**SEROPREVALENCE OF HUMAN IMMUNODEFICIENCY VIRUS (HIV) AMONG NEWLY ADMITTED STUDENTS OF BENUE STATE UNIVERSITY, MAKURDI, NIGERIA**

**ABSTRACT**

**Background & Aim:** Human Immunodeficiency Virus (HIV) is a virus that attacks the body's natural defence system. Without a strong immune system, the body finds it difficult to activate its defence mechanism. The last stage of HIV infection is Acquired Immunodeficiency Syndrome (AIDS). Epidemiological Survey of HIV, the causative agent of AIDS, was investigated among newly admitted students of Benue State University, Makurdi. This study was carried out to determine the prevalence of HIV antibodies among newly admitted students of the University. **Methodology:** A total of 500 freshly admitted Students to Benue State University were screened using structurally designed questionnaires and blood samples. Out of the 500 Students screened, 295(59%) were male and 205(41%) were female. Alere DetermineTM HIV-1/2 Test cards, HIV -1/2 Stat- Pak® Assay and Trinity Biotech UnigoldTM were used in a stepwise order for the detection of HIV antibodies in the blood samples of these fresh students. **Results and Discussion:** The overall prevalence rate of HIV was 32 (6.4%). The age group 21-25 years had the highest prevalence of HIV 19 (3.8%) compared to other age groups. Human Immunodeficiency Virus antibodies were more prevalent among females 19 (3.8%) than their male counterparts 13 (2.6%). Human Immunodeficiency Virus prevalence was higher among married students 20 (4.0%) than single students 12 (2.4%). The Chi-Square (χ2) analysis using Statistical Package for Social Science (SPSS) version 21.0 showed that there was no significant difference (P>0.05) between the age groups, sex, marital status, occupation and the prevalence of HIV among fresh students. **Conclusion and Recommendation:** The study shows that those having multiple sexual partners, unprotected sexual contact and a history of Sexually Transmitted Diseases, indicate significant differences (P<0.05) respectively. This study confirmed the presence of HIV antibodies among freshly admitted students. We therefore recommend free HIV screening and counselling services in all institutions of higher learning in the country.

Keywords: Human immunodeficiency virus (HIV), Acquired Immunodeficiency Syndrome (AIDS), Seroprevalence, Sexually Transmitted Diseases

1. **INTRODUCTION**

Human immunodeficiency virus (HIV) is the aetiological agent of the Acquired Immunodeficiency Syndromes (Crispin *et al., 2015*). Human Immuno-deficiency Virus is one of the human T-cell lymphotrophic retroviruses (human T-cell leukemia virus types I and II), of the family Retroviridae and sub-family Lentivirinae (Pritchard *et al.,* 2015). Human Immunodeficiency Virus is a virus that attacks the body's natural defence system. Without a strong immune system, the body finds it difficult to activate its defence mechanism. Both the virus and the infection it causes are called HIV (Akar-Ghibril, 2022; Fawole *et al.,* 2011 and Doitsh *et al.,* 2014). HIV can be transmitted through direct inoculation into the bloodstream or after contact and attachment through mucosal surfaces. It can also be transmitted through direct contact with a bodily fluid containing HIV such as blood, semen, vaginal fluid, and breastmilk, the transmission could involve anal, vaginal or oral sex, blood transfusion, contaminated hypodermic needles, exchange between mother and child during pregnancy, childbirth or breastfeeding (Azuonwu et al. 2012; Huldah and Renner, 2024; Uchechukwu et al. 2018). [White blood cells](http://www.webmd.com/hw-popup/white-blood-cell-leukocyte) play an important role in the immune system. Human Immuno-deficiency Virus infection destroys certain white blood cells called CD4+ cells. If too many CD4+ cells are destroyed, the body can no longer defend itself against infection. The last stage of HIV infection is Acquired Immunodeficiency Syndrome ([AIDS](http://www.webmd.com/hw-popup/aids)). People with AIDS have a low number of CD4+ cells which rarely occurs in healthy people (Uzochukwu *et al.,* 2011, Pritchard *et al.,* 2015 and Behrens *et al.,* 2016).

HIV/AIDS has become one of the most devastating diseases humanity has ever faced (Oppong and Oti-Oboadi, 2012). It has become a major public health concern with about half of new infections occurring in young people (UNAIDS, 2010; Oppong and Oti-Boadi, 2012). Sub-Saharan Africa, which has just over 10% of the world’s population, remains the most seriously affected region (UNAIDS, 2010; Oppong and Oti-Boadi, 2012).

Sub-Saharan Africa is home to some of the world’s most deadly diseases (Longdoh *et al.,* 2012). Sub-Saharan Africa represents a region with overlapping distribution of HIV and malaria, with approximately 22·5 million HIV patients, more than any other region in the world (UNAIDS, 2010; Longdoh *et al.,* 2012). UNAIDS (2010) estimates that in 2008, 2.7 million people worldwide became newly infected with HIV and 2 million people died from AIDS (Excler *et al.,* 2017). The total number of people living with HIV is estimated to be nearly 33.4 million, with 97% living in low- and mid-income countries and 48% being women (UNAIDS, 2009; Excler *et al.,* 2017).

