cross doi: 10.21276/SSR-IIJLS.2025.11.3.50

# **Original Article**

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# Prevalence of HIV Associated Neurocognitive Disorders among HIV Infected Patients in a Tertiary Care Center

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#### Received: 23 Jan 2025/ Revised: 21 Feb 2025/ Accepted: 20 Apr 2025

#### ABSTRACT

**Background:** HIV-Associated Neurocognitive Disorders (HAND) are significant comorbidities among HIV-positive individuals despite advancements in antiretroviral therapy (ART). HAND encompasses a spectrum of neurocognitive impairments ranging from asymptomatic neurocognitive impairment (ANI) to HIV-associated dementia (HAD). These disorders adversely impact the functional independence and quality of life of affected individuals and pose significant challenges to adherence to treatment regimens. The study aimed to assess the prevalence of HAND among HIV-positive patients and identify sociodemographic, clinical, and behavioral factors associated with neurocognitive impairments in a tertiary care setting.

**Methods:** A cross-sectional study was conducted on 500 HIV-positive patients attending a tertiary care center. Participants were assessed using the International HIV Dementia Scale (IHDS) and categorized based on neurocognitive performance. Data on sociodemographic variables, ART adherence, CD4 count, viral load, and substance use history were collected and analyzed for associations with HAND.

**Results:** HAND was prevalent in 50% of participants, with common symptoms including forgetfulness (45%) and difficulty concentrating (35%). Factors significantly associated with HAND included poor ART adherence, low CD4 counts, substance use, and advanced disease stage (p<0.05). Gender and educational level were not significantly associated with neurocognitive symptoms.

**Conclusion:** HAND prevalence underscores the need for routine neurocognitive screening in HIV care. Modifiable factors such as ART adherence and mental health should be prioritized in intervention strategies to improve outcomes for HIV-positive patients.

Key-words: HAND, HIV, Neurocognitive impairment, ART adherence, CD4 count, substance use, IHDS

# INTRODUCTION

HIV/AIDS remains one of the most significant global health challenges, with approximately 38 million individuals living with HIV as of 2023 <sup>[1]</sup>. Although the widespread implementation of ART has led to remarkable

#### How to cite this article

Das S, Adhvaryu B, Das I, Das S, Lahiri S. Prevalence of HIV Associated Neurocognitive Disorders among HIV Infected Patients in a Tertiary Care Center. SSR Inst Int J Life Sci., 2025; 11(3): 7655-7660.



Access this article online https://iijls.com/ improvements in life expectancy and reduced AIDSrelated mortality, the persistence of HIV-associated comorbidities, particularly neurocognitive disorders, remains a pressing concern <sup>[2]</sup>. HIV-Associated Neurocognitive Disorders (HAND) represent a spectrum impairments, of neurocognitive classified into asymptomatic neurocognitive impairment (ANI), mild neurocognitive disorder (MND), and HIV-associated dementia (HAD) [3]. HAND results from direct viral invasion of the central nervous system (CNS), chronic immune activation, and neuroinflammation. Even with ART, the incomplete suppression of viral replication within the CNS and the limited ability of ART drugs to

crossef doi: 10.21276/SSR-IIJLS.2025.11.3.50

penetrate the blood-brain barrier contribute to HAND's persistence <sup>[4]</sup>.

The prevalence of HAND has shifted in the post-ART era. HAD, once the predominant form of neurocognitive impairment in HIV, has declined, while ANI and MND have become more common <sup>[5]</sup>. Although ANI may appear asymptomatic, it significantly impacts daily functioning, treatment adherence, and overall quality of life when left unaddressed <sup>[6]</sup>.

In India, where HIV affects over 2.4 million individuals, addressing HAND is particularly challenging. Late ART initiation, inconsistent adherence, limited access to healthcare, and high prevalence of comorbid conditions exacerbate the risk of HAND <sup>[7]</sup>. Despite the importance of HAND, its diagnosis remains underprioritized in many clinical settings, particularly in resource-limited environments.

