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International Journal of Translational Medical Research and Public Health

ORIGINAL ARTICLE HIV

Advanced HIV Disease among Persons Newly Diagnosed with HIV: A Hospital-Based Study in Abia State, Nigeria

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Received: 10 September 2024
Accepted: 22 November 2024
Published: 07 February 2025

DOI
10.25259/IJTMRPH_77_2024

Quick Response Code:

ABSTRACT

Background and Objective: Advanced HIV disease (AHD), defined by the World Health Organization (WHO) as a CD4 count of fewer than 200 cells/mm³ or WHO stage 3 or 4, remains a significant contributor to AIDS-related mortality despite global antiretroviral therapy (ART) scale-up. This study aimed to determine the prevalence and identify the determinants of AHD among newly diagnosed persons living with HIV in Abia State, Nigeria.

Methods: This was a retrospective chart review that analyzed data from patients newly enrolled in the United States centers for disease control and prevention (CDC) human immunodeficiency virus (HIV) ART program in Abia State between October 2021 and September 2023. Data were collected using a proforma designed to capture socio-demographic and clinical variables, including age, gender, residence, marital status, education level, and co-morbidities. Descriptive statistics was conducted to analyze the demographic and clinical characteristics of the participants, while logistic regression was conducted to assess the determinants of advanced HIV disease among ART-naive individuals newly diagnosed with HIV.

Results: The prevalence of AHD among the study population was 10.7%. The odds of AHD were significantly lower among individuals aged 26–35 years (aOR = 0.587) and 36–45 years (aOR = 0.638) compared to other age groups. Rural residence was associated with a lower prevalence of AHD (8.6%) compared to urban (13.9%) and semi-urban (12.2%) areas. Individuals with tertiary education (aOR = 0.625) and those employed (aOR = 0.503) showed significantly reduced odds of AHD. Persons identified through outreach testing were associated with a lower prevalence of AHD (2.9%) compared to outpatient department testing (40.2%).

Conclusion and Implications for Translation: The study supports targeted community testing to reduce AHD prevalence among persons living with HIV. Expanding outreach programs to urban areas and supporting individuals with lower socioeconomic status are critical. Addressing social determinants of health, particularly education and employment, alongside early ART initiation, can mitigate the progression to advanced disease.

Keywords: Advanced HIV Disease, ART-naive, ART Therapy, Community Healthcare, Nigeria, Prevalence, Social Determinants of Health, Socioeconomic Factors

INTRODUCTION

Background of the Study

By the end of 2021, over 30 million clients living with human immunodeficiency virus (HIV) were accessing life-saving antiretroviral therapy (ART) globally, with attendant clinical and

public health benefits.[1,2] These benefits included reductions in AIDS-related deaths and drops in new infections, respectively.[2] According to the United Nations AIDS Program (UNAIDS) fact sheet for 2023, AIDS-related deaths declined markedly from 1.7 million deaths annually in 2004 to about 900,000 in 2014 by 56% among the female gender and by 47% among the male gender in 2023.[3]

However, the decline in AIDS-related deaths has slowed due to the burden of advanced HIV disease (AHD), which is a major predictor of mortality among people living with HIV.[2] AHD is defined by the World Health Organization (WHO) as CD4 cell count <200 cells/mm^3 or WHO stage 3 or 4 in adults and adolescents and all children younger than 5 years of age.[4]

Patients with AHD have a higher risk of death even after initiating ART.[5] The risk increases with decreasing CD4 count, lower CD4 counts are associated with opportunistic infections such as tuberculosis (TB), cryptococcal meningitis, severe bacterial infections, histoplasmosis, toxoplasmosis, cytomegalovirus, etc.[6]