Nigeria has the largest population in Africa with a population of over 150 million and an HIV prevalence of 4.6% in 2008 (FMOH, 2008; Sanyaolu *et al.,* 2013). It is estimated that 2.95 million individuals live with HIV/AIDS in Nigeria (WHO/UNAIDS/UNICEF, 2008) and integrated control efforts are immeasurably needed (Chukwujekwu *et al.,* 2010; Merrigan *et al.,* 2011; Sanyaolu *et al.,* 2013).

A more serious challenge today is the growing infection rates among adolescents in sub-Saharan Africa (Oppong and Oti-Boadi, 2012). This study aimed to investigate the prevalence of the Human Immuno-deficiency Virus (HIV) Seroprevalence among Newly Admitted Students of Benue State University, Makurdi, Benue State.

1. **MATERIALS AND METHODS**

**2.1 Study Area**

The study was carried out at university teaching hospital Makurdi. The town is located at Latitudes 7° 471and 10° 001 North and Longitudes 6° 251 and 8° 81 east of the equator. It is bounded by Guma Local Government Area to the North, Gwer East Local Government to the South, Gwer-West Local Government Area to the South-West and Doma Local Government Area of Nasarawa State to the North-West. It is situated in the Benue Valley on the bank of river Benue. The town is strategically located on the North to South transportation network by road and by rail between Nasarawa and Enugu States with a total land area of about 810 square kilometre (National Population Commission, 2009; Mngutyo and Ogwuche, 2013; Olayinka *et al.,* 2013).

**2.2 Study population:**

The population included in this study was newly admitted students, attending medical clinics in Benue State University, Makurdi. The samples obtained from these students were taken and analysed at the Department of Medical Microbiology and Parasitology, University Teaching Hospital Makurdi

**2.3 Sample Size Determination**

The sample size was determined using the standard formula adopted from Naing *et al.,* (2006).

N = Z2Pq

d2

Where n = the desired Sample size, when the population is greater than 10,000

Z=standard deviation at 95% confidence interval of 1.96.

P= the value of 56% were used (Niaing *et al.,* 2006)

Q= I-p

=1-0.56

=0.56

d =level of precision or standard error using 95% confidence interval at 0.5.

Therefore: n= (1.96)2 x 0.56 x 0.56

0.052

= 3.8416 × 0.3136/ 0.0025

n= 1.20471576/ 0.0025

= 481. 89.

Thus 500 samples were obtained for the purpose of the study

**2.4 INFORMED CONSENT AND ETHICAL CLEARANCE**

The surveys were performed at the request of the management of the university Clinic and respective student representative platforms for operational purposes to inform the institution of HIV programmes. Individual students only participated voluntarily in HIV testing after informed consent and questionnaires were answered. HIV testing was performed anonymously and no results were returned to participating individuals. No individual identifiers were collected. Those students who wished to know their HIV status were referred to VCT centres established in Benue State University Teaching Hospital.

**2.5 Method of Sample Collection and Preparation**

Questionnaires were distributed to the newly admitted students, attending the medical Clinic using the cross-sectional method of sampling. The completed biodata and risk factors involved in HIV transmission of each student were obtained with the aid of a structure-designed questionnaires.

Six ML (6ML) of venous blood was collected from 500 students attending a medical clinic at Benue State University. Three ML (3ML) were dispensed into a sterile dry tube containing no anticoagulant and 3ML each into a second EDTA anticoagulant tube, mixed and stored at 40C. The blood in the non-anticoagulated tubes was allowed to clot, and was centrifuged at 2,500 revolutions per minute for 10 minutes to separate the serum from the clotted cells. Both sera and plasma from EDTA tubes blood samples were separated and transferred into micro tubes using Pasteur pipettes. The samples were then stored in the freezer at -4oC at Benue State University Teaching Hospital, till the time of research.

**2.6 SCREENING FOR HIV 1 AND 2 ANTIBODIES**

The Abbott Determine, Chembio HIV-1/HIV-2 Stak Pak and Trinity Biotech UnigoldTM test kits which are single-use immune chromatographic, rapid screening tests for human immunodeficiency virus types 1 and 2 were employed in the detection of HIV-1/HIV-2 antibodies. All tests were carried out according to the manufacturer’s specifications. For the detection of the presence of HIV-1 and/or HIV-2 antibodies in the blood samples collected, a World Health Organization (WHO) approved kit called ‘Determine kit, was used. The kit was designed primarily to test for the presence of HIV-1 and/or HIV-2 antibodies in the blood of all students that screened. This Determine kit is both sensitive and specific (99-100%) and was used according to the manufacturer’s instructions. These kits are made up of strips impregnated with selenium colloid HIV antigen conjugate at one end and two reaction windows labelled as patient and control windows, respectively, at the other end. The samples that were non-reactive were considered and reported as HIV-negative. Any samples that were reactive on the first-line assay were retested again using a second-line assay different from the first (HIV 1/HIV 2 Stat-Pak). The samples that were reactive on both first and second-line assays were reported as HIV- positive. Uni-Gold HIV was used to check for discordance.

**2.7 Interpretation of test results**

When two red bars appeared in both the control and patient windows of the strip, the test was interpreted as positive. However, the appearance of only one red bar in the control window of the strip and the absence of the red bar in the patient window was interpreted as a negative test.

**2.8 Data analysis**

The statistical package for social sciences (SPSS 21.0) was used for data entry and analysis. The simple Percentage (%), means and Chi-square analysis (χ2) tests were used to test the difference proportions. A p-value less than 0.05 was considered to represent statistical significance.