This study aims to fill this gap by estimating the prevalence of HAND in an HIV-positive population and analyzing the associated sociodemographic, clinical, and behavioral factors. Identifying modifiable risk factors is critical for developing targeted interventions to mitigate HAND's impact on affected individuals.

#### MATERIALS AND METHODS

Study Design and Population- This cross-sectional study was conducted at a tertiary care center in India between January and December 2023. The study enrolled 500 HIV-positive adults aged ≥18 years who had been receiving ART for at least six months. Patients with preexisting psychiatric or neurological disorders, substance dependence, or opportunistic CNS infections were excluded to ensure the accuracy of HAND diagnosis.

**Data Collection-** Participants underwent a comprehensive assessment, including:

**Sociodemographic Data-** Age, gender, education level, marital status, and employment status were recorded.

**Clinical Variables-** Duration of HIV diagnosis, ART regimen, CD4 count, WHO clinical staging, and viral load were documented.

**Behavioral Factors-** ART adherence was assessed using patient-reported questionnaires. Substance use history and symptoms of depression or anxiety were also recorded.

**Neurocognitive Assessment-** Neurocognitive function was evaluated using the International HIV Dementia Scale (IHDS), a validated tool for detecting cognitive impairment in HIV-positive patients. The IHDS scores were categorized to identify neurocognitive impairment, with additional subcategorization into ANI, MND, and HAD as per Frascati criteria.

**Statistical Analysis-** Descriptive statistics summarized demographic, clinical, and neurocognitive variables. Chi-square and t-tests were used to assess associations between categorical and continuous variables, respectively. Logistic regression identified independent predictors of HAND. A p-value<0.05 was considered statistically significant.

**Ethical Considerations-** Ethical approval was obtained from the Institutional Review Board, and written informed consent was obtained from all participants.

### RESULTS

The 500 HIV-positive patients in the study cohort are mostly male (60%) and have an average age of 47.5 years (SD±12.3). These are differences in educational attainment: 22% have no formal education, 30% have completed secondary school, and 30% have a college degree or above. The majority of participants (45%) are married, while the percentages of those who are widowed (5%), divorced (20%), or single (30%) are lower. According to employment status, 20% are unemployed, 30% are self-employed, and half are employed. Regarding living arrangements, 40% of participants live alone, which may have an impact on their mental health and social support. The other participants live with friends or family.

According to the clinical data, most of the patients have had an HIV diagnosis for longer than five years; 35% of those in the five to ten-year and more than ten-year categories, respectively, fall into this category. Although there are other ART regimens, Regimen B is the most popular (35%). Although 55% of individuals had an undetectable viral load, indicating that more than half receive successful ART management, 40% of participants have a CD4 count below 200 cells/mm<sup>3</sup>, indicating substantial immunosuppression. According to WHO clinical staging, 40% of the group is in stage 1, while 15%

SSR Institute of International Journal of Life Sciences ISSN (0): 2581-8740 | ISSN (P): 2581-8732 Das et al., 2025

cross doi: 10.21276/SSR-IIJLS.2025.11.3.50

is in stage 4, indicating varying levels of disease progression.

Neurocognitive symptoms are common; 35% of people have trouble focusing, and 45% experience amnesia or memory loss. Despite this, 90% of people continue to be completely autonomous in their daily activities, and 50% report no neurocognitive symptoms. Mild to severe cognitive impairment is indicated by the International HIV Dementia Scale (IHDS) mean score of 8.0 (SD±2.5). Behavioral considerations show that 30% of patients have poor ART adherence, which may be a cause of neurocognitive impairments, whereas 70% show strong adherence. Twenty percent of participants report having a history of substance use, and twenty-five percent report having experienced anxiety or depression, highlighting the importance of integrated mental health assistance.

The results highlight the intricate interactions between behavioral, clinical and sociodemographic factors that affect neurocognitive outcomes. To enhance cognitive functioning and general quality of life in this population, tailored therapies are required because of the high prevalence of immunosuppression, ART adherence problems, and neurocognitive symptoms (Table 1).