Despite the success of ART scale-up, progress in reducing AIDS-related mortality has stalled due to the burden of AHD.[7] This has also placed considerable strain on healthcare systems, increased costs of medical care, and loss of productivity. Regrettably, the proportion of patients presenting with AHD has not decreased and, in some cases, has even doubled over the last decade, despite expanded access to ART in low- and middle-income countries.[8,9] Data indicate that more than 32% of individuals living with HIV in these countries have AHD.[8,10] Reports from six high-volume ART sites in Nigeria (Federal Medical Center Owerri, Ahamdu Bello University Teaching Hospital Zaria, University College Hospital Ibadan, University of Port Harcourt Teaching Hospital, University of Maiduguri Teaching Hospital, and Gwagwalada Specialist Hospital Abuja) suggest the burden of AHD may be as high as 50%.[11]

In Senegal, a study by Benzekri and colleagues identified age and the use of alternative therapies as drivers of AHD among ART-naive clients at initiation.[12] Other studies have found that factors such as male gender, tuberculosis co-infection, and unemployment are also associated with AHD at presentation.[13,14] It was observed that approximately one-third of all patients starting ART had AHD at initiation. According to reports from 10 countries, including Nigeria, AHD accounts for up to 27% of recorded deaths.[12] Additionally, nearly 40% of patients were found to initiate ART with AHD.[13]

The Nigerian HIV/AIDS Indicator and Impact Survey (NAIIS) of 2018 reported a prevalence of 2.1% in Abia State.[15] HIV response in the state was under government-led HIV treatment and care until 2021, when the United States Centers for Disease Control and Prevention (CDC) commenced comprehensively the President's Emergency Plan for AIDS Relief (PEPFAR) HIV response in the state. While anecdotal evidence suggests that some ART patients have AHD at the time of initiation, however, little is known about the prevalence of AHD among ART-naïve clients, making this study crucial for understanding and addressing AHD-related mortality.

Objectives of the Study

The objectives of this study were (1) to determine the prevalence of advanced HIV disease among newly enrolled clients and (2) to identify the determinants of AHD among the study population.

METHODS

This is a retrospective chart review study, which analyzed data from patients newly enrolled in the PEPFAR/CDC HIV ART program in Abia State, Nigeria, between October 2021 and September 2023. It involved the use of a standardized data abstraction tool, which was designed to collect relevant data from patients' records that included socio-demographic and clinical data. This study used strengthening the Reporting of Observational Guidelines in Epidemiology (Strobe) checklist for reporting this study.[16]

Study Variables

AHD was the main outcome variable of interest and the dependent variable, as explained in this study. The independent variables included clinical and demographic variables: age, gender, point of diagnosis, marital status, level of education, residence, CD4 count, and co-morbidities.

Statistical Analysis

Data collection passed through different layers of assessment to check for completeness, correctness, and concurrence with the information in patients' electronic medical records. The collected data were entered into an Excel database and then exported into Statistical Package for Social Sciences (SPSS) from International Business Machines (IBM) version 23 for analysis.

Descriptive statistics were conducted to analyze the demographic and clinical characteristics of the participants. Frequencies and percentages were used to summarize the variables. The prevalence of AHD across different sub-populations was also reported using percentages to highlight differences in AHD status by demographic groups, including age, gender, education, and employment status.

Logistic regression was conducted to assess the determinants of AHD among ART-naive individuals newly diagnosed with HIV. Adjusted odds ratios (aOR) were calculated to estimate the association between AHD and various demographic, clinical, and socioeconomic factors.

RESULTS

Clinical Characteristics

The clinical characteristics of the study population, as presented in Table 1, reveal that a majority of participants tested negative for AHD, with 89.3% having a negative status, while 10.7% tested positive for AHD. WHO staging classification shows that most participants were in Stage 1 (93.0%), while most were tested during outreach programs (79.0%).

Demographic Characteristics

The demographic characteristics of the study participants are summarized in Table 2. Most participants resided in rural areas (55.2%), and the study population was predominantly female (61.4%). The largest age group was 26–35 years (36.7%), followed by 36–45 years (27.5%). Almost half of the participants were married (49.3%), and 44.6% were single. In terms of education, the majority had a secondary education (59.2%), with tertiary education being the next most common (24.5%). Employment status reveals that 59.8% of participants were employed, 23.7% were unemployed, and 10.4% were students.

