COGNITIVE DYSFUNCTION AMONG HIV-POSITIVE PATIENTS ATTENDING CCC AT KENYATTA NATIONAL HOSPITAL

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INTRODUCTION

• Changes in memory, mood, attention, and motor skills are common in HIV-infected patients and present a diagnostic challenge to the clinician.

• HIV-associated neurocognitive disorders have a highly variable clinical course and a spectrum of signs and symptoms, ranging from subtle cognitive and motor impairments to profound dementia.
## Table 1: Clinical Manifestations of HIV-Associated Neurocognitive Disorders

<table>
<thead>
<tr>
<th>Type of Impairment</th>
<th>Manifestations</th>
</tr>
</thead>
</table>
| Affective          | • Apathy (depression-like features)  
                     • Irritability  
                     • Mania, new-onset psychosis |
| Behavioural        | • Psychomotor retardation (slowed speech or response time)  
                     • Personality changes  
                     • Social withdrawal |
| Cognitive          | • Lack of visuospatial memory (misplacing things)  
                     • Lack of visuomotor coordination  
                     • Difficulty with complex sequencing (difficulty in performing previously learned complex tasks) |
<table>
<thead>
<tr>
<th>Type of Impairment</th>
<th>Manifestations</th>
</tr>
</thead>
</table>
| Cognitive          | • Impaired concentration and attention  
                      • Impaired verbal memory (word-finding ability)  
                      • Mental slowing |
| Motor              | • Unsteady gait, loss of balance  
                      • Leg weakness  
                      • Dropping things  
                      • Tremors, poor handwriting  
                      • Decline in fine motor skills |
• Accurate diagnosis is critical for patient treatment. [1]

• The pre-HAART prevalence (Dana cohort):
  ✓ HIV-minor cognitive/motor disorder - 47.7% and
  ✓ HIV-dementia - 27.3% [2]

• In other studies done in Uganda (2003/2004), prevalence ranged from 11% (54% with CD4 count < 200/µl) \[^3\] to 31%. \[^4\]

• In a study done in Botswana and published in 2010, the prevalence of HIV-associated neurocognitive impairment was 38%.\[^5\]

3 Wong, M; Robertson, K; Nakasujja, N; et al. *Neurology* 2004; 62 (7) Supplement S5, p A444


• In the CNS HIV Anti-Retroviral Therapy Effects Research (CHARTER) study, overall, 40% of HIV-positive individuals were found to have had neurocognitive impairment in the HAART era.

• Since the introduction of the HAART, the incidence of HAD has declined by 40% to 50%, whereas prevalence has remained unchanged.\[6,7\]


Classification

• In 1991, the American Academy of Neurology defined two levels of neurologic impairment in patients with HIV: HIV-associated dementia (HAD) and minor cognitive motor disorder (MCMD).

• A core difference between the two is the degree of functional impairment present; patients with HAD have more impairment than those with MCMD.
• The term *HIV-associated dementia* or *HIV dementia* incorporates the cognitive changes seen in HIV-1 infection as well as those occurring in the setting of AIDS.

• It is synonymous with the previously existing terms *AIDS dementia complex* [8] and *HIV encephalopathy*. [9]

• AIDS dementia complex (ADC), describes the syndrome as a subcortical dementia with changes in memory, movement (motor) and mood.

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## Definition of HIV-Associated Neurocognitive Disorders (HAND)

<table>
<thead>
<tr>
<th></th>
<th>Acquired Impairment in 2 Cognitive Abilities</th>
<th>Interferes with Daily Functioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic Neurocognitive Impairment (ANI)</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Mild Neurocognitive Disorder (MND)</td>
<td>YES</td>
<td>MILD</td>
</tr>
<tr>
<td>HIV-Associated Dementia (HAD)</td>
<td>MARKED</td>
<td>MARKED</td>
</tr>
</tbody>
</table>

No Pre-Existing Cause, Delirium absent

*Antinori et al., Neurology 2007*
Diagnosis

1. Comprehensive neuropsychological testing. [10]

2. Bedside screening tests
   - MMSE (sensitivity 72%)
   - Grooved pegboard test (sensitivity 71%)
   - HIV Dementia Scale (HDS)
   - International HIV Dementia Scale (IHDS)

Grooved Pegboard Test
HIV Dementia Scale (HDS)

• Designed as a brief but sensitive (sensitivity 80%) screening instrument to identify HIV+ patients at risk for dementia. \[11\]

• Includes subtests that evaluate:
  – Motor speed (timed written alphabet)
  – Memory (recall of four words at 5 min)
  – Constructional praxis (cube copy time) and
  – Executive functions (anti-saccadic errors subtest).

