percentage of those infected having access to these drugs.

The use of these drugs in 50 patients followed up for the period of 12 months showed viral decrease by 1.79 log10 cells/mL, CD4 increase of 186 cells/uL, opportunistic infection decreasing in 82%, and weight gain of 4.8 Kg/m^2. Adherence was over 85% in this group [90]. Idoko et al. conducted a clinical trial on the effectiveness of nelfinavir, zalcitabine and zidovudine among 40 patients. There was viral load reductions of 1 log (25%), 2 log (17%), and 8% had undetected viral load in 24 weeks. An average of 27 cells/uL of CD4 increase was observed in 80% of them, with appreciable weight gain. However, 21% showed increase in their viral load, while 15% experienced decrease in their CD4 count and 5% withdrew due to adverse reaction. This combination was adjudged to be effective and relatively safe in treating patients with HIV [91]. More studies are needed in this area to give us the most effective and safest combinations to use in Nigeria, especially in this era of newer ARVs. There is however the increasing need for adequate monitoring of these patients using viral load and drug resistance tests, which currently have been lacking in the current treatment programmes in the country. This will go a long way in improving the effectiveness of the current programme.

Drug Resistance

Failure to suppress HIV replication effectively with an antiretroviral agent is strongly correlated with the emergence of drug resistance. In Nigeria, access to ARV has been limited, and this has given rise to suboptimal therapy, as well as to enhancing drug resistance.

Samples collected from Nigeria in 1996 showed no evidence of HIV-1 drug resistance. However, secondary substitutions associated with protease inhibitor (PI) resistance were observed in all the ten isolates characterized (positions L10V, M36I and L89M) [92]. Furthermore, 18 isolates collected in 1999 from drug-naïve patients were genetypically and phenotypically analyzed (14/18 isolates were subtype G and two were subtype CRF02_AG). All the isolates had mutations/polymorphic substitutions at six locations, two of which have been associated with resistance to PI (K20I and M36I). The phenotypic profiles of the viruses correlated well with the observed genotypes (two isolates showed slightly reduced susceptibility to one or two of the five PIs assessed (ritonavir and ritonavir/nelfinavir) and all 18 viruses were susceptible to all nucleoside reverse transcriptase inhibitors (NRTIs) and non-nucleoside reverse transcriptase inhibitors (NNRTIs) analyzed [73]. Cases of drug-selected reduced susceptibility to lamivudine, nevirapine, nelfinavir and ritonavir were later documented by Paxinos et al. in Nigeria. They suggested that polymorphism in pol may be responsible for the reduced susceptibility to ARV, in non-B-infected patients [93]. Of the 76 HIV strains that were analyzed in one study, 89% harbored multiple PI resistance-associated substitutions. This comprises both the major 461 and the other minor mutations (10V/1, 321, 361, 461, 47V, 71V and others) [94].

Recently 50 isolates from drug-naïve patients were characterized; 6/35 harbored primary mutations to reverse transcriptase inhibitors and 3/6 were infected with CRF02_cpx [95]. In addition, a larger study was conducted at ART enrollment involving 93 drug-naïve patients. They found out that 17 patients (18.3%) had viruses harboring mutations known to be linked with drug resistance like M184V, V179E, AND L10I/V179E [96].

Discrimination

People living with HIV/AIDS need a lot of care and love, but are often discriminated by friends, family, the community, and even health care providers. Reis et al. found out that 9% of health care professionals refused care for HIV patients. Fifty-nine percent said they should be confined in a separate ward, 91% said other staffs should be informed of patients status, while 8% said treating HIV patients is a waste of precious resources [4]. Among 254 journalists interviewed, 49.6% said AIDS patients should be detained in hospitals to prevent the spread of the disease [97]. Despite this position, about 47.7% of surgeons in one study reported operating on HIV-positive patients [98]. About 26 infected patients also received both elective and emergency surgical operations, predominantly pregnancy-related, in both private and company clinics in Port Harcourt [99].

Vaccines/Microbicides

Attempts to produce a viable vaccine for the HIV infection have not been successful over time, although efforts have been made in this direction, some very promising. Agwale et al., in molecular surveillance of HIV strains in Nigeria, in preparation for vaccine trails, have shown that there is a clear dominance and widespread distribution of subtypes A and G in fairly equal proportions, and with several recombinant forms. They suggest that vaccine design for use in this country should incorporate the gene(s) of both subtypes [74]. Agwale et al. (personal communication) have made appreciable efforts in vaccine development and candidate HIV DNA vaccines have been developed utilizing the sequences from predominant subtypes and these candidates have been shown to be immunogenic in animal models.

Several vaccine strategies have also been developed, aiming to produce broadly cross-neutralizing antibodies, and to afford protection through humoral mechanism [100]. Abalaka reported developing a therapeutic and preventive vaccine from blood of infected patients. He administered the therapeutic vaccine to 3,500 patients, while he took the preventive one alongside 300 healthy adults. He reported that, there were rapid improvement in the signs and symptoms of HIV, and serodeconversion of HIV (20 patients), HBV (50 patients) and HCV (16 patients). There was however no statistically significant effect on CD4 count and weight gain [100,101]. A lot of controversy, however, has surrounded

this vaccine, with the Federal Government banning its use, because according to the country's Vice-President, it has killed more people than it has cured, and also it was not approved by the appropriate regulatory agency before its use in the general population. The struggle was then taken to court for determination [102].

Several studies are ongoing in Nigeria and in other countries in an attempt to design an effective and safe vaccine against HIV. This is believed to be the only effective tool to reverse the epidemic. However, in addition to the development of an effective vaccine, microbicides are another group of products that are currently being promoted worldwide as new prevention technologies in HIV.

Microbicides are products, such as a gel or a cream, which could be applied topically to genital mucosal surfaces to prevent or significantly reduce the transmission of HIV and other disease-causing organisms during sexual intercourse. They could also take other forms, including films, suppositories, and slow-releasing sponges or vaginal rings.

In an expanded phase I trial conducted on cellulose sulphate (CS) in India, Nigeria and Uganda, Malonza et al. showed that a vaginal application of 6% cellulose sulfate twice daily for seven consecutive days is as safe and well tolerated as a similar regimen of K-Y Jelly. They suggested further development of 6% CS for the prevention of HIV and pregnancy. More studies therefore are required in this new field of HIV prevention in Nigeria [103].

Conclusion

It can be seen clearly from the foregoing that the HIV infection in Nigeria has come a long way. It affects people from all ways of life, both the young and the old, though the prevalence rate may differ among the various age groups and in the different geographical regions. The combined efforts of all the stakeholders have led to a gradual decline in the prevalence rate, after the initial peak of 5.8% in 2001. Present campaign efforts should focus more in attitudinal change in the population as well as mitigating the stigma and discrimination associated with the disease.

HIV treatment services, as well as adequate treatment of opportunistic infections, have been shown to be very beneficial, prolonging the lives of those living with the virus. This effort, by the Federal Government and other donor agencies, however, needs to be scaled up rapidly especially to the rural areas where the burden of the disease is still high, but they lacked the resources to effectively handle the scourge of the disease. Adequate treatment monitoring tests also need to be included in this package to further improve on the effectiveness of the treatment programme.

Current efforts in developing HIV vaccines relevant to the region are important and more researches are needed to understand the relevance of clades in vaccine design. Research on microbicides also needs to be intensified to protect the millions of women who are at risk of infection in Nigeria. It is therefore clear that only the integration of prevention and antiretroviral research programmes into a coherent programme is needed to address the public health needs that HIV/AIDS crisis represents for Nigeria.

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