

REVIEW / MISE AU POINT

NEUROPSYCHOLOGICAL DIAGNOSTICS IN ETHIOPIA - CHALLENGES AND CHANCES AMONG CONSIDERATIONS REGARDING DIFFERENTIAL DIAGNOSIS (LITERATURE OVERVIEW)**DIAGNOSTIC NEUROPSYCHOLOGIQUE EN ETHIOPE - DIFFICULTÉS ET OPPORTUNITÉS CONCERNANT LE DIAGNOSTIC (REVUE DE LA LITTÉRATURE)**

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Mots clés : *Ethiopie, Neuropsychologie, Psychiatrie*

Key words: *Cognition; Culture-fair; Ethiopian; Low-Income; Neuropsychology; Psychiatry*

RESUME**Background**

Neuropsychological tests can provide crucial information regarding the consideration of psychiatric differential diagnosis. This is especially important in developing countries like Ethiopia where advanced imaging is not widely available.

Methods

A detailed literature search was conducted using the search engines Pubmed, Science Direct, Web of Science and Google Scholar from February 2013 until May 2014. Selecting the identified studies pragmatically depending on the content, twenty-six studies were included.

Results

The administration of tests developed in Western-European settings to the African culture presents enormous challenge. Among these are especially the influence of low level of literacy, familiarity with the testing material, cultural aspects regarding social behavior and sense of time, cultural differences regarding cognitive functions and lack of norms. At the same time, there are opportunities for different fields of application, especially when considering the diagnosis of dementia and in the assessment of frontal lobe lesions. Assessment of cognitive flexibility appears to be an important way to differentiate between affective disorders and schizophrenia.

Conclusions

In conclusion, we suggest a „basic set of neuropsychological tests“ for application in psychiatric facilities in low income countries like Ethiopia, which mostly includes nonverbal tests. By using these tests, some of the challenges found during the literature search can be overcome. Additionally, they might provide extra information for diagnostic issues. However, they might have to be adapted to the Ethiopian culture.

RESUME**Introduction**

Les tests neuropsychologiques peuvent fournir des informations fondamentales dans le diagnostic différentiel des affections psychiatriques. Ceci est particulièrement important dans les pays en voie de développement tels que l'Éthiopie où la formation n'est pas largement disponible.

Méthodes

Une recherche détaillée de la littérature a été conduite en utilisant Pubmed, Science Directe, Web de la Science et Google Scholar sur la période de février 2013 jusqu'à mai 2014. : vingt-six études selon le contenu- particulièrement pragmatiques ont été identifiées

Résultats

L'utilisation des tests développés dans les pays d'Europe occidentale présente un réel intérêt pour l'Afrique. En particulier, celles intégrant le niveau d'instruction primaire, la maîtrise du test, les aspects culturels concernant le comportement social, la gestion du temps et les différences culturelles. Les champs d'application s'étendent au diagnostic de démence et l'exploration des lésions de lobe frontal. L'appréciation de la flexibilité cognitive semble être une voie importante pour différencier les désordres affectifs et la schizophrénie.

Conclusion

Nous proposons un ensemble tests neuropsychologiques de base pour l'appliquer dans les ressources psychiatriques dans les pays à revenu faible comme l'Éthiopie. Ils pourraient fournir des informations supplémentaires dans les problèmes diagnostiques et pourraient être adaptés à la culture éthiopienne.

INTRODUCTION

In the day-to-day psychiatric practice, neuropsychological tests are an important part for answering various questions and considerations. Examples include diagnostic considerations such as the differentiation between dementia and depression, progress evaluation or questions regarding vocational rehabilitation [46, p. 23].

In developing countries, where advanced diagnostic technologies like neuroimaging are not widely available, neuropsychological tests can provide crucial information [38]. Ethiopia, one of the poorest countries in the horn of Africa, bears enormous challenges in the field of psychiatry. On the other hand, there appears to be a great potential for the development of the field. In the last 15 years, large scale epidemiological studies were conducted [22, 23]. Through time, a number of diagnostic tools and questionnaires were translated into one of the most widely spoken local languages, Amharic [8, 24, 28]. This review attempts to present the current status of neuropsychological tests which have been used especially in Ethiopia and in other African countries. Additionally, potential challenges and opportunities regarding the application of tests developed within the Western-European setting in a cross-cultural context are discussed.