International HIV Dementia Scale (IHDS)

• Eliminates the anti-saccades subtest and replaces the timed written alphabet and cube copy time subtests with tests of motor speed and psychomotor speed which can easily be performed across different cultures.

• Consists of three subtests:
  – timed fingertapping
  – timed alternating hand sequence test
  – recall of four items at 2 minutes.
Timed fingertapping test

• The number of fingertaps of the first two fingers of the non-dominant hand is measured by instructing the participant to open and close the fingers as widely and as quickly as possible over a 5-s period.

• The finger tapping test is scored as follows:
  ➢ 4 = 15 in 5 seconds
  ➢ 3 = 11-14 in 5 seconds
  ➢ 2 = 7-10 in 5 seconds
  ➢ 1 = 3-6 in 5 seconds
  ➢ 0 = 0-2 in 5 seconds
Alternating hand sequence test

• Individuals are asked to perform the following movement with the non-dominant hand as quickly as possible over a 10s period:
  - Clench the hand in a fist on a flat surface
  - Put the hand flat on the surface with the palm down, and
  - Put the hand perpendicular to the flat surface on the side of the fifth digit.
Verbal recall subset

• Similar to that of the HDS.
• Registration (new learning) is measured by reciting four words to the subject and then asking him/her to repeat them immediately.
• The words are repeated by the examiner until the subject can repeat all four words correctly.
• The subject is then asked to recall the four words after the timed fingertapping and alternating hand sequence tests are performed.
• The sensitivity of the IHDS for HIV dementia in the Uganda cohort was 80%, and the specificity for HIV dementia was 55% using a cut-off of ≤ 10 for abnormal performance.

• If the cut-off of ≤ 10.5 for abnormal performance was used, the sensitivity of the IHDS for HIV dementia in the Uganda cohort was increased to 88% with a mild decrease in the specificity to 48%.
• The IHDS does not require knowledge of the English language, can be performed briefly in 2-3 minutes by non-neurologists in an outpatient setting, and requires no special instrumentation other than a watch with a second hand.
• It useful for HIV+ individuals with and without a complete high school education (US cohort mean education, 13 years; Uganda cohort mean education, 9 years).
• The IHDS though does have some limitations:
  i. It is not useful for detecting mild cognitive impairment associated with HIV infection.
  ii. It cannot be used to distinguish between different stages of HIV-associated cognitive dysfunction.
Treatment

• Optimal HAART regimen.
• Regardless of the CNS penetration of HAART medications, patients improve clinically and have improvement of surrogate markers of HIV dementia. [12]
• Use of selegiline in HIV-infected subjects experiencing cognitive impairment is investigational.

Research Question

• What is the prevalence of cognitive dysfunction and its associated factors in HIV-positive patients at the CCC at Kenyatta National Hospital?
Study Justification

• HIV-associated neurocognitive disorders is common (prevalence 11-40 %) and continues to represent substantial personal, economic and societal burdens.
• No local data available.
• It is an important complication to diagnose in patients with HIV infection for several reasons:
  i. It is associated with an increased risk of mortality. [13]

ii. The presence of cognitive dysfunction can contribute to an individual’s inability to function effectively in the workplace and at home \[^{14}\] as well as adversely affect a patient’s adherence to HAART. \[^{15}\]

iii. HAART has been associated with an improvement in cognitive function. \[^{16}\]


• The IHDS may have great value as a screening test for HIV-associated neurocognitive disorders.
• The diagnosis of HIV dementia may then be an indication for initiation of HAART.
Main Objective

• To determine the prevalence of cognitive dysfunction and its associated factors in HIV-positive patients attending CCC at Kenyatta National Hospital.
Specific Objectives

1. To determine the proportion of HIV-positive patients attending CCC, KNH with cognitive dysfunction.

2. To determine the sociodemographic factors of HIV-positive patients with cognitive dysfunction.

3. To determine the association between cognitive dysfunction and CD4 count, duration of diagnosis of HIV infection and duration of HAART.
Study Methodology

• Study Setting: Comprehensive Care Clinic, Kenyatta National Hospital.
• Study Population: HIV-positive patients attending CCC at KNH.
• Study Design: Cross-sectional questionnaire-based study.
Inclusion Criteria

• Aged >18 years.
• HIV-positive (diagnosed using two of the three Rapid Diagnostic Tests – Determine®, Bioline® and Unigold®).
• Given informed consent.
Exclusion Criteria