**3. RESULTS**

3.1 **The Seroprevalence of HIV Infection among Newly Admitted Students of Benue State University in Relation to Sex.**

A total of 500 students newly admitted of Benue State University were screened for HIV infection using structurally designed questionnaires and blood samples. Out of the 500 Students screened, 295(59%) were male and 205(41%) were female. A total of 32 students out of the 500 Students screened for HIV infection using Alere DetermineTM, Trinity Biotech UnigoldTM and the chem-bio HIV-1/2 STAT PAK Assay were seropositive, accounting for the prevalence of 6.4%

**3.2 The Seroprevalence of HIV Infection among Newly Admitted Students of Benue State University in Relation to Age**

In relation to Age, this study showed that the highest prevalence was recorded among students aged 21-25 years 19 (3.8%) followed by students aged 15-20 years 7 (1.4%), students of aged 26-30 years 5(1.0%) and students of aged 31-35 years 1(0.2%) recorded low prevalence.

**3.3 The Seroprevalence of HIV Infection among Newly Admitted Students of Benue State University in Relation to Marital Status.**

Prevalence of 13(2.6%). Based on the Marital Status of students, this study showed the highest prevalence rate of 20(4.0%) was among the married students, and those students who responded to being single had an HIV prevalence rate of 12 (2.4%).

**3.4 The Seroprevalence of HIV Infection among Newly Admitted Students of Benue State University in Relation to History of Multiple Sex Partners.**

Considering another dangerous risk factor profile behaviour of the History of Multiple Sex Partners, those students that responded having the History of Multiple Sex Partners had an HIV infection prevalence rate of 28(5.6%) and the low HIV infection prevalence was recorded among the students that responded not having a history of multiple sex partners 4(0.8%).

**3.5 The Seroprevalence of HIV infection Among Newly Admitted Students of Benue State University in Relation to using Protective Measures during Sexual Intercourse.**

Another risky factor profile behaviour of not using protective measures during sexual intercourse in this study recorded the highest HIV infection prevalence for the newly admitted students of Benue State University which responded not using protective measures during sexual intercourse 28(5.6%) and low HIV infection prevalence was recorded among this particular group of students that responded that they have been using protective measures during sexual intercourse 4(0.8%).

**Table 1: The Seroprevalence of HIV Infection among newly admitted Students of Benue State University in Relation to Age.**

|  |  |  |  |
| --- | --- | --- | --- |
| Age | NO. Examined | Positive (%) | Negative (%) |
| 15-20 | 135 | 7(1.4%) | 128(25.6%) |
| 21-25 | 286 | 19(3.8%) | 267(53.4%) |
| 26-30 | 71 | 5(1.0%) | 66(13.2%) |
| 31-35 | 8 | 1(0.2%) | 7(1.4%) |
| Total | 500 | 32(6.4%) | 468(93.6%) |

(χ2 = (df=3) .907 P=0.824, P>0.05)

**Table 2: The Seroprevalence of HIV Infection among newly Admitted Students of Benue State University in Relation to Sex.**

|  |  |  |  |
| --- | --- | --- | --- |
| Sex | No. Examined | No. Positive (%) | No. Negative (%) |
| Male | 295 | 13(2.6%) | 364(72.8%) |
| Female | 205 | 17(3.8%) | 186(37.2%) |
| Total | 500 | 32(6.4%) | 468(93.6%) |

(χ2= (df=1).002, P=0.964, P>0.05).

**Table 3: The Seroprevalence of HIV Infection among newly Admitted Students of Benue State University in Relation to Marital Status.**

|  |  |  |  |
| --- | --- | --- | --- |
| Marital Status | No. Examined | No. Positive (%) | No.Negative (%) |
| Single | 376 | 12 (2.4%) | 364 (72.8%) |
| Married | 124 | 20 (4.0%) | 104 (20.8%) |
| Total | 500 | 32 (6.4%) | 468 (93.6%) |

(χ2= (df=1).157, P=0.002, P<0.05).

**Table 4: The Seroprevalence of HIV Infection among newly Admitted Students of Benue State University in Relation to History of Multiple Sex Partners.**

|  |  |  |  |
| --- | --- | --- | --- |
| Multiple Sex Patterns | No. Examined | No. Positive (%) | No. Negative (%) |
| YES | 109 | 28 (5.6%) | 81 (16.2%) |
| NO | 391 | 4 (0.8%) | 387 (77.4%) |
| Total | 500 | 32 (6.4%) | 468 (93.6%) |

(χ2= (df=1) 86.565, P=0.000, P<0.05).

**Table 5: The Seroprevalence of HIV infection Among Newly Admitted Students of Benue State University in Relation to using Protective Measures during Sexual Intercourse.**

|  |  |  |  |
| --- | --- | --- | --- |
| Protective Measures | NO. Examined | NO Positive (%) | NO. Negative (%) |
| YES | 239 | 4 (0.8%) | 235 (47.0%) |
| NO | 261 | 28 (5.6%) | 233 (46.6%) |
| Total | 500 | 32 (6.4%) | 468 (93.6%) |

**(**χ2= (df=1) 17.074, P=0.000, P<0.05).

**DISCUSSION**

The overall seroprevalence among newly admitted students of Benue State University is 6.4%. This is consistent with the 5.6% prevalent rate found in the general population of Benue State (Akinsola, 2015) and (6.0%) in Puerto Rico (Roberto *et al.,* 2016) but lower than (11%) positivity rate recorded by Frank-Peterside *et al*. (2013) from University of Port Harcourt among the undergraduate students (Frank-Peterside *et al.,* 2013). The seroprevalence rate obtained from this study is also similar (6.4%) to that research carried out by Gail among university students in the Eastern Cape (Gail, 2010). This agrees with the observations of Harding who reported that in developing countries, HIV infection in the university population reflects HIV prevalence rates among young adults in the communities who acquire the infection through multiple sexual contacts.