METHODS

In the present literature overview, we conducted a detailed investigation using the search engines Pubmed, Science Direct, Web of Science and Google Scholar from February 2013 until May 2014. Therefore, we focused systematically on studies found by the keywords „cognitive research developing countries“, „neuropsychology developing countries“, „cognitive assessment Ethiopia“, „Ethiopia cognitive/ cognition“. Additionally, studies which were found by screening the references of already used studies or by extended search strategies were included by exploration. The authors assessed the relevance of these studies by reviewing their title and abstract. We mainly chose an exploratory approach without inclusion or exclusion criteria and selected the identified studies pragmatically depending on the content. As a result, we included n = 26, whose content is presented in detail in the results and is discussed in relation to the research question.

RESULTS***Neuropsychological tests currently used in Ethiopia:***

Until the time of the review, only a few studies existed (n = 4) about the current procedure of neuropsychological tests in Ethiopia. Most of them focus on the assessment of cognitive impairment among HIV-patients [5]. The International HIV Dementia Scale is used quite often. It focuses especially on motor performances (Finger Tapping, Grooved Pegboard, adaptation of the Luria Motor test). However, using this

measure, there was no difference between HIV positive and negative patients [5]. It is a big problem thereby, that the norms were not adapted [5]. Besides, the test should be extended by measures for learning ability, processing speed and short term and working memory to improve the sensitivity.

Regarding considerations about the diagnosis for dementia, the application of the Mini-Mental Status-Examination (MMSE) was assessed in Ethiopia [22]. Thereby, the prevalence of severe cognitive impairment was significantly increased to 2.6%. However, the authors noted critically that the MMSE was highly influenced by the level of education. In Addis Ababa, about 13-17% of the population has no education, in rural areas the percentage is even higher [22].

Besides, the influence of iodine deficiency on cognitive functions among young mothers and their 5-years-old children was explored, which is especially widespread in rural Sidama, in Southern Ethiopia [3]. For the assessment of the adults, they used the Raven's Coloured Progressive Matrices (to assess the visual planning and problem solving functions and the fluid intelligence) and subtests of the Kaufmann Assessment Battery for Children (K-ABC-II), which were partly adapted for the adults. According to the authors, these tests are especially suitable for application, as only small differences depending on the respective cultures existed so far. Both, the mothers and their children showed reduced cognitive performance with significant impairments especially in the visual area, in planning functions, in the short and long term memory and processing speed.

Challenges:

As some authors already discussed while checking the application of the MMSE in Ethiopia, the lack of taking into account education during the application of the MMSE is an essential limitation of this test [22]. Comparing European Americans with Mexican Americans, it was found that the risk for Mexican Americans to get a MMSE-score lower than 24 is 2.2 times higher than for European Americans [9]. Such a score formally indicated a potential diagnosis of dementia. The authors believe that this result cannot be explained in terms of ethnicity, but actually in terms of the level of education and the socio-economic background. The authors, who investigated the application of the MMSE in Brazil, also found out that there was a high association between the MMSE and education. Patients formally educated for at least one year reached on average about 3.7 points more than uneducated patients. Even after adaptation for different cut-off-scores, there were still high rates of misclassification, meaning that people were assessed as „being demented“ four times higher than using clinical evaluation according to DSM-IV [42]. However, this kind of association between cognitive functioning and level of education is not just limited to the MMSE, but is generally part of the creation of cognitive performance profiles [39]. It is discussed on the one hand the relevance of being familiar with academic testing situations and on the other hand the inability to read - illiteracy is partly still common in Ethiopia; in rural areas, for example in Butajira, the rate of illiteracy was 70% [30] - and the lack of familiarity with letters and numbers closely associated with this [38]. Keeping this in mind, for example tasks like the TMT-A or TMT-B can also be distorted during the cognitive performance, because difficulties in connecting the right symbols as quickly as possible are actually attributable to the lack of familiarity with the material rather than to the reduction of processing speed or to the lack of cognitive flexibility [38].