Prevalence of AHD

The overall prevalence of AHD among the study population was 10.7%. This rate was consistent across genders, with both males and females having an AHD prevalence of 10.7%. However, notable differences in AHD prevalence exist across various sub-populations.

Urban areas showed a prevalence of 13.9%, semi-urban areas had 12.2%, and rural areas exhibited a lower prevalence of 8.6%. Age-specific prevalence revealed significant variability, with the highest prevalence found in the youngest age group (<5 years) at 48.7%. The lowest prevalence rates were observed in the 19–25 (7.3%) and 26–35 (6.9%) age groups.

The prevalence of AHD also varied by marital status and education level, with widowed individuals having a higher prevalence of 24.7%. Individuals with primary education showed a higher prevalence (19.8%), while those with tertiary education had a lower prevalence (7.7%). Employment status also affected AHD prevalence, with the unemployed group showing a prevalence of 14.7%, compared to 2.6% among the employed.

Determinants of AHD among the Study Population

The logistic regression analysis identified significant correlates of AHD among treatment-naive HIV-positive individuals. As presented in Table 3, living in rural areas was associated with significantly lower odds of AHD (aOR = 0.661, $p < 0.001$). Individuals aged 26–35 years (aOR = 0.587, $p = 0.004$) and 36–45 years (aOR = 0.638, $p = 0.003$) showed

Table 1: Demographic characteristics.

Characteristic	Category	Frequency	Percentage (%)
Residence	Urban	3,499	29.5
	Rural	6,545	55.2
	Semi-urban	1,823	15.4
Sex	Male	4,585	38.6
	Female	7,282	61.4
Age group	<5	39	.3
	5–10	62	.5
	11–18	141	1.2
	19–25	1,543	13.0
	26–35	4,361	36.7
	36–45	3,266	27.5
	46–55	1,696	14.3
	>55	759	6.4
Marital status	Single	5,293	44.6
	Married	5,853	49.3
	Divorced	82	.7
	Separated	189	1.6
	Widowed	247	2.1
	Co-habiting	203	1.7
Education	None	368	3.1
	Primary	1,016	8.6
	Secondary	7,021	59.2
	Tertiary	2,902	24.5
	Informal	560	4.7
Occupation	Not applicable*	336	2.8
	Employed	7,100	59.8
	Unemployed	2,811	23.7
	Retired	56	.5
	Student	1,235	10.4
	No response	329	2.8
AHD status	Positive	1,270	10.7
	Negative	10,597	89.3
WHO staging	Stage 1	11,032	93.0
	Stage 2	216	1.8
	Stage 3	101	.9
	Stage 4	15	.1
Test point	OPD	1,774	14.9
	Outreach	9,376	79.0
	Other	717	6.0

*Not applicable refers to patient whose age are below the working age.
AHD: Advanced HIV disease.

Table 2: Prevalence of AHD among various sub-populations.

Characteristic	Category	Total number of individuals	Number with AHD	Prevalence (%)
Residence	Urban	3,499	485	13.9
	Rural	6,545	562	8.6
	Semi-urban	1,823	233	12.2
Sex	Male	4,585	491	10.7
	Female	7,292	779	10.7
Age group	<5	39	19	48.7
	5–10	62	14	22.6
	11–18	141	29	20.6
	19–25	1,543	113	7.3
	26–35	4,361	303	6.9
	36–45	3,266	425	13.0
	46–55	169	22	13.0
	>55	759	138	18.4
Marital status	Single	5,293	417	7.9
	Married	5,853	746	12.7
	Divorced	82	11	13.4
	Separated	189	18	9.5
	Widowed	247	61	24.7
	Co-habiting	203	17	8.4
Education level	None	365	59	17.6
	Primary	849	167	19.8
	Secondary	6,268	753	12.0
	Tertiary	2,695	207	7.7
	Informal	476	84	17.6
Occupation	Not applicable*	336	27	8.0
	Employed	6,386	714	2.6
	Unemployed	2,456	360	14.7
	Retired	45	11	24.4
	Student	1,141	94	8.2
	No response	265	64	24.2
Point of diagnosis	OPD	1,774	741	40.2
	Outreach	9,396	270	2.9
	Other service point	717	259	36.1