- Clinical presumptive evidence of past or present CNS opportunistic infections.
- Known psychiatric disorders (schizophrenia, major depressive disorder, bipolar disorder).
- Patients with positive VDRL.
- Active kidney / liver disease.
- Past or present substance abuse (alcohol, opioids, cannabis).
- Patients on medications such as anti-psychotics, sedative hypnotics and anti-depressants.
- Patients with known Vitamin B12 deficiency or thyroid disease.
Sample Size Calculation

- Sample size was calculated as shown below:

\[ N = \frac{(Z_{\alpha/2})^2 \times p (1-p)}{d^2} \]

Where:

- \( N \) = minimum sample size required
- \( \alpha \) = the level of significance (5%) i.e the acceptable margin of error that the true value does not lie outside the range chosen
- \( Z_{\alpha/2} \) = the value of Z at the selected level of significance
- \( p \) = likely prevalence (40%)
- \( d \) = the maximal acceptable difference of estimate from true value (10%)

\[
N = \frac{(1.96)^2 \times 0.40 \times 0.60}{(0.1)^2}
\]

\( N = 93 \) patients
Sampling Method

- Random sampling of HIV-positive patients attending CCC at Kenyatta National Hospital using a table of random numbers was done to obtain five patients per day until the desired sample size was achieved.
Ethical Consideration

• Ethical approval was obtained from the Kenyatta National Hospital / University of Nairobi Scientific and Ethical Review Committee.
• Informed written consent was obtained.
• All patients were offered standard of care whether or not they agreed to participate in the study.
• All information was kept confidential
105 patients screened

4 patients excluded –
history of CNS opportunistic infections and VDRL positive

101 patients satisfied
the inclusion criteria

1 patient declined consent

100 patients recruited
• The questionnaire and IHDS tool were administered by the PI as part of the clinical evaluation of the patient.
Potential Predictor Variables

1. Demographic
   • Age
   • Gender
   • Level of education
   • Duration of diagnosis of HIV infection
   • Duration of HAART
   • ARV drug classes used as HAART component.

2. Laboratory
   • Baseline and current (most recent) CD 4 counts (using CyFlowSL_3® software FloMax version 2.52).
Data Analysis

• Data input was done using Excel and analysis done using Stata version 11.0.

• Categorical data such as presence / absence of cognitive dysfunction, gender and level of education were summarized as proportions.

• Associations between presence / absence of cognitive dysfunction and categorical variables were analyzed using the Chi-square test and logistic regression.
• Level of significance was set at P<0.05.
• Results were presented as Odds ratios (OR) with 95% Confidence Intervals (CI).
• Continuous data such as duration of HIV infection, duration of HAART and CD4 counts were summarized as means, modes and medians.
• Data was presented in the form of tables, bar graphs and pie charts.
## Results

### Table 3: Characteristics of Study Subjects by Dysfunction Status

<table>
<thead>
<tr>
<th></th>
<th>No Cognitive Dysfunction</th>
<th>Cognitive Dysfunction</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Age (mean (SD))</td>
<td>37.5 (7.9)</td>
<td>40.7 (7.6)</td>
<td>0.08</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>22</td>
<td>29.73</td>
<td>17</td>
</tr>
<tr>
<td>Secondary</td>
<td>36</td>
<td>48.65</td>
<td>7</td>
</tr>
<tr>
<td>College</td>
<td>16</td>
<td>21.62</td>
<td>2</td>
</tr>
<tr>
<td>Baseline CD4 Count (µl)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 200</td>
<td>27</td>
<td>36.5</td>
<td>16</td>
</tr>
<tr>
<td>201-350</td>
<td>26</td>
<td>35.1</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 350</td>
<td>21</td>
<td>28.4</td>
<td>7</td>
</tr>
<tr>
<td>Nadir CD4 Count (µl)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 200</td>
<td>34</td>
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<td>18</td>
</tr>
<tr>
<td>201-350</td>
<td>28</td>
<td>37.8</td>
<td>4</td>
</tr>
<tr>
<td>&gt; 350</td>
<td>12</td>
<td>16.2</td>
<td>4</td>
</tr>
<tr>
<td>Duration of HAART</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2yrs</td>
<td>39</td>
<td>52.7</td>
<td>10</td>
</tr>
<tr>
<td>&gt; 2yrs</td>
<td>35</td>
<td>47.3</td>
<td>16</td>
</tr>
</tbody>
</table>
### Table 3: Characteristics of Study Subjects by Dysfunction Status