Similar rates were also reported in Kenya universities (7%) by Trendinginkenya (2016) and in Tanzania (6.4%) by Mmbaga *et al.* (2007). On the contrary, this seroprevalence was lower than the seropositivity rates found among other Kenya universities, University of Nairobi, Kenyatta University, Egerton University, and Kissi University showing rates of 15%, 13%, 11%, and 10% respectively (Trendinginkenya, 2016), South African’s large population 17.3% (CIA, 2011), and the much higher rate was found in Sub-sahara Africa, Swaziland (26.5%), Lesotho (23.1%), Botswana (23,0%) and South Africa (17.9%) and Kenya in Nairobi (Helgar *et al.,* 2015). The high positivity rates reported from these regions may be a reflection of the extremely high rates of social risk behaviours for HIV acquisition in these regions. Another higher prevalence was also recorded in Uyo Metropolis (34.2%), in Nigeria (Akinjogunla and Adegoke, 2009).

The prevalence of the 6.4% HIV infection rate reported in this study is higher than that reported by Nwachukwu and Orji (2008) who reported a prevalence of 4.8% among fresh graduates in Nigerian Universities. Contrastingly, the 6.4% prevalence of HIV reported in this study is higher than the 0.9% previously reported by Mbakwen-Aniebo *et al* (2012) and new students in Uniport (3.69%) reported by Ijeoma *et al* (2014), 0.3% reported in India (CIA, 2011), 3.4% reported in South African Universities (Gail, 2010) and also higher than 3.0% HIV prevalence rate report in Port Harcourt among pregnant women in Rumubiakani (Okerentugba *et al.,* 2015). Furthermore, a lower prevalence (3.88%) was reported among students and staff at the University of Jos (Obekpa *et al.,* 2014) and among Some Fresh Nigerian Graduates (4.79%) by Nwachukwu and Orji (2008).

The prevalence rate of 6.4% HIV infection reported in this study is contrastingly lower than 15.3% previously reported by Ingrid *et al* (2012) among university students in Namibia, 11.5% and 17.2% by Alan in the University of Kwazulu-Natal (Alan Whiteside, 2010) and 14% reported by Alia (2013) in Tanzania. Furthermore, it is lower than 13.7% HIV Infection among Students of Tertiary and Secondary Institutions in Nigeria ([Abdulazeez Abubakar](https://www.ncbi.nlm.nih.gov/pubmed/?term=Abubakar%20A%5BAuthor%5D&cauthor=true&cauthor_uid=22536559), 2012).

This study shows that there was no significant difference (p>0.05) between the age groups and the prevalence of HIV among newly admitted students. In this study, new students aged 21-25 years old have a higher prevalence of 3.8% followed by 15-20 (1.4%) compared to other groups. This age group is characterized by social vices such as abortion, drug use, and sexually transmitted infections (Mamman, 2003; Laah, 2003; FMOH, 2007 Mbakwen-Aniebo *et al.,* 2012). This is comparable to the findings of previous studies in some parts of Nigeria and outside Nigeria. Mbakwen-Aniebo *et al.* (2012) reported that HIV prevalence was higher among age group 20-25 years. Laah and Ayiwulu (2010) reported a higher Seroprevalence rate of HIV in the age group 24-34 years. Macpherson *et al.* (2006) reported a higher prevalence of HIV among children greater than 15 years of age in Canada. The study by Middelkoop *et al.* (2011) showed a high force of infection among adolescents, positively associated with increasing age.

This study reported no significant difference (p>0.05) between sex and prevalence of HIV among freshly admitted students to Benue State University. Female students recorded higher HIV prevalence in Table 1 than their male counterparts. This finding is consistent with that of some studies in Nigeria. Laah and Ayiwula (2010) reported a higher seroprevalence rate of HIV infection in females in Nasarawa State Nigeria, Ijeoma *et al.* (2014) reported a higher prevalence of HIV infection among females in Southeast Nigeria and on the other hand, National HIV/AIDS prevention Plan (2015) reported higher prevalence rate (27%) in males and another report by National HIV/AIDS prevention plan (2013) had higher prevalence rate of HIV for males. A few studies have, however, documented a higher prevalence rate of HIV/AIDS infection among males (Celikbas *et al.,* 2008 and Avert, 2010).

The highest prevalence of 4.0% was recorded among married students while singles had an HIV prevalence of 2.4%. There were significant differences (p<0.05) in marital status of HIV prevalence of newly admitted students. This study deviates from what was reported by Mbakwen-Aniebo *et al.* (2012) who found HIV prevalence to be highest among singles. This might be due to other contributing factors such as pre-marital and extra-marital sexual contacts which are common in Makurdi amongst married men. According to previous studies, prevalence of the HIV is fuelled by low levels of male and female condom use, high rate of casual and transactional unprotected sex among young people, poverty, low literacy levels, cultural and religious factors, as well as stigma and discrimination (National Population Commission and ICF Macro, 2009; Avert, 2010; Inungu and Karl, 2010; Mbakwen-Aniebo *et al.,* 2012).