Besides, familiarity with the material is a culture-specific challenge. Especially for auditory or visual stimuli like pictures, the specific context is an important factor [38]. The „draw a person test“, for example, where the children are asked to draw a person using paper and pencil, in Zambia is implemented with clay (for girls) or wire (for boys). In Zambia, this task is called „Panga Munthu“ („panga“ means to build; „munthu“ means person) [21]. Additionally, for the appropriate integration of the nonverbal material into the special culture-specific context, the instructions and verbal material have to be translated into the respective language. Here, it should be noted that particular criteria like the frequencies of words in daily context, the length of words (especially when using memory tests) and the meaning of the content should be maintained adequately and not falling apart from the criteria for validity because of the translation process. To avoid such a tendency, the linguistic implementation should be performed by using some runs of retranslations and should be proved by pilot studies regarding the feasibility and by local psychologists regarding the linguistic standard [15, 38]. However, especially in such a multilingual country as Ethiopia, verbal tests might be difficult to use adequately, especially in rural areas. Although a majority of the population speaks Amharic (the official language of the country) or Oromiffa, the rest of the population belongs to one of the other 82 ethnic groups, bilingually speaking either Amharic or Oromiffa as well as their own language, or monolingually speaking only their own language. Only an urban, academically educated minority and the political elite society speaks English [2].

As values and meanings as well as rules of communication and interaction differ quite strongly between cultures, instructions and formulations also have to be adapted according to the particular cultural background. Looking, for example at the raven matrices test, there are big differences. Afro-American children implicitly believe that authorities want them not to give logical and obvious suggestions to solve a problem, but expect them to give creative, nonorthodox answers [1]. Another relevant, culture-specific aspect concerns the meaning of time. In Western neuropsychological tests, time plays an essential role, which can be seen for example in subtests for the assessment of intelligence (WAIS-III; [49]) or for the assessment of cognitive processing speed as one part of attention (e.g. d2 test of attention; [4]). In Western countries, the

basic rule for this test says: „Work as fast and as carefully as you can“ [38]. Time is seen as something limited which should be used as wisely as one can; in Western-European countries, we have a monochronic understanding of time. By contrast, in African cultures there is a polychronic understanding of time. As procedures are running in parallel to each other, there is more flexibility, but also more distraction; however, distractions are not interpreted as disruptions [11, 14]. Besides culture specific influence of the administration, we have to ask, to what extent testing measures can be transferred to the international context while keeping their validity. There is often a lack of evidence that a test assesses the same construct, regardless of the cultures [15]. For example, intelligence in Zambia is associated with cognitive willingness as well as diligence and wisdom, but also some kind of personality and social sense of responsibility [21]. In Liberia, when performing a semantic category task, most people choose the functional category instead of the taxonomic one (for example they pair a potato and knife, because you use the knife for peeling the potato) [13].

Keeping in mind the influences of education and illiteracy as well as culture specific values for the adaptation of the tests, last but not least, there is often a lack of population-specific norms. Some authors showed that during the establishment of current norms in the context of the WHO-Neurobehavioral Core Test Study, there were big differences in the performances between Western and non-Western cultures [38]. Therefore, it is recommended, especially in the clinical context regarding the application of neuropsychological tests for example in Sub-Saharan Africa, to collect data on local healthy comparison group for the evaluation of the performance of the patients; however, there are still no specific norms [40]. Similar results were reported in Cameroon in comparison to the Western population when adapting a test battery for the evaluation of cognitive impairment associated with HIV [20]. However, a huge influence of education and age existed. Kathuria and Serpell also recommended comparison and evaluation of the results only among the people of Cameroon, because only by this kind of handling a context specific evaluation of the healthy cognitive performance can be done. Additionally, the collection of age specific norms is often challenging, as in some African communities the actual ages or dates of birth are not known [21].

Opportunities and application areas:

Despite the difficulties of the transferability of neuropsychological tests in a cross-cultural context, these methods are, especially in many developing countries where technical resources are seldom available, a valuable supplement to diagnostic questions [38]. In the following, this is presented in the context of psychiatric disorders using application examples from other African countries.

Hereby, an important focus lies in the assessment of the dementia associated with HIV or AIDS and in the differentiation between Alzheimer's disease and other subcortical dementias, e.g. Parkinson's dementia. However, there are some overlaps in the cognitive impairment between the HIV dementia and the Alzheimer's disease [18]. According to some studies, these can be differentiated by using the International HIV Dementia Scale [41] (see table 1). This screening instrument consists of one memory task and two psychomotor tasks and keeps the same high sensitivity and specificity as the MMSE, independently of being performed in a developed or in a developing country. Additionally, it is less dependent on education than the MMSE [41] and is evidently superior to the MMSE as a screening instrument for the assessment of a potential HIV dementia [34]. In comparison to the former development HIV Dementia Scale (Power, Selnes, Grim & McArthur, 1995; quoted from [36]), the low verbal component of the International HIV Dementia Scale represents a big benefit, although the sensitivity and specificity of the HIV Dementia Scale of Power and colleagues lies a bit higher than the values of the International HIV Dementia Scale [36].