Variable	Category	Descriptive Statistics	N=500	
		(Mean/SD or N/%)		
Age (Years)	-	47.5±12.3	-	
Gender	Male	60%	300 (60%)	
	Female	40%	200 (40%)	
Educational Level	No Formal Education	22%	110 (22%)	
	Primary School	18%	90 (18%)	
	Secondary School	30%	150 (30%)	
	College or Above	30%	150 (30%)	
Marital Status	Married	45%	225 (45%)	
	Divorced	20%	100 (20%)	
	Single	30%	150 (30%)	
	Widowed	5%	25 (5%)	
Employment Status	Employed	50%	250 (50%)	
	Self-employed	30%	150 (30%)	
	Unemployed	20%	100 (20%)	
Current Living Conditions	Living Alone	40%	200 (40%)	
	Living with Family	30%	150 (30%)	
	Living with Friends/Others	30%	150 (30%)	
Duration Since HIV Diagnosis (Years)	Less than 5 years	30%	150 (30%)	
	5 to 10 years	35%	175 (35%)	
	More than 10 years	35%	175 (35%)	
Current ART Regimen	Regimen A	25%	125 (25%)	
	Regimen B	35%	175 (35%)	
	Regimen C	25%	125 (25%)	
	Regimen D	15%	75 (15%)	
CD4 Count (cells/mm <sup>3</sup> )	Less than 200	40%	200 (40%)	
	200 to 350	25%	125 (25%)	
	351 to 500	20%	100 (20%)	
	More than 500	15%	75 (15%)	
Plasma Viral Load	Undetectable	55%	275 (55%)	

Table 1: Descriptive Statistics of Sociodemographic, Clinical, Behavioral, and Neurocognitive Variables

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	Detectable	45%	225 (45%)
WHO Clinical Stage	Stage 1	40%	200 (40%)
	Stage 2	20%	100 (20%)
	Stage 3	25%	125 (25%)
	Stage 4	15%	75 (15%)
Neurocognitive Symptoms	None	50%	250 (50%)
	Forgetfulness or Memory	45%	225 (45%)
	Loss		
	Difficulty Concentrating	35%	175 (35%)
	Slowed Thinking	30%	150 (30%)
	Speech Difficulties	25%	125 (25%)
	Trouble with Daily Activities	15%	75 (15%)
Adherence to ART	Good Adherence	70%	350 (70%)
	Poor Adherence	30%	150 (30%)
History of Substance Use	Yes	20%	100 (20%)
	No	80%	400 (80%)
History of	Yes	25%	125 (25%)
Depression/Anxiety			
	No	75%	375 (75%)
Daily Functioning (Scale)	Trouble with Activities	10%	50 (10%)
	Fully Independent	90%	450 (90%)
IHDS Score	Mean±SD	8.0±2.5	_

The findings of statistical tests looking at correlations between different parameters and neurocognitive symptoms are shown in Table 2. Neurocognitive symptoms do not significantly correlate with gender (Chisquare: 0.32), suggesting that the incidence of symptoms is comparable for males and females. IHDS scores and age had a weak correlation (T-test: 0.05), indicating that cognitive impairment may be more prevalent in older adults. Additionally, educational attainment does not significantly impact neurocognitive symptoms (Chisquare: 0.15). Nonetheless, neurocognitive symptoms and CD4 count are substantially correlated (T-test: 0.01), with worse cognitive impairment associated with lower CD4 counts. Neurocognitive symptoms and ART adherence are substantially correlated (Chi-square: 0.04), suggesting that inadequate adherence leads to cognitive impairments. Substance abuse also exacerbates cognitive deterioration, as seen by its substantial correlation with neurocognitive symptoms (Chi-square: 0.001). Overall, these findings imply that clinical and behavioural factors including immune function, treatment compliance, and drug use have a greater influence on HIV-positive people's cognitive health than sociodemographic characteristics like education and gender (Table 2).