In this study, a history of multiple sexual partners and not using protective measures during sexual intercourse were the most frequently observed risk factors among the seropositive groups. Moreover, a significant association was also demonstrated between HIV positivity and the above-mentioned risk factors. This finding agrees with earlier reports by Mmbaga *et al* (2007) in Tanzania, Zhang *et al* (2013) in China, Monica *et al* (2016) in Uganda, Esther *et al* (2008) in Uganda. They all noted that high-risk lifestyle characteristics such as multiple sexual partners and not use of protective measures for sexual intercourse were the most important risk factors of HIV infection in African university students. This may be a result of poor economic conditions in Nigeria which has resulted in many youths at universities becoming involved in sexual networking to earn a living. In this regard, rural communities hosting universities are often neglected and unreachable. It is pertinent that host communities are included in HIV prevention programs. Our study did not address university host community interactions and the status of VCT facilities on campus; hence these omissions are limitations of our study. This is also supported by the findings in this study that, HIV seropositivity rates were significantly higher among those students who have agreed to practice the above-mentioned risk factors. This finding also agrees with studies conducted by Kimberly *et al.* (2017) in Cambodia, Denise *et al.* (2007) in the US, Gudelia *et al.* (2012) in the USA and Mexico by Helgar *et al.* (2015) in Kenya, Nairobi, UNAIDS (2015) and (2016) in Thailand. This observation is however, contrary to that made by Grail (2010) among South African universities, NDHS (2013), and GARPR (2014) among Nigerians.

The study was carried out using three different test kits (Alere DetermineTM, Trinity Biotech UnigoldTM and the chembio HIV-1/2 STAT PAK Assay) which is consistent with the recommendation of WHO (WHO 2004). This is good because it serves as a quality check to avoid errors that may be peculiar to a particular test kit.

**CONCLUSION**

The HIV seroprevalence rate of 6.4% among new students in this study compared well with the Benue State seroprevalence rate of 5.6% in the State general population. Though the prevalence is high, the rising prevalence of HIV infection in the country will compound the problem of HIV infection in Nigerian Universities in the near future.

It has been established in this study that, married students have a higher prevalence of HIV antibodies than their unmarried counterparts and it has also been established that female students have a higher prevalence of HIV antibodies than their men counterparts.

It was found in this study that this disease affects mostly the young, sexually active adults in the university community (15-30) years.

Students with high-risk behavioral characteristics and lifestyles such as having multiple sexual partners, a history of STD, and unprotected sexual practices constituted a high-risk group for HIV infection among these new students. Students should be discouraged from practising high-risk lifestyles such as having multiple sexual partners, a history of STD, and unprotected multiple sexual relations with students, strangers, sugar daddy and others.

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**Details of the AI usage are given below:**

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**2.**

**3.**

**REFERENCES**

Crispin, M; and Doores, K. J (2015)**.** ["Targeting host-derived glycans on enveloped viruses for antibody-based vaccine design"](http://www.sciencedirect.com/science/article/pii/S1879625715000267). *Current Opinion in Virology. Viral pathogenesis Preventive and therapeutic vaccines*. 11: 63–69.

Pritchard, L K.; Harvey, D J.; Bonomelli, C; Crispin, M; and Doores, K.J. (2015a). ["Cell- and Protein-Directed Glycosylation of Native Cleaved HIV-1 Envelope"](http://jvi.asm.org/content/89/17/8932). *Journal of Virology.* 89 (17): 8932–8944.

Fawole AO, Ogunkan DV, and Adegoke GS. (2011): Sexual behaviour and perception of HIV/AIDS in Nigerian tertiary institutions: University of Ilorin, cases study. *Global Journal Human and Sococial Sciences*. 11(1):65–7.

Doitsh, G ; Galloway, N. L. K.; Geng, X; Yang, Z; Monroe, K. M.; Zepeda, O; Hunt, P W.; Hatano, H; Sowinski, S; Muñoz, I; and Greene, W. C. (2014). ["Cell death by pyroptosis drives CD4 T-cell depletion in HIV-1 infection."](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4047036). *Nature*. 505 (7484): 509–514.

Uzochukwu B, Uguru N, Ezeoke U, Onwujekwe O, and Sibeudu T. (2011): “Voluntary counseling and testing (VCT) for HIV/AIDS: a study of the knowledge, awareness and willingness to pay for VCT among students in tertiary institutions in Enugu State Nigeria”. *Health Policy*. 99(3):277–284.

Behrens, A; Vasiljevic, S; Pritchard, L. K.; Harvey, D. J.; Andev, R. S.; Krumm, S. A.; Struwe, W. B.; Cupo, A; Kumar, A. (2016). ["Composition and Antigenic Effects of Individual Glycan Sites of a Trimeric HIV-1 Envelope Glycoprotein"](http://www.cell.com/article/S2211124716301796/abstract). 1 (11): 2695–706.

Oppong A K, and Oti-Boadi M. (2013): HIV/AID Sknowledge among undergraduate university students: implications for health education programs in Ghana. *African Health Sciences* 13(2): 270 – 277.

