A Comparison of 5 Brief Screening Tools for HAND in the USA and South Africa P-G3

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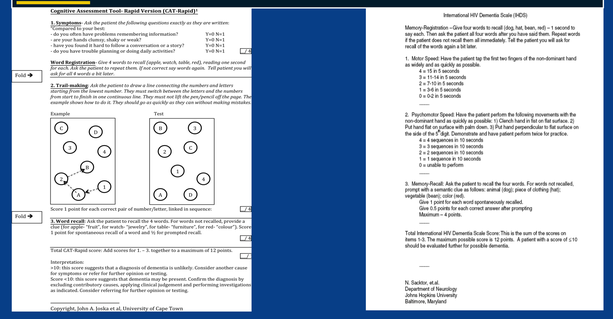
Background:

A screening test for HIV associated neurocognitive disorders (HAND) is urgently needed in busy HIV clinics. The ideal tool would be brief; can be administered by non-neuropsychologists; and would display good sensitivity (>80%) and fair specificity (>50%). The tool needs to tap domains affected by HIV, including when ART use might alter the cognitive picture. There is growing recognition of the importance of detecting all types of HAND, and not only HIV-D. We compared the sensitivity and specificity of five brief screening tools for HIV-dementia and any HAND.The Cognitive Assessment Tool-rapid version (CAT-rapid) (pictured right) is a novel screener developed in Cape Town, incorporating symptom questions, a brief trail-making test, and 4-word recall. It requires no instruments. We hypothesised that the International HIV Dementia Scale (IHDS), the Montreal Cognitive Assessment (MOCA) and the CAT-rapid would be more sensitive than the Mini-Mental State Examination (MMSE) and the Simioni Symptom Questions (SSQ) in screening for HIV-D and all types of HAND. Additionally, we hypothesised that the inclusion of symptom questions in the CAT-Rapid would increase its sensitivity for HIV-D.

Methods:

We recruited individuals established on ART in Cape Town, South Africa, and Baltimore, USA. Participants underwent the 5 screening tests, a detailed neuropsychological test battery, an assessment of activities of daily living, subjective adherence measures and neuromedical assessment. Cases were classified into HAND categories using American Academy of Neurology criteria. HAND diagnosis was confirmed by regular case conferences between the two sites. We calculated the sensitivity and specificity of each tool to correctly identify HIV-D and any form of HAND (including ANI, MND and HIV-D) across the full sample, using 2x2 contingency tables and a receiver operating characteristic analysis.

The Cognitive Assessment Tool- Rapid Version and the International HIV Dementia Scale



Cognitive Assessment Tool- Rapid Version (CAT-Rapid)[1]

1. Symptoms - *Ask the patient the following questions exactly as they are written:* (circle one)
- do you often have problems remembering information? Y=0 N=1
- are your hands clumsy, shaky or weak? Y=0 N=1
- have you found it hard to follow a conversation or a story? Y=0 N=1
- do you have trouble planning or doing daily activities? Y=0 N=1

Word Registration - *Give 4 words to recall (apple, watch, table, red), reading one second for each. Ask the patient to repeat them. If not correct say words again. Tell patient you will ask for all 4 words a bit later.*

Fold ➔

2. Trail-making - *Ask the patient to draw a line connecting the numbers and letters in ascending order. Start with 1 and finish with A. Connect numbers and letters from start to finish in one continuous line. They must not lift the pen/pencil off the page. The example shows how to do it. They should go as quickly as they can without making mistakes.*

Example — Test

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Score: 1 point for each correct pair of numbers/letter, linked in sequence:

3. Word recall - Ask the patient to recall the 4 words. For words not recalled, provide a clue (for apple- "fruit", for watch- "jewelry", for table- "furniture", for red- "colour"). Score 1 point for spontaneous recall of a word and ½ for prompted recall.

Total CAT-Rapid score: Add scores for 1.– 3. together to a maximum of 12 points.

Interpretation:
=10: this score suggests that a diagnosis of dementia is unlikely. Consider another cause for symptoms (e.g. depression, delirium).
Score <10: this score suggests that dementia may be present. Confirm the diagnosis by excluding contributory causes, applying clinical judgement and performing investigations as indicated. Consider referring for further opinion or testing.

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International HIV Dementia Scale (IHDS)

Memory Registration – Give four words to recall (dog, hot, bean, red) – 1 second to say each. Then ask the patient all four words after you have said them. Repeat words if the patient does not recall them all immediately. Tell the patient you will ask for recall of the words again a bit later.

1. Motor Speed: Have the patient tap the first two fingers of the non-dominant hand as widely and as quickly as possible.
4 = 15 in 5 seconds
3 = 11 to 14 in 5 seconds
2 = 7-10 in 5 seconds
1 = 3-6 in 5 seconds
0 = 0-2 in 5 seconds

2. Psychomotor Speed: Have the patient perform the following movements with the non-dominant hand as quickly as possible: 1) Clench hand in fist on flat surface. 2) Put hand flat on surface with palm down. 3) Put hand perpendicular to flat surface on the side of the R hand. Demonstrate and have patient perform twice for practice.
4 = 4 sequences in 10 seconds
3 = 3 sequences in 10 seconds
2 = 2 sequences in 10 seconds
1 = 1 sequence in 10 seconds
0 = unable to perform

3. Memory-Recall: Ask the patient to recall the four words. For words not recalled, prompt with semantic cue as follows: animal (dog); piece of clothing (hat); vegetable (bean); colour (red).
Give 1 point for each word spontaneously recalled.
Give 0.5 points for each correct answer after prompting
Maximum – 4 points.