However, regarding the relevance of the verbal component, there are some controversial discussions. While according to some authors cognitive impairment in the context of a HIV-dementia especially arises in the verbal area and in the executive functions [40], others suggest, that verbal abilities are mostly unaffected [38]. However, both authors note that no clear neuropsychological patterns can be identified [38]; instead, there are even sometimes different kinds of cognitive impairments dependent on the subtype of HIV [40]. The international HIV Dementia Scale has already been examined regarding its applicability in South Africa [19], Zambia [16], Kenya [26], Cameroon [33] and Uganda [41]. In general, the sensitivity and specificity showed moderate results [26, 41] as well as satisfying values of validity regarding the question of the assessment of HIV-dementias [19, 33]. With a focus on executive impairment, further extensive diagnostics are recommended [19]. However, a critical comment has to be made that the symptoms in day-to-day clinical practice sometimes can only be identified in an ambiguous manner, as they are often nonspecific [36]; besides, objectivity and reliability might often be limited because of a lack of training and formal evaluations [26, 38]. As the performance patterns of patients with HIV-dementia and Parkinson's dementia is often quite similar, this differentiation on neuropsychological level might be especially difficult (see table 1).

Regarding the diagnostic differentiation between dementia and depression, a central task of neuropsychology on the diagnostic questions [6], the validity of the combination of the three tests Geriatric Mental State (GMS), Community Screening Instrument for Dementia (CSI D) and the list of ten words from the CERAD (Consortium to Establish a Registry for Alzheimer's Disease) was examined in India, China, Taiwan, Nigeria and different countries of Latin America [35]. Hereby, the CSI D turned out to be especially suitable, because it was both unaffected by culture and independent of education. By combining these three measures a valid

rate of identifying dementia reaches up to 94%. However, the critical comment has to be made that these measures are not nonverbal. Some authors also note, that in the international setting, especially in developing countries, there is still a huge gap regarding the diagnostic differentiation between depression and dementia on neuropsychological level [41].

The diagnostic differentiation between affective disorders and schizophrenia on neuropsychological level has not been examined so far in African countries. Comparing cognitive functions of patients with schizophrenia with those of healthy controls in the areas attention (processing speed, selective attention), memory (verbal and visual material, working memory, learning and reproduction of a list of words), executive functions (inhibition, flexibility) and verbal fluency in the Congo, patients with schizophrenia showed worse results in all areas [32]. Up to now, in Ethiopia, such questions were answered by psychiatric assessment using the Composite International Diagnostic Interview (CIDI) or the Key Informant Method. The last measure includes the information of a person who is highly respected in particular community and is an expert regarding the issue the others are interested in - in the current case psychiatric diseases - which is combined with the clinical assessment. Such a person can, e.g., be a religious leader. It was found out that regarding the recognition of affective disorders the CIDI is more valid, whereas the Key Informant Method is especially suitable concerning the identification of schizophrenia and other psychotic disorders [45]. Especially the differentiation between bipolar and schizophrenia can hardly be reached by the cognitive profile. Thereby, the symptoms can rather be differentiated in the quantity and the extent of severity in the following way, that patients with bipolar disorders show cognitive impairment of a lower degree than patients with schizophrenia [43]. In general, patients with affective disorders differ neuropsychologically from patients with schizophrenia only in the cognitive flexibility with the latter showing more perseverative mistakes [52]. The other executive functions as well as attention and memory are impaired in a similar manner. In contrast, Negash and colleagues found in their population-based epidemiological study in Butajira, that patients with schizophrenia showed more pervasive disturbances, whereas patients with bipolar I disorder had more impairment in complex motor acts. Examining the Neurological Soft Signs, they found a correlation with higher cognitive functions corresponding to the neurophysiological test findings [31].

Instead, there is seldom ambiguity regarding the identification of frontal lobe syndromes. Therefore, the impairment of executive functions is most characteristic, which can be examined for example by using the matrices (visual problem solving; subtest from the WAIS-III; [49]) or the Tower of London (planning and problem solving; [44]). For the specific assessment of frontal impairment the Frontal Assessment Battery (FAB; [7]) was developed. Hereby, beside capability of abstraction and lexical fluency, there is a focus on motor coordination and the ability to implement orders adequately into actions. The latter helps to assess susceptibility of interference, inhibition of behaviour and utilisation. So far, no studies exist about the applicability or the examination of validity in African cultures.