<table>
<thead>
<tr>
<th></th>
<th>No Cognitive Dysfunction</th>
<th>Cognitive Dysfunction</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration of HIV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2yrs</td>
<td>30 40.54</td>
<td>7 26.92</td>
<td>0.216</td>
</tr>
<tr>
<td>&gt;2yrs</td>
<td>44 59.46</td>
<td>19 73.08</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>54 72.97</td>
<td>18 69.23</td>
<td>0.715</td>
</tr>
<tr>
<td>Male</td>
<td>20 27.03</td>
<td>8 30.77</td>
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<tr>
<td><strong>Employment Status</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>10 13.51</td>
<td>4 15.38</td>
<td>0.813</td>
</tr>
<tr>
<td>Employed</td>
<td>64 86.49</td>
<td>22 84.62</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>Freq (%)</td>
<td>OR</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----</td>
<td>----------</td>
<td>-----</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>26(26)</td>
<td>1.054</td>
<td>0.994</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>72</td>
<td>18(25)</td>
<td>1[Ref]</td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>8(29)</td>
<td>0.271</td>
</tr>
<tr>
<td><strong>Level of Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>40</td>
<td>17(43)</td>
<td>1[Ref]</td>
</tr>
<tr>
<td>Secondary</td>
<td>42</td>
<td>7(17)</td>
<td>0.169</td>
</tr>
<tr>
<td>College</td>
<td>18</td>
<td>2(11)</td>
<td>0.169</td>
</tr>
<tr>
<td><strong>Baseline CD4 Count (µl)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤200</td>
<td>43</td>
<td>16(37)</td>
<td>1[Ref]</td>
</tr>
<tr>
<td>201-350</td>
<td>29</td>
<td>3(10)</td>
<td>0.195</td>
</tr>
<tr>
<td>&gt;350</td>
<td>28</td>
<td>7(25)</td>
<td>0.563</td>
</tr>
<tr>
<td><strong>Nadir CD4 Count (µl)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤200</td>
<td>52</td>
<td>18(35)</td>
<td>1[Ref]</td>
</tr>
<tr>
<td>201-350</td>
<td>32</td>
<td>4(13)</td>
<td>0.270</td>
</tr>
<tr>
<td>&gt;350</td>
<td>16</td>
<td>4(25)</td>
<td>0.630</td>
</tr>
<tr>
<td><strong>Duration of HIV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤2yr</td>
<td>37</td>
<td>7(19)</td>
<td>1[Ref]</td>
</tr>
<tr>
<td>&gt;2yr</td>
<td>63</td>
<td>19(30)</td>
<td>1.851</td>
</tr>
<tr>
<td><strong>Duration on HAART</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤2yr</td>
<td>49</td>
<td>10(20)</td>
<td>1[Ref]</td>
</tr>
<tr>
<td>&gt;2yr</td>
<td>51</td>
<td>16(31)</td>
<td>1.783</td>
</tr>
</tbody>
</table>
The prevalence of cognitive dysfunction among HIV-positive patients attending CCC, KNH was 26%. The IHDS score for HIV-positive patients with cognitive dysfunction was ranging from a minimum of 8.0 to 10.0.
• The female: male ratio was 2.6:1.
• The peak age of the study patients was 36-45 years with a mean age of 38.3 +/- 7.9 yrs and a median of 38 years.
• The youngest patient was 19 years of age and the oldest was 58 years of age.
• For patients with cognitive dysfunction, the mean age was 40.7 +/- 7.6 years, while for those with normal cognitive function, it was 37.5 +/- 7.9 years (P=0.08).
Relative to those with primary education, the odds of cognitive dysfunction were 0.271, and 0.169 for those with secondary and tertiary education respectively (p=0.012).
• The mean baseline CD4 count was 252+/−199/μl (median 236/μl and ranging from 2 to 850/μl).

• For those with cognitive dysfunction, the mean baseline CD4 count was 240+/−222/μl (median 146/μl and ranging from 11-700/μl), while those with normal cognitive function had a mean baseline CD4 count of 256+/−192/μl (median 250/μl and ranging from 2 to 850/μl) (P=0.719).
Relative to those with a baseline CD4 count of ≤200 /µl, the odds of cognitive dysfunction were 0.195 and 0.563 for those with a baseline CD4 count of 201-350 /µl and >350 /µl respectively (P=0.053).
• The mean nadir CD4 count was 205+/-160/μl (median 195/μl and ranging from 2 to 680/μl).