UNAIDS (2010). UNAIDS Report on the global HIV/AIDS epidemic update, Geneva: Switzerland. Retrieved From <http://www.unaids.org/en/regionscountries/countrie>

Longdoh A. Njunda1, H. F. Kamga1, D. S. Nsagha, J C N Assob, E. (2012): **“**Low Malaria Prevalence in HIVPositive Patients in Bamenda, Cameroon”. *Journal of Microbiology* 7(9)66-70.

Excler, J. L; Geogia, D. T; and Nina, D. R. (2017) Novel Directions in HIV-1 Vaccines Revealed from clinical trial. *Curr. Opin AIDS* 8(5): 421-431.

UNAIDS (2009). Joint United Nations Programme On HIV/AIDS and WHO. AIDS Epidemic Update; 20 Avenue Appia CH- 1211 Geneva 27 Switzerland.

Sanyaolu AO, Fagbenro-Beyioku AF, Oyibo WA, Badaru OS, Onyeabor OS, and Nnaemeka CI. (2013). “Malaria and HIV co-infection and their effect on haemoglobin levels from three healthcare institutions in Lagos, southwest Nigeria”. *African Health Sciences* 13(2): 295 – 300.

Federal Ministry of Health (FMOH), (2007). HIV/STI biological and behavioral surveillance survey 2007. National AIDS/STI Control Programme and the Federal Ministry of Health, Abuja.

WHO/UNAIDS/UNICEF. (2008): Epidemiological fact sheet on HIV and AIDS. Core data on epidemiology and response Nigeria 2008 update. October 2008. 1-24.

Merrigan M, Azeez A, Afolabi B, Chabikuli ON, Onyekwena O, Eluwa G, Aiyenigba B, Kawu I, Ogungbemi K, and Hamelmann C. (2011): HIV prevalence and risk behaviours among men having sex with men in Nigeria. Sexually Transmitted Infections 87:65-70.

Mngutyo, I. D and Ogwuche, J. (2013). “Comparative Analysis of Effects of Annual Flooding on the Maternal Health of Women Floodplain and Non Floodplain Dwellers in Makurdi Urban Area, Benue State, Nigeria”, *Wudpecker Journal of Geography and Regional Planning. 1 . 1,*2013.

Olayinka, D. N, Nwilo, P.C and Adzandeh, A. E. (2013). From Catchment to Reach: Predictive Modeling of Flood in Nigeria, *Environment for Sustain ablility,* 2013.

Naing L, Winn T and Rusli BN (2006). Sample Size Calculator for Prevalence Studies. *Archives of Orofacial Sciences*; 1: 9-14. Available at: <http://www.kck.usm.my/ppsg/stats_resources.htm>

Roberto A, Melissa W. L, Camila G.A, Juan C R and Kirk D (2016). “Understanding differences in HIV/HCV prevalence according to differentiated risk behaviors in a sample of PWID in rural Puerto Rico”. *Harm Reduction Journal* (2016) 13:10.

Frank-Peterside N, Joshua RA, Okerentugba PO, and Okonko IO (2013). “Prevalence of HIV-1 & HIV-2 Antibodies Among Undergraduate Students of Uniport, Nigeria”. *Academia Arena, 5(10):48-52*.

Mmbaga E. J ; Akhtar Hussain, Germana H Leyna, Kagoma S Mnyika, Noel E Sam and Knut-Inge Klepp; (2007). “Prevalence and risk factors for HIV-1 infection in rural Kilimanjaro region of Tanzania”: *Implications for prevention and treatment. BMC Public Health20077:58.*

[Helgar Musyoki](https://www.ncbi.nlm.nih.gov/pubmed/?term=Musyoki%20H%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), [Timothy A. Kellogg](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kellogg%20TA%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), [Scott Geibel](https://www.ncbi.nlm.nih.gov/pubmed/?term=Geibel%20S%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), [Nicholas Muraguri](https://www.ncbi.nlm.nih.gov/pubmed/?term=Muraguri%20N%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), [Jerry Okal](https://www.ncbi.nlm.nih.gov/pubmed/?term=Okal%20J%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), [Waimar Tun](https://www.ncbi.nlm.nih.gov/pubmed/?term=Tun%20W%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), [H. Fisher Raymond](https://www.ncbi.nlm.nih.gov/pubmed/?term=Raymond%20HF%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), [Sufia Dadabhai](https://www.ncbi.nlm.nih.gov/pubmed/?term=Dadabhai%20S%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), [Meredith Sheehy](https://www.ncbi.nlm.nih.gov/pubmed/?term=Sheehy%20M%5BAuthor%5D&cauthor=true&cauthor_uid=25428282), and [Andrea A. Kim](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kim%20AA%5BAuthor%5D&cauthor=true&cauthor_uid=25428282) (2015). “Prevalence of HIV, Sexually Transmitted Infections, and Risk

Behaviors among Female Sex Workers in Nairobi, Kenya”: *Results of a Respondent Driven Sampling Study* [*AIDS Behav. 19(1): S46–S58.*](https://www.ncbi.nlm.nih.gov/entrez/eutils/elink.fcgi?dbfrom=pubmed&retmode=ref&cmd=prlinks&id=25428282)

Akinjogunla O. J and Adegoke A. A. (2009). “Seroprevalence of human immunodeficiency virus (HIV) 1 and 2 infections in Uyo metropolis, Akwa Ibom State”. *Scientific Research and Essay Academic Journals.* 4 (11): 1381-1384.