CONCLUSION AND OUTLOOK:

Keeping in mind the background of the application areas above, especially questions of differential diagnosis, we would like to suggest a „neuropsychological basic set“ in table 2, which focuses mainly on nonverbal testing measures especially because of the multilingualism in Ethiopia.

When administering test measures, we have to keep in mind, that first the applicability has to be examined in a feasibility study similar to a pilot study. Secondly, the measures have to be adapted to the Ethiopian, cultural context, whenever possible. Next, to control for the convergent validity, the results of the differential diagnosis provided by neuropsychological measures should be compared to the findings of purely psychiatric methods (for example the Amharic version of the CIDI; [23]) or of the Amharic version of the SCAN (Schedule for Clinical Assessment in Neuropsychiatry; [25,45]). At this point, however, we also want to make clear that a neuropsychological assessment can only provide additional information for diagnosis, but can never substitute a psychiatric interview and it also should not do that. When measures are specifically adapted, testing can be performed precisely and accurately. Last, but not least, norms with healthy Ethiopian people have to be collected to get specific values for comparison as well as for the adequate classification of cognitive performance (overview regarding the phases of implementation, please read [15]).

Tables

Table 1: Neuropsychological symptoms of the three kinds of dementia - Alzheimer’s disease, HIV dementia and Parkinson’s dementia

<i>Alzheimer’s Disease</i>	<i>HIV Dementia</i>	<i>Parkinson’s Dementia</i>
memory: especially short-term and working memory; later also long-term memory affected	working memory affected (short-term and long-term memory mostly intact)	short-term and episodic memory, high interference susceptibility, specific deficits regarding the clustering of reminding material (executive functions!)
learning abilities and reproduction; impairment in encoding as well as reproduction		
intrusions, confabulations		
visuo-spatial ability	visuo-spatial ability mostly intact	
	processing speed	processing speed
	reduced sustained attention, impairment in the divided attention, switching of attention; no information about distractibility	high level of distractibility, lack of internal attention (external cues necessary!), difficulties regarding the sustained attention, neglect
capability of abstraction, flexibility (many perseverations!); reduced judgement abilities	capability of abstraction, problem solving, planning (slowly), flexibility, inhibition	planning, creating/ keeping/ switching of mental categories (WCST!), programming and executing of motoric programs, lack of inhibition? many perseverations
	psychomotor speed	psychomotor speed, tremor
maintenance of personality	apathic personality traits	maintenance of personality

Notes. WCST = Wisconsin Card Sorting Test. (overview read at [10, 17, 29, 33, 38, 51]).

Table 2: Proposed nonverbal testing measures as a neuropsychological basic set for assessment of cognitive performance in Ethiopia

<i>Functional Area</i>	<i>Testing Measures</i>
attention	
processing speed	▶ Trail-Making-Test A (TMT A; [37, 48]) ▶ Digit Symbol Test (DST, from the WAIS-III; [49])
selective attention	d2 Test of Attention [4]
memory	
visual short-term and working memory	Wechsler Memory Scale: Spatial Span forwards/backwards [50]
learning and reproduction ability/ long-term memory	▶ Wechsler Memory Scale: visual reproduction [50] ▶ Complex Figure of Rey [27]
executive functions	
	Frontal Assessment Battery (FAB; [7]) ▶ Conceptualization ▶ Lexical Fluency ▶ Luria Motor Test ▶ Sensitivity to Interference

<i>Functional Area</i>	<i>Testing Measures</i>
	<ul style="list-style-type: none"> ▶ Go/ No Go ▶ Environmental Autonomy
flexibility	<ul style="list-style-type: none"> ▶ Wisconsin Card Sorting Test (WCST; card version; [12]) ▶ Trail-Making-Test B (TMT-B; [37, 48])
planing/ problemsolving	<ul style="list-style-type: none"> ▶ Tower of London [44] ▶ Matrices (from the WAIS-III; [49])
psychomotor speed	Grooved Pegboard [47]
visuo-spatial ability	Block Design (from the WAIS-III; [49])
Screening for dementia	<ul style="list-style-type: none"> ▶ International HIV Dementia Scale [41] ▶ Memory Task (4 words) ▶ Finger Tapping ▶ adaptation of the Luria Motor Test

Notes. WAIS-III = Wechsler Adult Intelligence Scale (Third edition)