*Not applicable refers to patient whose age are below the working age. AHD: Advanced HIV disease.

significantly lower odds of AHD compared to the youngest and older categories. Those diagnosed at the OPD points had higher odds of AHD (aOR = 1.380, $p = 0.001$) compared to those tested at outreaches (aOR = 0.072, $p < 0.001$).

Education and occupation also emerged as important correlates, with those that had tertiary education (aOR = 0.625, $p = 0.019$), being employed (aOR = 0.503, $p = 0.032$), and student (aOR = 0.621, $p = 0.039$) associated with significantly reduced odds of AHD.

DISCUSSION

The findings from this hospital-based study on AHD among newly diagnosed persons living with HIV in Abia State highlight key clinical and demographic factors associated with AHD at the time of diagnosis. The overall prevalence of AHD was 10.7%, significantly lower than reported in previous studies, which have documented AHD prevalence rates of 43.45% among ART-naïve patients. This reduction may be attributed to the

Table 3: Correlates of AHD among treatment naive HIV positive persons.

	B	SE	Wald	*df*	*p*-value	aOR	95% CI for EXP(*B*)	
Residence			18.224	2	0.000			
Urban	−0.196	0.106	3.403	1	0.065	0.822	0.667	1.012
Rural	−0.413	0.103	16.245	1	0.000	0.661	0.541	0.809
Age			30.321	7	0.000			
Age(4)	−0.533	0.184	8.366	1	0.004	0.587	0.409	0.842
Age(5)	−0.449	0.151	8.808	1	0.003	0.638	0.475	0.859
Testing point			1,302.199	2	0.000			
OPD	0.322	0.098	10.771	1	0.001	1.380	1.139	1.674
Outreaches	−2.629	0.107	600.572	1	0.000	0.072	0.058	0.089
Education			19.013	4	0.001			
Tertiary	−0.471	0.201	5.500	1	0.019	0.625	0.422	0.926
Occupation			11.640	5	0.040			
Employed	−0.688	0.320	4.614	1	0.032	0.503	0.268	0.942
Student	−0.476	0.231	4.261	1	0.039	0.621	0.395	0.976

AHD: Advanced HIV disease, aOR: Adjusted odds ratio, df: Degree of freedom, SE: Standard error, EXP(B): Exponential value of B, B: Estimated coefficient, CI: Confidence interval.

increased community testing and index testing interventions conducted as part of the HIV surge project during the study period, which are known strategies for identifying individuals at risk of late ART initiation and AHD.[17]

The results showed that outreach testing significantly impacted AHD prevalence, with those diagnosed during outreach programs exhibiting much lower AHD prevalence (2.9%) compared to those diagnosed in outpatient departments (40.2%). This suggests that community-based interventions are effective in reaching individuals earlier in their HIV infection, potentially reducing the risk of AHD.[16] These findings are consistent with existing literature, which reported clients diagnosed in health facilities have a higher prevalence of AHD.[18]

This study revealed notable differences in AHD prevalence across various demographic subgroups. Urban areas showed a higher prevalence of AHD (13.9%) compared to rural areas (8.6%). This is understandable as rural areas are the primary focus of outreach efforts, which have been shown to support early detection of HIV.[19,20] This underscores the importance of expanding community outreach interventions to urban populations, where barriers to early testing and care might be more prevalent.