Variables	Chi-Square (p-value)	T-test (p-value)	ANOVA (p-value)
Gender & Neurocognitive Symptoms	0.32	-	-
Age & IHDS Score	-	0.05	-
Educational Level & Neurocognitive Symptoms	0.15	-	-
CD4 Count & Neurocognitive Symptoms	-	0.01	-
ART Adherence & Neurocognitive Symptoms	0.04	-	-
Substance Use & Neurocognitive Symptoms	0.001	-	-

Table 2: Statistical Test Results (Chi-Square, T-test, ANOVA)

#### DISCUSSION

The prevalence of HAND in this study (50%) aligns with global estimates, which range from 30% to 60% <sup>[8,9]</sup>. The predominance of ANI reflects the subtle nature of neurocognitive impairments in the ART era, where severe forms like HAD have declined significantly due to improved virologic control <sup>[10]</sup>. Despite this shift, ANI has substantial implications for patient care, as it often remains undiagnosed but affects adherence to ART and daily functioning <sup>[8]</sup>.

Unlike some studies reporting gender differences in HAND prevalence, our findings showed no significant association between gender and HAND (p=0.32). This aligns with studies indicating that biological differences in HIV pathogenesis do not substantially influence neurocognitive outcomes <sup>[11]</sup>. Educational attainment was not significantly associated with HAND in this cohort (p=0.15), which contrasts with the cognitive reserve hypothesis suggesting that higher education mitigates neurocognitive impairment <sup>[12]</sup>.

CD4 count emerged as a critical determinant of HAND, with participants having counts below 200 cells/mm<sup>3</sup> showing significantly higher neurocognitive impairment (p=0.01). These findings are consistent with prior studies linking immune suppression to worsening neurocognitive function <sup>[13]</sup>. ART adherence was another significant predictor (p=0.04). Poor adherence can lead to virologic rebound and systemic inflammation, which contribute to HAND progression <sup>[14]</sup>.

Substance use was significantly associated with HAND (p=0.001), supporting prior evidence that HIV and substance use together exacerbate neuroinflammation and oxidative stress <sup>[15]</sup>. Additionally, a history of depression or anxiety, present in 25% of participants, highlights the importance of integrating mental health services into HIV care <sup>[15]</sup>.

The observed 50% HAND prevalence in this cohort is higher than the 30–40% reported in some settings [9], likely due to contextual factors such as late diagnosis, poor ART adherence, and limited healthcare access. This calls for incorporating neurocognitive screening in routine HIV care, particularly for high-risk individuals like those with low CD4 counts or substance use.

Timely neurocognitive evaluation and multidisciplinary care involving neurologists, psychiatrists, and HIV specialists can enhance early identification and management of HAND. Although this was a crosssectional study, future longitudinal assessments with neuroimaging may help better understand disease progression and response to intervention <sup>[12–14]</sup>.

#### CONCLUSIONS

HAND affects 50% of HIV-positive individuals in this cohort, emphasizing the need for routine neurocognitive screening in HIV care. Factors such as poor ART adherence, substance use, and immune suppression were significant predictors, highlighting areas for intervention. Early identification and targeted management of HAND are critical to improving patient outcomes, particularly in resource-limited settings. Future research should focus on longitudinal assessments and interventions that address both biological and behavioral determinants of HAND.

## LIMITATIONS

The cross-sectional design limits the ability to establish causation between identified risk factors and HAND. Self-reported adherence and substance use data may introduce recall bias. The study's single-center setting limits generalizability to other populations. Additionally, the use of IHDS, while practical for resource-limited settings, may underestimate subtle impairments. Future studies should adopt longitudinal designs, larger samples, and more robust neurocognitive tools to validate findings and assess HAND progression.