REFERENCES

1. ARDILA A. Cultural values underlying psychometric cognitive testing. *Neuropsychology Review*. 2005;15(4):185-195.
1. BENSON C, HEUGH K, BOGALE B, GEBRE YOHANNES, M. Multilingual education in Ethiopian primary schools. In: Skutnabb-Kangas T, Heugh K (eds) *Multilingual Education and Sustainable Diversity Work*, New York/ Abington, OX, Taylor & Francis, 2012; 32-61.
2. BOGALE A, ABEBE Y, STOECKER BJ, ABUYE C, KETEMA K, HAMBIDGE KM. Iodine status and cognitive functions of women and their five year-old children in rural Sidama, Southern Ethiopia. *East African Journal of Public Health*. 2009;6(3):299-302.
3. BRICKENKAMP R, ZILLMER E. *d2 Test of Attention: Manual*. Göttingen, Germany: Hogrefe & Huber 1998
4. CLIFFORD DB, MITIKE MT, MEKONNEN Y, ZHANG J, ZENEBE G, ZENEBE M, ZEWDE A, GESSESE N, WOLDAY D, MESSELE T, TESHOME M, EVANS S. Neurological evaluation of untreated human immunodeficiency virus infected adults in Ethiopia. *Journal of NeuroVirology*. 2007;13(1):67-72.
5. CUENI C, ABBRUZZESE EA, BRUEHL AB, HERWIG U. Neuropsychological aspects of depression. *Zeitschrift für Psychiatrie, Psychologie und Psychotherapie*. 2011;59(2):103-114.
6. DUBOIS B, LITVAN I. The FAB: A frontal assessment battery at bedside. *Neurology*. 2000;55(11):1621-1626.
7. EMIRU T. *The Amharic translation of MMPI-2: Inventory adaptation and equivalence evaluation (Unpublished dissertation)*. University of Minnesota 2003
8. ESPINO DV, LICHTENSTEIN MJ, PALMER RF, HAZUDA HP. Ethnic differences in Mini-Mental State Examination (MMSE) Scores: Where you live makes a difference. *Journal of the American Geriatrics Society*. 2001;49(5):538-548.
9. FIMM B. Neuropsychologische Beeinträchtigungen bei extrapyramidalen Erkrankungen. In: Sturm W, Herrmann M, Münte T (eds) *Lehrbuch der klinischen Neuropsychologie*. 2. Auflage. Heidelberg, Spektrum Akademischer Verlag, 2009: 651-671
10. GOYDKE T. Intercultural competence as a key factor in dialogue between west and east. *West-Ost-Report - International Forum for Science and Research*. 2012/13;3/4:9-22.
11. GRANT DA, BERG EA. *Wisconsin Card Sorting Test (WCST)*. Odessa, FL: Psychological Assessment Resources 1993
12. GREENFIELD PM. You can't take it with you: Why ability assessments don't cross cultures. *American Psychologist*. 1997;52(10):1115-1124.
13. HALL E, HALL M. *Verborgene Signale. Studien zur internationalen Kommunikation: Über den Umgang mit Amerikanern*. Hamburg: Gruner + Jahr GmbH 1983
14. HOLDING PA, TAYLOR HG, KAZUNGU SD, MKALA T, GONA J, MWAMUYE B, MBONANI L, STEVENSON J. Assessing cognitive outcomes in a rural African population: Development of a neuropsychological battery in Kilifi District, Kenya. *Journal of the International Neuropsychological Society*. 2004;10(2):246-260.
15. HOLGUIN A, BANDA M, WILLEN EJ, MALAMA C, CHIYENU KO, MUDENDA VC, WOOD C. HIV-1 effects on neuropsychological performance in a resource-limited country, Zambia. *AIDS and Behavior*. 2011;15(8):1895-1901.
16. JAHN T. Neuropsychologie der Demenz. In: Lautenbacher S, Gauggel S (eds) *Neuropsychologie psychischer Störungen*. Berlin, Heidelberg, Springer, 2010: 347-383.
17. JAYADEV S, GARDEN GA. Host and viral factors influencing the pathogenesis of HIV-associated neurocognitive disorders. *Journal of Neuroimmune Pharmacology*. 2009;4(2):175-189.
18. JOSKA JA, WESTGARTH-TAYLOR J, HOARE J, THOMAS KGF, PAUL R, MYER L, STEIN DJ. Validity of the International HIV Dementia Scale in South Africa. *AIDS PATIENT CARE and STDs*. 2011;25(2):95-101.
19. KANMOGNE GD, KUATE CT, CYSIQUE LA, FONSAH JY, ETA S, DOH, R, NJAMNSHI, DM, NCHINDAP, E, FRANKLIN JR DR, ELLIS RJ, MCCUTCHAN, JA, BINAM, F, MBANYA, D, HEATON RK, NJAMNSHI AK. HIV-associated neurocognitive disorders in sub-Saharan Africa: A pilot study in Cameroon. *BioMedCentral Neurology*. 2010;10:60-71.
20. KATHURIA R, SERPELL R. Standardization of the Panga Munthu Test - A nonverbal cognitive test developed in Zambia. *Journal of Negro Education*. 1998;67(3):228-241.
21. KEBEDE D, ALEM A. Major mental disorders in Addis Ababa, Ethiopia. I. Schizophrenia, schizoaffective and cognitive disorders. *Acta Psychiatrica Scandinavica*. 1999;100(S397):11-17.
22. KEBEDE D, ALEM A. Major mental disorders in Addis Ababa, Ethiopia. II. Affective disorders. *Acta Psychiatrica Scandinavica*. 1999;100(S397):18-23.
23. KEBEDE D, ALEM A, SHIBRE T, DEYASSA N, NEGASH A, BEYERO T, MEDHIN G, FEKADU A. Symptomatic and functional outcome of bipolar disorder in Butajira, Ethiopia. *Journal of Affective Disorders*. 2006;90(2-3):239- 249.
24. KEBEDE D, ALEM A, SHIBRE T, NEGASH A, FEKADU A, FEKADU D, DEYASSA N, JACOBSSON