The study also identified age as a significant factor influencing AHD prevalence, with the highest rates observed in children under five years (48.7%), agreeing with the WHO classification of <5 years as a high-risk population for AHD.[21] Lower prevalence rates were observed among adults aged 26–35 years (6.9%) and 19–25 years (7.3%). Previous publications have reported that age is a factor in immunity among ART-naïve persons living with HIV, with the age category 18–36 years having the highest CD4 count.[22]

Educational level and employment status were also associated with AHD prevalence. Participants with tertiary education and those who were employed or students had significantly lower odds of AHD, suggesting that socioeconomic factors, such as education and employment, play protective roles against the progression to advanced disease. This agrees with another study that found education level and employment status were associated with AHD among persons living with HIV (PLHIV).[23] These findings highlight the importance of addressing social determinants of health in HIV care.

Marital status influenced AHD prevalence, with widowed individuals showing significantly higher rates of AHD (24.7%). This may be due to reduced social support and increased barriers to accessing HIV services among widowed persons. Addressing these barriers through targeted support has been acknowledged to help reduce poor outcomes among PLHIV. This can also be an explanation for the lower AHD prevalence observed among rural dwellers where stronger community life promotes social support.[19]

Strengths and Limitations

The study's use of large programmatic data ensured that the information is reliable and competently collected as part of routine patient care, while the inclusion of community outreach programs offers valuable insights into early HIV detection strategies.

However, as a chart review of programmatic data, the demographic and clinical characteristics were limited to indicators tracked within the program, excluding other potentially relevant variables.

CONCLUSION AND IMPLICATIONS FOR TRANSLATION

The study's findings emphasize the ongoing need for targeted community interventions for early detection of infection to reduce AHD prevalence among vulnerable individuals. Education and social support for persons like widowed are found to be key programmatic considerations. Future efforts should focus on expanding outreach programs to urban areas, enhancing support for individuals with lower socioeconomic status, and prioritizing early ART initiation to mitigate the risk of advanced disease progression.

The study findings have significant implications for enhancing HIV care and guiding policy decisions, particularly in funding strategies for HIV case-finding initiatives. The high prevalence of AHD among specific sub-populations, such as young children, widowed individuals, and those with lower educational levels, emphasizes the need for targeted community-based outreach and testing programs. These insights support the argument for increased funding in community HIV case-finding, countering the common donor focus on cost by highlighting the broader benefits of preventing AHD, such as reducing morbidity and healthcare costs associated with late-stage HIV.[24]

Evidence is also provided to support the mainstreaming of policies that target these inequalities, as outlined in the UNAIDS Global AIDS Strategy 2021–2026.[25] These findings advocate for integrating socioeconomic support services into HIV care, addressing the structural barriers that contribute to disease progression and unequal access to health services. The evidence provided by this research will support conversations and policy dialogues on incorporating social support and community-level interventions in HIV care, ultimately leading to a more equitable and effective HIV response.

Key Messages

1. Children, widowed people, and those with less education are at higher risk of advanced human immunodeficiency virus (HIV). 2. Education, employment, and location impact the risk of advanced HIV. 3. More funding for community testing and tackling social inequalities is essential to fighting HIV effectively.

Acknowledgments

None.

COMPLIANCE WITH ETHICAL STANDARDS

Conflicts of Interest: The authors declare no competing interests. **Financial Disclosure:** Nothing to declare. **Funding/Support:** There was no funding for this study. **Ethics Approval:** Ethical approval was sought from the Ethical Committee in the Abia State Ministry of Health for this study and consequently received approval number AB/MH/PRS/ECS/T.1/224. The patients' privacy and confidentiality were ensured by de-identifying the data during analysis. **Declaration of Patient Consent:** Not applicable, as the study used de-identified programmatic data with no direct patient involvement. **Use of Artificial Intelligence (AI)-Assisted Technology for Manuscript Preparation:** The authors confirm that there was no use of Artificial Intelligence (AI)-Assisted Technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI. **Disclaimer:** None.

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How to cite this article: Ikpe G, Enukeme J, Amuta C, Nwakanma I, Agomoh O, Chukwudinma O, et al. Advanced HIV disease among persons newly diagnosed with HIV: A hospital-based study in Abia State, Nigeria. Int J Transl Med Res Public Health. 2025;9:e003. doi: 10.25259/IJTMRPH_77_2024