Nwachukwu, N.C., and A. Orji, (2008). “Sero Prevalence of Human Immunodeficiency Virus among Some Fresh Nigerian Graduates”. *Research Journal of Immunology,1: 51-55*

Mbakwem-Aniebo C, Ezekoye CC, Okonko IO. (2012). “Detection of HIV-1 and -2 Antibodies AmongFreshmen of the University of Port Harcourt, Port Harcourt, Southern Nigeria”. *World Applied Sciences* *Journal 16 (8): 1087-1092*

[Ijeoma E. N](https://www.ncbi.nlm.nih.gov/pubmed/?term=Emeka-Nwabunnia%20I%5BAuthor%5D),  [Bartholomew O I](https://www.ncbi.nlm.nih.gov/pubmed/?term=Ibeh%20BO%5BAuthor%5D), and [Tochukwu E O](https://www.ncbi.nlm.nih.gov/pubmed/?term=Ogbulie%20TE%5BAuthor%5D)(2014). “High HIV sero-prevalence among students of institutions of higher education in Southeast Nigeria” [*Asian Pactical Journal of Tropical Dis*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4032049/)*ease. 4(2): 159–165.*

Obekpa S, Khatib M, Mbwas M, Francis A, and Das N, (2014). “Prevalence of HBV and HIV among students and staff at university of Jos, Nigeria: results from medical outreach screening program” *International Journal of Scientific and Research Publications, Volume 4, Issue 11, November 2014 1 ISSN 2250-3153* [www.ijsrp.org](http://www.ijsrp.org)

Okerentugba PO, Uchendu SC, and Okonko IO, (2015). “Prevalence of HIV among Pregnant Women in Rumubiakani, Port Harcourt, Nigeria”, *Public Health Research*, 5 (2) 58- 65.

[Ingrid H de Beer](https://www.ncbi.nlm.nih.gov/pubmed/?term=de%20Beer%20IH%5BAuthor%5D&cauthor=true&cauthor_uid=22353579), [Huub C Gelderblom](https://www.ncbi.nlm.nih.gov/pubmed/?term=Gelderblom%20HC%5BAuthor%5D&cauthor=true&cauthor_uid=22353579), [Onno Schellekens](https://www.ncbi.nlm.nih.gov/pubmed/?term=Schellekens%20O%5BAuthor%5D&cauthor=true&cauthor_uid=22353579), [Esegiel Gaeb](https://www.ncbi.nlm.nih.gov/pubmed/?term=Gaeb%20E%5BAuthor%5D&cauthor=true&cauthor_uid=22353579),[Gert van Rooy](https://www.ncbi.nlm.nih.gov/pubmed/?term=van%20Rooy%20G%5BAuthor%5D&cauthor=true&cauthor_uid=22353579), [Alta McNally](https://www.ncbi.nlm.nih.gov/pubmed/?term=McNally%20A%5BAuthor%5D&cauthor=true&cauthor_uid=22353579), [Ferdinand W Wit](https://www.ncbi.nlm.nih.gov/pubmed/?term=Wit%20FW%5BAuthor%5D&cauthor=true&cauthor_uid=22353579), and [Rinke de Wit F Tobias](https://www.ncbi.nlm.nih.gov/pubmed/?term=Tobias%20Rd%5BAuthor%5D&cauthor=true&cauthor_uid=22353579) (2012) University students and HIV in Namibia: an HIV prevalence survey and a knowledge and attitude survey. *Journal International AIDS Society*. 15: 9.

Abdulazeez A. (2012). “Frequency of Human Immunodeficiency Virus Infection Among Students of Tertiary and Secondary Institutions in An Endemic State” [*Northern American Journal of Medical Sci*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3334256/)*ences*; 4(4): 170–173.

Laah, J.G., (2003). “The prevalence of HIV/AIDS in Zaria, Kaduna State”. *Journal of Population Association of Nigeria.* 3(1): 95-101.

Federal Ministry of Health (FMOH), (2007). HIV/STI biological and behavioral surveillance survey 2007. National AIDS/STI Control Programme and the Federal Ministry of Health, Abuja

Mamman, M., (2003). “Gender HIV-infection and AIDS -Related deaths in sub-Saharan Africa”. *Journal of Population Association of Nigeria*, 3(1): 79-94.

Laah, J.G., and Ayiwulu, E., (2010). “Socio-Demographic Characteristics of Patients Diagnosed with HIV/AIDSin Nasarawa Eggon”. *Asian Journal of Medical Sciences* 2(3): 114-120.

Macpherson, W.D., M. Zencorich and B.D. Gushulak, (2006). “Emerging pediatric HIV Epidemic related to migration”. *Emerging Infectious Diseases*, 12: 612-615.

Middelkoop, K.**,** L.G. Bekker**,** H. Liang**,** L.D.H. Aquino**,** E. Sebastian**,** L. Myer, and Wood, R (2011). “Force of tuberculosis infection among adolescents in a high HIV and TB prevalence community”: a cross sectional observation study. *BMC Infectious Diseases*,11:156.