- L, KULLGREN G. Onset and clinical course of schizophrenia in Butajira-Ethiopia. A community-based study. *Social Psychiatry and Psychiatric Epidemiology*. 2003;38(11):625-631.
25. KWASA J, CETTOMAI D, LWANYA E, OSIEMO D, OYARO P, BIRBECK GL, PRICE RW, BUKUSI EA, COHEN CR, MEYER A-CL. Lessons learned developing a diagnostic tool for HIV-associated dementia feasible to implement in resource-limited settings: Pilot testing in Kenya. *PLoS ONE*. 2012;7(3)e32898:1-9.
26. MEYERS JE, MEYERS KR. *Rey Complex Figure Test and Recognition Trial: Professional manual*. Lutz, FL: Psychological Assessment Resources 1995
27. MULATU MS. Psychometric properties of scores on the preliminary Amharic version of the State-Trait Anxiety Inventory in Ethiopia. *Educational and Psychological Measurement*. 2002;62(1):130-146.
28. MUENTE T. Neuropsychologische Defizite bei Demenzerkrankungen. In: Sturm W, Herrmann M, Münte T (eds) *Lehrbuch der klinischen Neuropsychologie*. 2. Auflage. Heidelberg, Spektrum Akademischer Verlag, 2009: 726-739.
29. NEGASH A, ALEM A, KEBEDE D, DEYESSA N, SHIBRE T, KULLGREN G. Prevalence and clinical characteristics of bipolar I disorder in Butajira, Ethiopia: A community-based study. *Journal of Affective Disorders*. 2005;87(2-3):193-201.
30. NEGASH A, KEBEDE D, ALEM A, MELAKU Z, DEYESSA N, SHIBIRE T., FEKADU A, FEKADU D, JACOBSSON L, KULLGREN G. Neurological soft signs in bipolar I disorder patients. *Journal of Affective Disorders*. 2004;80(2-3): 221-230.
31. NGOMA M, VANSTEELANDT K, DELESPAUL P, KRABBENDAM L, MAMPUNZA MA MIEZI S, PEUSKENS J. Cognitive deficits in nonaffective functional psychoses: A study in the Democratic Republic of Congo. *Psychiatry Research*. 2010;180(2-3):86-92.
32. NJAMNSHI AK, DJIENTCHEU VP, FONSAH JY, YEPNJO FN, NJAMNSHI DM, MUNA, WF. The International HIV Dementia Scale is a useful screening tool for HIV-associated dementia/ cognitive impairment in HIV-infected adults in Yaoundé-Cameroon. *Journal of Acquired Immune Deficiency Syndromes*. 2008;49(4):393-397.
33. OSHINAKE OO, AKINBAMI AA, OJO OO, OJINI IF, OKUBADEJO N, DANESI AM. Comparison of the Minimal State Examination Scale and the International HIV Dementia Scale in assessing cognitive function in Nigerian HIV patients on antiretroviral therapy. *AIDS Research and Treatment*. 2012:1-6.
34. PRINCE M, ACOSTA D, CHIU H, SCAZUFCA M, VARGHESE M. Dementia diagnosis in developing countries: A cross-cultural validation study. *Lancet*. 2003;361(9361):909-917.
35. RACKSTRAW S. HIV-related neurocognitive impairment - A review. *Psychology, Health & Medicine*. 2011;16(5):548-563.
36. REITAN RM, WOLFSON D. *The Halstead-Reitan Neuropsychological Test Battery: Therapy and clinical interpretation*. Tucson, AZ: Neuropsychological Press 1985
37. ROBERTSON K, LINER J, HEATON R. Neuropsychological assessment of HIV-infected populations in international settings. *Neuropsychology Review*. 2009;19(2),232-249.