Total International HIV Dementia Scale Score: This is the sum of the scores on items 1-3. The maximum possible score is 12 points. A patient with a score of ≤10 should be evaluated further for possible dementia.

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Analysis:

For each screener and AAN HAND category, participants were coded as "0" for normal and "1" for neurocognitive impairment. We used three groups of impairment as follows to establish sensitivity and specificity of each tool for various levels and types of impairment: (1) All three forms of HAND (2) Mild HAND: ANI and MND (3) Symptomatic HAND: MND and HIV-D and (4) HIV-Dementia. According to the established cut-off points for each tool, participants scoring above the cut-off point were coded as *"0"* (cognitively intact according to the screener), and at or below the cut-off point were coded as *"1"* (cognitively impaired). We then generated a series of 2 x 2 contingency tables for the screeners vs the *AAN HAND classification*. The output displayed the number of true positives, true negatives, false positives and false negatives of the CAT-Rapid at the specified cut-off point. We then determined the tool's sensitivity, specificity, positive predictive value and negative predictive value at the specified cut-off point using http://www.medcalc.org/calc/diagnostic_test.php) . We report on sensitivity and specifity for each screener's ability to detect HIV-D and any form of HAND (Table 2).

Participants:

The sample included 156 participants (89 from SA, 67 from the USA): median age of 40 years, 11 years of education, % women=62.80%, median CD4 cell count=460 cells/ml (Table 1). Nearly half of the participants had symptomatic HAND [46 were classified as mild neurocognitive disorder (MND) and 19 as having dementia (HIV-D)].

Table 1. Demographic and Clinical Data Stratified by Cognitive Diagnosis

Characteristics	*N*	Normal	ANI	MND	HIV-D	*p*
Total	156	50	41	46	19	
SA	89	39	24	22	4	
USA	67	11	17	24	15	
Female, No. (%)	98	36 (72.0)	31 (75.6)	25 (54.3)	6 (31.4)	.003
Age, No., years	154	49	40	46	19	.001
Median		35.0	38.5	44.5	54.0	
Interquartile range		13.5	24.3	26.5	16.0	
Education, No., years	154	50	39	46	19	.289
Median		11.0	11.0	11.0	12.0	
Interquartile range		1.3	2.0	2.0	3.0	
CD4 count, No., cells/ml	124	43	33	32	16	.006
Median		363.0	498.0	454.0	635.5	
Interquartile range		300.0	229.0	329.5	460.8	

ANI, asymptomatic neurocognitive impairment; MND, mild neurocognitive disorder; HIV-D, HIV-dementia.

Screening for HIV-D:

We regarded a value of >80% as good sensitivity and >50% as good specificity to maximise the utility of the screening tool. The combined sensitivity and specificity of the CAT-Rapid and IHDS respectively performed better than the other tools: The CAT-rapid displayed a better sensitivity, while the IHDS had a better specificity. The MOCA was highly sensitive but was poorly specific.

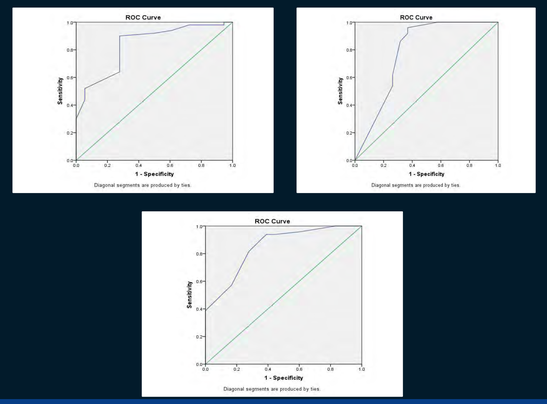
Screening for any HAND:

No tool met the above criteria. The IHDS and CAT-Rapid displayed fair combined sensitivity and specificity to all any HAND (using cut-off of 11 for IHDS). The MOCA again showed high sensitivity but weak specificity. The SSQ showed fair to good sensitiviy but poor specificity. In screening for any HAND, the IHDS showed weak sensitivity but good specificity.

Table 2. Sensitivity and Specifity of the 5 screening tools

Tool and cut-off point	Sensitivity	Specificity
IHDS		
Normal vs. HAND (≤ 11)	64.8%	62.0%
Normal vs. HIV-D (≤ 10)	68.4%	86.0%
CAT-Rapid		
Normal vs. HAND (≤ 10)	64.4%	52.0%
Normal vs. HIV-D (≤ 10)	94.4%	52.0%
MoCA		
Normal vs. HAND (< 26)	89.3%	22.5%
Normal vs. HIV-D (< 26)	100.0%	22.5%
MMSE		
Normal vs. HAND (<24)	23.8%	98.1%
Normal vs. HIV-D (<24)	26.3%	98.1%
Simioni		
Normal vs. HAND (≥ 1)	77.6%	32.0%
Normal vs. HIV-D (≥ 1)	79.1%	32.0%

Receiver operating characteristics of the CAT-rapid (AUC= .835), MOCA (AUC= .849), and IHDS (AUC= .784) for HIV-dementia.



Discussion and Conclusions:

The IHDS and the CAT-rapid provided the best combination of sensitivity and specifity for HIV-D, while the MOCA displayed high sensitivity but weak specificity. The CAT-rapid offered better sensitivity, while the IHDS better specificity. This may reflect the nature of the items included in these tools- with the CAT-Rapid including symptom questions, and the IHDS including psychomotor processing. In screening for any HAND, no single tool proved to be ideal. In order to screen for any HAND, the addition of symptom questions, as well as a measure of executive function and psychomotor processing speed may be useful components of a screener.

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