• For those with cognitive dysfunction, the mean nadir CD4 count was 188+/-158/μl (median 146/μl and ranging from 11-584/μl), while those with normal cognitive function had a mean nadir CD4 count of 211+/-161/μl (median 207/μl and ranging from 2 to 680/μl) (P=0.531).
Relative to those with a nadir CD4 count of \( \leq 200 \, /\mu l \), the odds of cognitive dysfunction were 0.27 and 0.63 for those with a nadir CD4 count of 201-350 \( /\mu l \) and \( >350 \, /\mu l \) respectively (P=0.096).
• The mean duration of HIV infection from the time of diagnosis was 3.27 +/- 2.59 years. For patients with cognitive dysfunction, the mean duration of HIV infection from the time of diagnosis was 3.60 +/- 2.64 years, while for those with normal cognitive function, the duration was 3.15 +/- 2.58 years (P=0.445)

Relative to those having HIV infection for ≤ 2 years, the odds of cognitive dysfunction was 1.851 for those with HIV infection for more than 2 years (P=0.220).
The mean duration of HAART was 2.37 +/- 2.28 years. For patients with cognitive dysfunction, the mean duration of HAART was 2.59 +/- 2.23 years, while for those with normal cognitive function, the duration was 2.29 +/- 2.31 years (P=0.576).

Relative to those on HAART for ≤ 2 years, the odds of cognitive dysfunction was 1.783 for those on HAART for > 2 years (P=0.214).
The ARV regimens used were as follows:

<table>
<thead>
<tr>
<th>ARV regimen</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZT/3TC/EFV</td>
<td>14</td>
<td>14.00</td>
<td>14.00</td>
</tr>
<tr>
<td>AZT/3TC/NVP</td>
<td>10</td>
<td>10.00</td>
<td>24.00</td>
</tr>
<tr>
<td>TDF/3TC/EFV</td>
<td>14</td>
<td>14.00</td>
<td>38.00</td>
</tr>
<tr>
<td>TDF/3TC/NVP</td>
<td>4</td>
<td>4.00</td>
<td>42.00</td>
</tr>
<tr>
<td>TDF/3TC/SQV/r</td>
<td>1</td>
<td>1.00</td>
<td>43.00</td>
</tr>
<tr>
<td>d4T/3TC/EFV</td>
<td>15</td>
<td>15.00</td>
<td>58.00</td>
</tr>
<tr>
<td>d4T/3TC/NVP</td>
<td>20</td>
<td>20.00</td>
<td>78.00</td>
</tr>
<tr>
<td>HAART naive</td>
<td>22</td>
<td>22.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>ART</td>
<td>No Cognitive Dysfunction</td>
<td>Cognitive Dysfunction Present</td>
<td>Total</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------</td>
<td>--------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>On HAART</td>
<td>58</td>
<td>20</td>
<td>78</td>
</tr>
<tr>
<td>Not on HAART</td>
<td>16</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>26</td>
<td>100</td>
</tr>
</tbody>
</table>

Relative to those on HAART, the odds of cognitive dysfunction was 1.0875 for those not on HAART (P=0.878).
CONCLUSION

• HIV-associated neurocognitive dysfunction is quite prevalent (26%) among HIV-positive patients attending the CCC at KNH.

• No statistically significant associations between cognitive dysfunction and sociodemographic and laboratory variables were found except for education. This could be due to the fact that education may be protective against dementia and also, the IHDS tool might not be as robust to the effects of education as previously thought.
• The high prevalence of cognitive dysfunction was seen despite the fact that more than 75% of the HIV-positive patients with cognitive dysfunction were on HAART, and more than 50% were on HAART for ≥ 2 years.
• This could be explained by the “legacy effect” of HIV infection in the CNS which results in aberrant and persistent immune activation and inflammation thus establishing slow and irreversible brain damage and subsequently leading to cognitive decline.
A report in the 16th CROI concluded that HIV infection was equivalent to approximately 15-20 years increase in brain aging, and HIV and aging produce similar additive effects i.e. reduce resting cerebral blood flow and decrease functional blood oxygen level dependent brain activity for visual stimuli.

Hence HAART should be started earlier rather than waiting until the CD4 count drops to ≤ 200/µl, and this is in line with the recent (March 2011) Kenyan Ministry of Medical Services directive that HAART should be initiated at a CD4 count of ≤ 350/µl.
Study Limitations

• The study population represents those HIV-positive patients who can access health care at the CCC, Kenyatta National Hospital and therefore results are not generalizable.

• Lab and radiological procedures and investigations such as HIV viral load (which is a useful variable for assessing association with neurocognitive dysfunction), lumbar punctures, CT scans and MRIs to rule out CNS opportunistic infections were not done because of financial constraints. CD4 count was used as a surrogate marker for HIV viral load.
This was a cross-sectional study and therefore follow up of patients was not done, hence it is not possible to assess the impact of HAART on those patients found to have cognitive dysfunction.
RECOMMENDATIONS

• HIV-positive patients should be routinely screened for cognitive dysfunction using the IHDS tool.

• Further validation of the IHDS tool is needed (since it is significantly affected by education).
THANK YOU