38. ROOS A, CALATA D, JONKERS L, MARITZ SJ, KIDD M, DANIELS WMU, HUGO FJ. Normative data for the Tygerberg Cognitive Battery and Mini-Mental Status Examination in a South African population. *Comprehensive Psychiatry*. 2010;51(2),207-216.
39. SACKTOR N, NAKASUJJA N, ROBERTSON K, CLIFFORD DB. HIV-associated cognitive impairment in sub-Saharan Africa - The potential effect of clade diversity. *Nature Clinical Practice Neurology*. 2007;3(8):436-443.
40. SACKTOR NC, WONG M, NAKASUJJA N, SKOLASKY RL, SELNES OA, MUSISI S, ROBERTSON K, MCARTHUR JC, RONALD A, KATABIRA E. The international HIV Dementia Scale: A new rapid screening test for HIV dementia. *AIDS*. 2005;19(13):1367-1374.
41. SCAZUFCA M, ALMEIDA OP, VALLADA HP, TASSE WA, MENEZES PR. Limitations of the Mini-Mental State Examination for screening dementia in a community with low socioeconomic status. Results from the Sao Paulo Ageing & Health Study. *European Archives of Psychiatry and Clinical Neuroscience*. 2009;259(1):8-15.
42. SCHRETLEN DJ, CASCELLA NG, MEYER SM, KINGERY LR, TESTA SM, MUNRO CA, PULVER AE, RIVKIN P, RAO VA, DIAZ-ASPER CM, DICKERSON FB, YOLKEN RH, PEARLSON GD. Neuropsychological functioning in bipolar disorder and schizophrenia. *Biological Psychiatry*. 2007;62(2):179-186.
43. SHALLICE T. Specific impairments in planning. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*. 1982;298(1089):199-209.
44. SHIBRE T, KEBEDE D, ALEM A, NEGASH A, KIBREAB S, FEKADU A, FEKADU D, JACOBSSON L, KULLGREN G. An evaluation of two screening methods to identify cases with schizophrenia and affective disorders in a community survey in rural Ethiopia. *International Journal of Social Psychiatry*. 2002;48(3):200-208.
45. STURM W, HARTJE W. *Neuropsychologie - Gegenstand, Methoden, Diagnostik und Therapie. Experimentelle und klinische Neuropsychologie*. In: Hartje W, Poeck K (eds.) *Klinische Neuropsychologie*. 6. unveränderte Auflage. Stuttgart, Georg Thieme Verlag, 2002: 1-48.

46. TRITES RL. Neuropsychological Test Manual. Ottawa, Ontario, Canada: Royal Ottawa Hospital 1977
47. TOMBAUGH T. Trail Making Test A and B: Normative data stratified by age and education. Archives of Clinical Neuropsychology. 2004;19(2):203-214.
48. WECHSLER DA. Wechsler Adult Intelligence Scale (Third edition). San Antonio, TX: Psychological Corporation 1997
49. WECHSLER DA. Wechsler Memory Scale-Third edition manual. San Antonio, TX: Psychological Corporation 1997
50. WOODS SP, MOORE DJ, WEBER E, GRANT I. Cognitive neuropsychology of HIV-associated neurocognitive disorders. Neuropsychology Review. 2009;19(2):152-168.
51. ZIHL J, GRÖN G, BRUNNAUER A. Cognitive deficits in schizophrenia and affective disorders: evidence for a final common pathway disorder. Acta Psychiatrica Scandinavica. 1998;97(5):351-357.