#### **CONTRIBUTION OF AUTHORS**

Research concept- Santanu Das, Saptarshi Lahiri Research design- Santanu Das, Saptarshi Lahiri Supervision- Bipasha Adhvaryu, Ishita Das, Shayan Das Materials- Santanu Das, Saptarshi Lahiri Data collection- Santanu Das, Saptarshi Lahiri Data analysis and interpretation- Bipasha Adhvaryu, Ishita Das, Shayan Das Literature search- Santanu Das, Saptarshi Lahiri Writing article- Santanu Das, Saptarshi Lahiri Critical review- Bipasha Adhvaryu, Ishita Das, Shayan Das Article editing- Santanu Das, Saptarshi Lahiri Final approval- Bipasha Adhvaryu, Ishita Das, Shayan Das

#### REFERENCES

 UNAIDS. Global HIV & AIDS statistics—2023 fact sheet. Joint United Nations Programme on HIV/AIDS (UNAIDS); 2023. Available at: https://www.unaids. org/en/resources/fact-sheet#:~:text=39.9%20million

crossef doi: 10.21276/SSR-IIJLS.2025.11.3.50

%20%5B36.1%20million%E2%80%9344.6,AIDS%2Dre lated%20illnesses%20in%202023.

- [2] Heaton RK, Clifford DB, Franklin DR Jr, et al. HIVassociated neurocognitive disorders persist in the era of potent antiretroviral therapy: CHARTER Study. Neurol., 2010; 75(23): 87–96.
- [3] Antinori A, Arendt G, Becker JT, et al. Updated research nosology for HIV-associated neurocognitive disorders. Neurol., 2007; 69(18): 89–99.
- [4] Ellis RJ, Badiee J, Vaida F, et al. CD4 nadir is a predictor of HIV neurocognitive impairment in the era of combination antiretroviral therapy. AIDS, 2011; 25(14): 47–51.
- [5] Robertson KR, Smurzynski M, Parsons TD, et al. The prevalence and incidence of neurocognitive impairment in the HAART era. AIDS, 2007; 21(14): 15–21.
- [6] Sacktor N, Nakasujja N, Skolasky RL, et al. Antiretroviral therapy improves cognitive impairment in HIV+ individuals in sub-Saharan Africa. Neurol., 2006; 67(2): 11–14.
- [7] NACO. HIV Estimates Report 2022. National AIDS Control Organization, Ministry of Health and Family Welfare, Government of India.
- [8] Heaton RK, Franklin DR, Ellis RJ, et al. HIV-associated neurocognitive disorders before and during the era of combination antiretroviral therapy: differences in rates, nature, and predictors. J Neurovirol., 2011; 17(1): 03–16.

- [9] Robertson KR, Su Z, Margolis DM, et al. Neurocognitive effects of treatment interruption in stable HIV-positive patients in an observational cohort. Neurol., 2010; 74(16): 60–66.
- [10]Ellis RJ, Calero P, Stockin MD. HIV infection and the central nervous system: a primer. Neuropsychol Rev., 2009; 19(2): 44–51.
- [11]Cysique LA, Brew BJ. Neuropsychological functioning and antiretroviral treatment in HIV/AIDS: a review. Neuropsychol Rev., 2009; 19(2): 69–85. doi: 10.1007/s11065-009-9092-3.
- [12]Stern Y. Cognitive reserve in ageing and Alzheimer's disease. Lancet Neurol., 2012; 11(11): 06–12. doi: 10.1016/S1474-4422(12)70191-6.
- [13]Cohen RA, Harezlak J, Schifitto G, et al. Effects of nadir CD4 count and duration of HIV infection on brain volumes in the HAART era. J Neurovirol., 2010; 16(1): 25–32.
- [14]Tozzi V, Balestra P, Bellagamba R, et al. Persistence of neuropsychologic deficits despite long-term highly active antiretroviral therapy in patients with HIVrelated neurocognitive impairment: prevalence and risk factors. J Acquir Immune Defic Syndr., 2007; 45(2): 74–82.
- [15]Guillemin GJ, Brew BJ. Implications of the kynurenine pathway and quinolinic acid in Alzheimer's disease. Redox Rep., 2002; 7(4): 199–206. doi: 10.1179/135100002125000550.

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