Celikbas, A., O. Ergonul, N. Baykam, S. Eren, H. Esener, M. Eroglu and B. Dokuzoguz, (2008). “Epidemiologic and clinical characteristics of HIV/AIDS patients in Turkey, where the prevalence is the lowest in the region”. *Journal of International Association of Physician.* AIDS Care, 7(1): 42-45.

Avert, T. (2010). HIV and AIDS in Nigeria. Retrieved from: [www.avert.org/aids.htm](http://www.avert.org/aids.htm). (Accessed date: February 18, 2010).

Monica H. Swahn,1 Rachel Culbreth,1 Laura F. Salazar,1 Rogers Kasirye,2 and Janet Seeley3 (2016). “Prevalence of HIV and Associated Risks of Sex Work among Youth in the Slums of Kampala”. *AIDS Research and Treatment Volume 2016, Article ID 5360180, 8 pages.*

Zhang L, Zhang D, Yu B, Wang S, Liu Y, Wang J, et al. (2013). “Prevalence of HIV Infection and Associated Risk Factors among Men Who Have Sex with Men (MSM) in Harbin, P. R. China. PLoS ONE 8(3):

Esther B, William B, Bente E. M, Charles M, and Knut F. (2008). “HIV RISK Behavior and Work in Uganda: A Cross-Sectional Study East African”. *Journal of Public Health* Volume 5 Number 1 April 2008 43-48

Kimberly P, Ellen S, Neth S, Jennifer E, Marie, C .C, Keo S, Melissa C, Julie M.S, Pisith P, John K, and Lisa M, (2017). “Sex work and HIV in Cambodia: trajectories of risk and disease in two cohorts of high-risk young women in Phnom Penh”, *Cambodia BMJ Open 2017*

Gudelia [M.,](https://www.ncbi.nlm.nih.gov/pubmed/?term=Rangel%20MG%5BAuthor%5D&cauthor=true&cauthor_uid=22562390) [Ana P. Martinez-Donate](https://www.ncbi.nlm.nih.gov/pubmed/?term=Martinez-Donate%20AP%5BAuthor%5D&cauthor=true&cauthor_uid=22562390), [Melbourne Hovell](https://www.ncbi.nlm.nih.gov/pubmed/?term=Hovell%20M%5BAuthor%5D&cauthor=true&cauthor_uid=22562390), [Carol L. Sipan](https://www.ncbi.nlm.nih.gov/pubmed/?term=Sipan%20CL%5BAuthor%5D&cauthor=true&cauthor_uid=22562390), [Jennifer A. Zellner](https://www.ncbi.nlm.nih.gov/pubmed/?term=Zellner%20JA%5BAuthor%5D&cauthor=true&cauthor_uid=22562390), [Eduardo Gonzalez-Fagoaga](https://www.ncbi.nlm.nih.gov/pubmed/?term=Gonzalez-Fagoaga%20E%5BAuthor%5D&cauthor=true&cauthor_uid=22562390), [Norma J. Kelley](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kelley%20NJ%5BAuthor%5D&cauthor=true&cauthor_uid=22562390), [Ahmed Asadi-Gonzalez](https://www.ncbi.nlm.nih.gov/pubmed/?term=Asadi-Gonzalez%20A%5BAuthor%5D&cauthor=true&cauthor_uid=22562390), [Catalina Amuedo-Dorantes](https://www.ncbi.nlm.nih.gov/pubmed/?term=Amuedo-Dorantes%20C%5BAuthor%5D&cauthor=true&cauthor_uid=22562390), and [Carlos Magis-Rodriguez](https://www.ncbi.nlm.nih.gov/pubmed/?term=Magis-Rodriguez%20C%5BAuthor%5D&cauthor=true&cauthor_uid=22562390) (2012). “A Two-Way

Denise D. H, Bonita J. Iritani, MA, William C. Miller, MD, MPH, and Daniel J. B, (2007). “Sexual and Drug Behavior Patterns and HIV and STD Racial Disparities”: *The Need for New Directions* *American Journal of Public Health.* 97:125–132.

UNAIDS (2016). Global Summary of the AIDS Epidemic. Joint United Nations Programme on HIV/AIDS. 20 Avenue Appia 1211 Geneva 27 Switzerland.

Azuonwu, O., Erhabor, O., & Obire, O. (2012). HIV among military personnel in the Niger Delta of Nigeria. Journal of community health, 37, 25-31.

Huldah, H. A., & Renner, B. B. (2024). Sero-prevalence of Human Immunodeficiency Virus among Students Undergoing Medical Examination in a Tertiary Institution. International STD Research & Reviews, 13(1), 63–70. <https://doi.org/10.9734/ISRR/2024/v13i1171>

Uchechukwu, O. F., Abdulrahman, Y., Aliyu, A. U., Mustaphar, U., Zama, I., Charles, A. T., Kwaifa, I., Ali, B. H., Augustine, O., Marafa, A., Osaro, E., Patrick, U. F., Momudu, I., Ibrahim, B. A., & Hope, O. (2018). Seroprevalence of HIV, HBV and HCV among Prisoners in Sokoto, Nigeria. Asian Journal of Medicine and Health, 13(3), 1–8. <https://doi.org/10.9734/AJMAH/2018/33128>

Akar-Ghibril, N. (2022). Defects of the innate immune system and related immune deficiencies. Clinical Reviews in Allergy & Immunology, 63(1), 36-54.